559 Riverdale Avenue Ottawa

Assessment of Adequacy of Public Services

Project # CW-07-15

Prepared for:

Mr. Luca Diaconescu
34 Glencairn Avenue
Ottawa, Ontario, K1S 1N6

By:

Arch-Nova Design Inc.

April 2016

(Updated November 2016)

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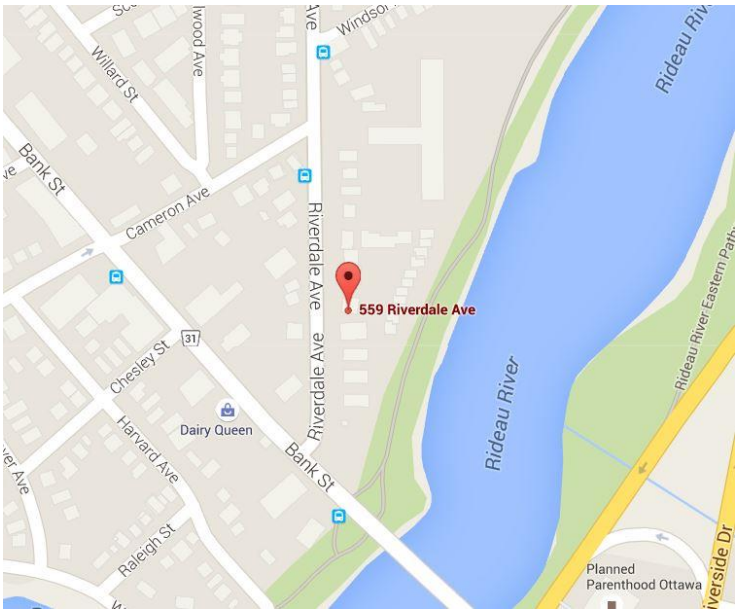
1. Introduction

The subject property is located at 559 Riverdale Avenue, Ottawa. The proposed work comprises of a 3-storey+basement apartment building. For the purpose of this report the site is considered to run south-north.

Currently, a bungalow house is located on the central part of the property. It is occupied, but scheduled for demolition. A yard covered with grass is located on the east side of the property. On the north side of the house there is a garage at the basement level with access driveway-ramp. Adjacent properties are also residential.

The area is serviced by municipal water, sanitary and storm water systems.



559 Riverdale Avenue, Ottawa: Location

2. Public Services Capacity

This section of the report will analyze existing municipal services and the potential impact of the proposed building at 559 Riverdale Avenue on the existing service capacity.

2.1 Water Supply

[1]The following are boundary conditions, HGL, for a hydraulic analysis at 559 Riverdale Avenue, connecting to the 203 mm watermain:

Max Day + FF = 108 m assuming a fire flow of 150 L/s

Minimum HGL = 102.4 m

Maximum HGL = 116.8 m, the estimated ground elevation is 59.2 m, the estimated maximum pressure is more than 80 psi.[2]

Table 1 presents the City of Ottawa design criteria based on MOE Guidelines.

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	9.5 x Average Daily *
Residential Maximum Hourly	1.5 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
During Peak Hourly Demand operating pressure must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

Table 1.: Water Supply Design Criteria

The consumption is expected to increase from **4.55 l/min (0.08 l/sec)** to **60.61 l/min (1.01 L/sec)** for peak period. The fire flow for residential

[1] City of Ottawa boundary condition information is based on current operation of the city water distribution system (also see Appendix A for complete correspondence information)
[2] City of Ottawa: April 01. 2015

spaces was estimated to be 8,000 l/min (133 l/sec)[3] however, the Fire Underwriters Survey (FUS) calculation[4] provided the following:

a. fire flow: 8,000 l/min

b. available fire flow[5] is 5,100 l/min (85 l/sec) which will require additional fire protection measures including fire separation structures, Siamese fire connection and/or fire extinguishers on each floor. Updated plans (October 2016) included Siamese connection as the closest fire hydrant is more than 45 m away from the site.

The table below summarizes the pressure for the designed parameters:

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (kPa)
Average Daily Demand	4.25	
Max Day + Fire Flow	5140.41	116.8
Peak Hour	60.61	102.4

Table 2: Water Demand and Boundary Conditions

[3] OBC SectionA.3.2.5.7, Table 2.
[4] See Appendix A: Calculations
[5] City of Ottawa: Boundary Conditions, April 2016

2.2 Sanitary Sewer

Current sanitary sewer outflow from the location of 559 Riverdale Avenue is estimated **0.22 l/sec** (peak flow+wet weather). The estimated outflow for the new buildings is **0.30 l/sec** (peak flow+wet weather), therefore the maximum flow increase is estimated to be **0.08 l/sec**.

Design Parameter	Value[6]
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s

Table 3: Wastewater Design Criteria

Existing municipal sewer 225 mm has a capacity of 46.58 l/sec for 0.54% slope and the flow from proposed development will create only 0.2% of increase.

Detailed calculation of pre and post development flow is presented in Appendix A.

[6] Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.

3. Stormwater

3.1 Existing Site Stormwater Services

The subject property is covered with different surfaces as shown in the Table 4. The roof drains onto the green area. No other storm water services (i.e. storage, ponds) are on the property.

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Green area	A1	0.00069	1.3%	0.35	0.000
Building+driveway	A2	0.01752	34.3%	0.95	0.017
Patio	A3	0.00218	4.3%	0.70	0.002
Backyard	A4	0.02041	40.0%	0.30	0.006
Patio	A5	0.00274	5.4%	0.70	0.002
Green area	A6	0.00753	14.7%	0.30	0.002
TOTAL		0.0511	100.0%		0.029
Weighted C =					0.50

Table 4: Current Drainage Areas

Entire site drains uncontrolled over surface to Riverdale Avenue or to the rear access driveway. Predevelopment C=0.5 is used for the calculation for the post development calculation[7]. Also the 100-year runoff coefficient is increased for 25% to compensate for the climate changes.

A municipal stormwater service 675 mm is provided on Riverdale Avenue and has capacity of 132 l/sec for slope of 0.31% and 30% full and 660 l/sec for 80% full.

Proposed development will provide on-site storage and there will be no impact on the municipal system.

3.2 Proposed Development

The proposed 3-storey building will cover the main part of the property however the flat roof storage is expected to compensate for the pervious areas so the balance between pre and post development run-off is not

[7] City of Ottawa stormwater management design reqirement

changed. Also, the main drainage routes, such as the roof drains to the front (Riverdale Ave.) and the backyard will remain almost unchanged. There is an increase in impervious surfaces in the area where the existing yard is.

For the purpose of managing the 5 year predevelopment runoff (7.40 l/sec), the uncontrolled post development runoff was used to determine the controlled runoff from the roof storage. The postdevelopment uncontrolled runoff is calculated to be 2.14 l/sec which leaves 5.26 l/sec for the controlled runoff. The excess of water should be stored on the roof and released under this condition.

Predevelopment Runoff:		
Uncontrolled Runoff		
5-year	7.40	l/sec
100-year	15.85	l/sec
Controlled Runoff:		
5-year	0.00	l/sec
100-year	0.00	l/sec

Postdevelopment Runoff:		
Uncontrolled Runoff		
5-year	2.67	l/sec
100-year	4.58	l/sec
Controlled Runoff:		
5-year	8.85	l/sec
100-year	16.85	l/sec

Controlled allowable runoff		
Controlled Runoff:		
5-year	4.73	l/sec
100-year	11.27	l/sec

Table 5: Uncontrolled and Controlled Runoff Summary

The calculation was based on 10 minutes concentration times. Detailed calculation is provided in Appendix A.

The drainage system comprises of weeping tiles around the building and a connection to the storm pipe at Riverdale Avenue. Details are presented in the Grading and Site Services Plan.

Adjacent property on south will be protected with 6" high curb in order to prevent overflow from the site.

The basement of the new building will be used as a parking and access to the parking will be over a ramp. The basement will be equipped with drains and a sump pump I order to prevent atmospheric water entering the basement.

Details are presented in Appendix A.

4. Conclusion

Based on the information provided by the City of Ottawa, the existing municipal services are adequate and will not be overloaded after the construction of the buildings at 559 Riverdale.

Water supply system will not provide sufficient flow for the fire protection however, additional preventive and structural measures are proposed; Siamese connection will be installed in front of the building and it will compensate for the hydrant which is more than 45 meters away from the site as well as for the insufficient flow.

Sanitary system inflow will be increased for only 0.2% of its capacity and it is deemed as capable to receive flow from the site.

Stormwater system will not be impacted by the new development as the site will provide storage for water and its release under the predevelopment condition.

Prepared by:

_____
Zoran Mrdja, P.Eng.

April 2016.
Updated November 2016.

Authorized by Professional Engineers of Ontario to provide professional services to public

Appendix A: Calculations

Water Supply Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	2.5 x Average Daily *
Residential Maximum Hourly	2.2 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4	1	3
Semi-detached	2.7		0
Townhouse	2.7		0
Apartment			0
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	3	1.19	0.83	2.98	2.07	6.55	4.55

Institutional / Commercial / Industrial Demand

				Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**		**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5	L/m2/d	0	0.00	0.00	0.00	0.00	0.00	0.00
Office	75.0	L/9.3m2/d							
Restaurant*	125.0	L/seat/d							
Industrial -Light	35,000.0	L/gross ha/d							
Industrial -Heavy	55,000.0	L/gross ha/d							
Total I/C/I Demand				0.00	0.00	0.00	0.00	0.00	0.00

Total Demand	1.19	0.83	2.98	2.07	6.55	4.55

Wastewater Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.	

Sanitary Sewer Post Development Outflow

Site Area	**0.605 ha**
Extraneous Flow Allowances	
Infiltration / Inflow	**0.1694 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	**Pop**
Single Family	3.4	1	3.4
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7		0
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0
Average	1.8		0
Total Population			**3.4**
Average Domestic Flow			**0.01 L/s**
Peaking Factor			**4.00**
Peak Domestic Flow			**0.06 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space*	5 L/m2/d		0
Hospitals	900 L/bed/d		0
Industrial - Light**	35,000 L/gross ha/d	0	0
Industrial - Heavy**	55,000 L/gross ha/d		0
School	70 L/student/d		0
Institutional Buildings (Church)***	36 L/Seat/d	0	0
Average I/C/I Flow			**0**
Peak Institutional / Commercial Flow			
Peak Industrial Flow**			
Peak I/C/I Flow			

Total Estimated Average Dry Weather Flow Rate	**0.01**
Total Estimated Peak Dry Weather Flow Rate	**0.06**
Total Estimated Peak Wet Weather Flow Rate	**0.22**

* assuming a 12 hour commercial operation

** peak industrial flow per City of Ottawa Sewer Design Guidelines Appendix 4B

*** Churches and Similar Places of Worship - per seat; Kitchen facilities provided

OBC (2012) Div.B, Section 8.2.1.3, Table B

Water Supply Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	9.5 x Average Daily *
Residential Maximum Hourly	1.5 x Maximum Daily *
Commercial Demand	2.5 L / m2 /d
Commercial Maximum Daily Demand	1.5 x Average Daily
Commercial Maximum Hourly	1.8 x Maximum Daily
Minimum Watermain Size	150mm diameter
Minimum Depth of Cover	2.4m from top of watermain to finished grade
must remain within	275kPa and 552kPa (40-80 psi; 28-56m)
During fire flow operating pressure must not drop below	140kPa (20 psi; 14 m)
* Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons.	

559 Riverdale Avenue, Ottawa
New Development

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4		0
Semi-detached	2.7		0
Townhouse	2.7		0
Apartment			0
Bachelor	1.4		0
1 Bedroom	1.4	8	11
2 Bedroom	2.1	3	6
3 Bedroom	3.1		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	18	6.13	4.25	58.19	40.41	87.28	60.61

Institutional / Commercial / Industrial Demand

				Avg. Daily		Max Day		Peak Hour	
Property Type	**Unit Rate**		**Units**	m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Commercial floor space	2.5	L/m2/d	0	0.00	0.00	0.00	0.00	0.00	0.00
Office	75.0	L/9.3m2/d							
Restaurant*	125.0	L/seat/d							
Industrial -Light	35,000.0	L/gross ha/d							
Industrial -Heavy	55,000.0	L/gross ha/d							
Total I/C/I Demand				0.00	0.00	0.00	0.00	0.00	0.00

Total Demand	6.13	4.25	58.19	40.41	87.28	60.61

* Estimated number of seats at 1seat per $9.3m^2$

Water Demand and Boundary Conditions

Proposed Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] (kPa)
Average Daily Demand	4.25	
Max Day + Fire Flow	5,140.41	108
Peak Hour	60.61	108.3

[1)] Water demand calculation per Water Supply Guidelines. See Appendix B for detailed calculations.

[2)] Boundary conditions supplied by the City of Ottawa. See Appendix B for correspondence with the City.

Wastewater Design Criteria

Design Parameter	Value
Residential Average Apartment	1.8 P/unit
Average Daily Demand	350 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0
Commercial Space	5L/m2/day
Infiltration and Inflow Allowance	0.28L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = (1/n)AR^{2/3}S^{1/2}$
Minimum Sewer Size	200mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6m/s
Maximum Full Flowing Velocity	3.0m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, November 2004.	

559 Riverdale Avenue, Ottawa
New Development

Sanitary Sewer Post Development Outflow

Site Area	**0.048 ha**
Extraneous Flow Allowances	
Infiltration / Inflow	**0.01344 L/s**

Domestic Contributions

Unit Type	Unit Rate	Units	**Pop**
Single Family	3.4		0
Semi-detached and duplex	2.7		0
Duplex	2.3		0
Townhouse	2.7		0
Apartment			
Bachelor	1.4		0
1 Bedroom	1.4	8	11.2
2 Bedroom	2.1	3	6.3
3 Bedroom	3.1		0
Average	1.8		0
Total Population			**17.5**
Average Domestic Flow			**0.07 L/s**
Peaking Factor			**4.00**
Peak Domestic Flow			**0.28 L/s**

Institutional / Commercial / Industrial Contributions

Property Type	**Unit Rate**	**No. of Units**	**Avg Wastewater (L/s)**
Commercial floor space	5 L/m2/d		0
Hospitals	900 L/bed/d		
School	70 L/student/d		
Industrial - Light	35,000 L/gross ha/d		
Industrial - Heavy	55,000 L/gross ha/d		
Average I/C/I Flow			**0**
Peak Institutional / Commercial Flow			
Peak Industrial Flow**			
Peak I/C/I Flow			

Total Estimated Average Dry Weather Flow Rate	**0.07**
Total Estimated Peak Dry Weather Flow Rate	**0.28**
Total Estimated Peak Wet Weather Flow Rate	**0.30**

FUS Fire Flow Calculations

Project: 559 Riverdale Avenue , Ottawa

Calculations Based on 1999 Publication "Water Supply for Public Fire Protection " by Fire Underwriters' Survey (FUS)
Project Name: 559 Riverdale Avenue, Ottawa — Fire Flow Calculation #: 1
Date: March 13, 2016 — Building Type/Description/Name:Apartment Building
Data input by: Zoran Mrdja, P.Eng.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.50	Non-combustible construction	0.80	m	
			Ordinary construction	1.00				
			Non-combustible construction	0.80				
			Fire resistive construction (< 2 hrs)	0.70				
			Fire resistive construction (> 2 hrs)	0.60				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, ind)	1	Units	
			Townhouse - indicate # of units	1				
			Other (Comm, Ind, etc.)	1				
2.2	# of Storeys	Number of Floors/ Storeys in the Unit (do not include basement):			1	1	Storeys	
3	Enter Ground Floor Area of One Unit	Enter Ground Floor Area (A) of One Unit Only :				760	Area in Square Meters (m^2)	
		Measurement Units	Square Feet (ft^2)	0.093	Square Metres (m^2)			
			Square Metres (m^2)	1				
			Hectares (ha)	10000				
4	Obtain Required Fire Flow without Reductions	Required Fire Flow(without reductions or increases per FUS) ($F = 220 * C * \sqrt{A}$) Round to nearest 1000L/min						4,852
5	Apply Factors Affecting Burning	Reductions/Increases Due to Factors Affecting Burning						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0.00	N/A	0
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete Automatic Sprinkler Protection	-0.3	None	0.00	N/A	0
			None	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	3.1-10.0 m	0.20	0.65	m	3,154
			East Side	10.1-20.0 m	0.15			
			South Side	3.1-10.0 m	0.20			
			West Side	20.1-30 m	0.10			
6	Obtain Required Fire Flow, Duration & Volume	Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:						8,000
		Total Required Fire Flow (above) in L/s:						133
		Required Duration of Fire Flow (hrs)						2.00
		Required Volume of Fire Flow (m^3)						960

Note: The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline

Legend	
	Drop down menu - choose option, or enter value.
	No Information, No input required.

Note: The structure is considered as non-combustible as separation walls are incorporated and the basement-garage is sprinklered.

The most current FUS document should be referenced before design to ensure that the above figures are consistent with the intent of the Guideline.
The basement of the builidng will be used as a gathering/dining area and it is recommended to be equiped with sprinkler system

Project Number: CW-07-15 559 Riverdale Ave., Ottawa

ARCH-NOVA DESIGN INC.
Architecture
Engineering
Consulting

PRE-DEVELOPMENT

The pre-development time of concentration is 10 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

I_5 = 104.2 mm/hr I_{100} = **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Green area	A1	0.00069	1.3%	0.35	0.000
Building+driveway	A2	0.01752	34.3%	0.95	0.017
Patio	A3	0.00218	4.3%	0.70	0.002
Backyard	A4	0.02041	40.0%	0.30	0.006
Patio	A5	0.00274	5.4%	0.70	0.002
Green area	A6	0.00753	14.7%	0.30	0.002
TOTAL		0.0511	100.0%		0.029
Weighted C =					0.50

0.562235

C=0.5 used for predevelopment calculation (City of Ottawa requirement)

$Q_{5pre} = (2.78)*(C)*(I_5)*(A)$
$Q_{5pre} = 2.78 \times 0.5 \times 104.2 \times 0.0511$
$Q_{5pre} = 7.40$ L/s

$Q_{100pre} = (2.78)*(C)*(I_{100})*(A)$
$Q_{100pre} = 2.78 \times 0.62 \times 178.6 \times 0.0511$
$Q_{100pre} = 15.85$ L/s

POST-DEVELOPMENT (UNCONTROLLED RUNOFF)

The post-development time of concentration is 10 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

I_5 = 104.2 mm/hr I_{100} = **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Walkway	A1	0.0045	26.4%	0.70	0.003
Green Area	A3	0.0118	68.6%	0.30	0.004
Landscape	A4	0.0009	5.0%	0.70	0.001
TOTAL		0.0172	100.0%		0.007
Weighted C =					0.43

$Q_{5post} = (2.78)*(C)*(I_5)*(A)$
$Q_{5post} = 2.78 \times 0.5 \times 104.2 \times 0.0172$
$Q_{5post} = 2.67$ L/s

$Q_{100post} = (2.78)*(C)*(I_{100})*(A)$
$Q_{100post} = 2.78 \times 0.5 \times 178.6 \times 0.0172$
$Q_{100post} = 4.58$ L/s

Project Number: CW-07-15 559 Riverdale Ave., Ottawa

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PRE-DEVELOPMENT

The pre-development time of concentration is 10 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

I_5 = 104.2 mm/hr I_{100} = **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
	A2	0.0000	0.0%	0.90	0.000
TOTAL		0.0000	0.0%		0.000
Weighted C =					0.50

C=0.5 used for predevelopment calculation (City of Ottawa requirement)

$Q_{5pre} = (2.78)*(C)*(I_5)*(A)$
Q_{5pre} = 2.78 x 0.50 x 104.2 x 0.0000
Q_{5pre} = 0.00 L/s

$Q_{100pre} = (2.78)*(C)*(I_{100})*(A)$
Q_{100pre} = 2.78 x 0.62 x 178.6 x 0.0000
Q_{100pre} = 0.00 L/s

POST-DEVELOPMENT (CONTROLLED RUNOFF)

The post-development time of concentration is 10 minutes

where:

$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ $I_{100} = 1735.688 / (Tc + 6.014)^{0.820}$

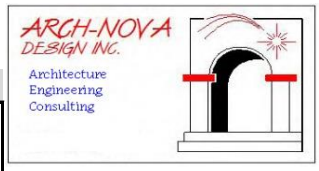
I_5 = 104.2 mm/hr I_{100} = **178.6 mm/hr**

Surface Type	ID	Area (ha)	Percent of total Area	C	A X C (ha)
Building	A2	0.0339	100.0%	0.90	0.031
TOTAL		0.0339	100.0%		0.031
Weighted C =					0.90

$Q_{5post} = (2.78)*(C)*(I_5)*(A)$
Q_{5post} = 2.78 x 0.92 x 104.2 x 0.0339
Q_{5post} = 8.85 L/s

$Q_{100post} = (2.78)*(C)*(I_{100})*(A)$
$Q_{100post}$ = 2.78 x 1.13 x 178.6 x 0.0339
$Q_{100post}$ = 18.96 L/s

ALLOWABLE RUNOFF



Predevelopment Runoff:		
Uncontrolled Runoff		
5-year	7.40	l/sec
100-year	15.85	l/sec
Controlled Runoff:		
5-year	0.00	l/sec
100-year	0.00	l/sec

Postdevelopment Runoff:		
Uncontrolled Runoff		
5-year	2.67	l/sec
100-year	4.58	l/sec
Controlled Runoff:		
5-year	8.85	l/sec
100-year	18.96	l/sec

Controlled allowable runoff		
Controlled Runoff:		
5-year	4.73	l/sec
100-year	11.27	l/sec

Comment:

Storage Volumes (5-Year Storm)

Project: 559 Riverdale Avenue

Tc = 10 (mins)
C_{AVG} = 0.95 (dimmensionless)
Area = 0.0339 (hectares)
Storm = 5 (year)
Release Rate = 4.73 (L/sec)
Time Interval = 5 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	204	1.8	4.73		
6	132	7.1	4.73	2.35	0.85
11	99	8.9	4.73	4.17	2.75
16	80	7.2	4.73	2.49	2.39
21	68	6.1	4.73	1.38	1.74
26	59	5.3	4.73	0.59	0.93
31	53	4.7	4.73	0.00	0.00
36	48	4.3	4.73	-0.46	-1.00
41	43	3.9	4.73	-0.83	-2.05
46	40	3.6	4.73	-1.14	-3.15
51	37	3.3	4.73	-1.40	-4.28
56	35	3.1	4.73	-1.62	-5.44
61	33	2.9	4.73	-1.81	-6.62
66	31	2.8	4.73	-1.97	-7.82
71	29	2.6	4.73	-2.12	-9.03
76	28	2.5	4.73	-2.25	-10.26
81	26	2.4	4.73	-2.37	-11.50
86	25	2.3	4.73	-2.47	-12.75
91	24	2.2	4.73	-2.57	-14.01
96	23	2.1	4.73	-2.65	-15.28
101	22	2.0	4.73	-2.73	-16.56
106	21	1.9	4.73	-2.81	-17.84
111	21	1.9	4.73	-2.87	-19.13
116	20	1.8	4.73	-2.93	-20.42
121	19	1.7	4.73	-2.99	-21.72
126	19	1.7	4.73	-3.05	-23.02
131	18	1.6	4.73	-3.10	-24.33
136	18	1.6	4.73	-3.14	-25.64

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 998.071 / (Tc + 6.053)^0.814 (5 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

Storage Volumes (100-Year Storm)

Tc = 10 (mins)
C_{AVG} = 0.95 (dimmensionless)
Area = 0.0339 (hectares)
Storm = 100 (year)
Release Rate = 4.73 (L/sec)
Time Interval = 5 (mins)

Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	351	3.2	4.73		
6	226	12.2	4.73	7.43	2.68
11	170	15.2	4.73	10.51	6.93
16	138	12.3	4.73	7.61	7.30
21	116	10.4	4.73	5.70	7.18
26	101	9.1	4.73	4.34	6.78
31	90	8.1	4.73	3.33	6.19
36	81	7.3	4.73	2.53	5.47
41	74	6.6	4.73	1.89	4.66
46	68	6.1	4.73	1.37	3.77
51	63	5.7	4.73	0.92	2.83
56	59	5.3	4.73	0.55	1.84
61	55	4.9	4.73	0.22	0.82
66	52	4.7	4.73	-0.06	-0.24
71	49	4.4	4.73	-0.31	-1.32
76	47	4.2	4.73	-0.53	-2.43
81	45	4.0	4.73	-0.73	-3.55
86	43	3.8	4.73	-0.91	-4.69
91	41	3.7	4.73	-1.07	-5.85
96	39	3.5	4.73	-1.22	-7.02
101	38	3.4	4.73	-1.35	-8.20
106	36	3.2	4.73	-1.48	-9.40
111	35	3.1	4.73	-1.59	-10.60
116	34	3.0	4.73	-1.70	-11.82
121	33	2.9	4.73	-1.80	-13.04
126	32	2.8	4.73	-1.89	-14.27
131	31	2.8	4.73	-1.97	-15.50
136	30	2.7	4.73	-2.05	-16.75

Notes

1) For a storm duration that is less than the time of concentration the peak flow is equal to the product of 2.78CIA and the ratio of the storm duration to the time of concentration.

2) Rainfall Intensity, I = 1735.688 / (Tc + 6.014)^0.820 (100 year, City of Ottawa)
3) Peak Flow = Duration/Tc x 2.78 x C x I x A (Duration < Tc)
4) Peak Flow = 2.78 x C x I x A (Duration > Tc)
5) Storage = Duration x Storage Rate

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Architecture
Engineering
Consulting

Total Storage Required

5-year **3.95 m^3**

100-year **8.50 m^3**

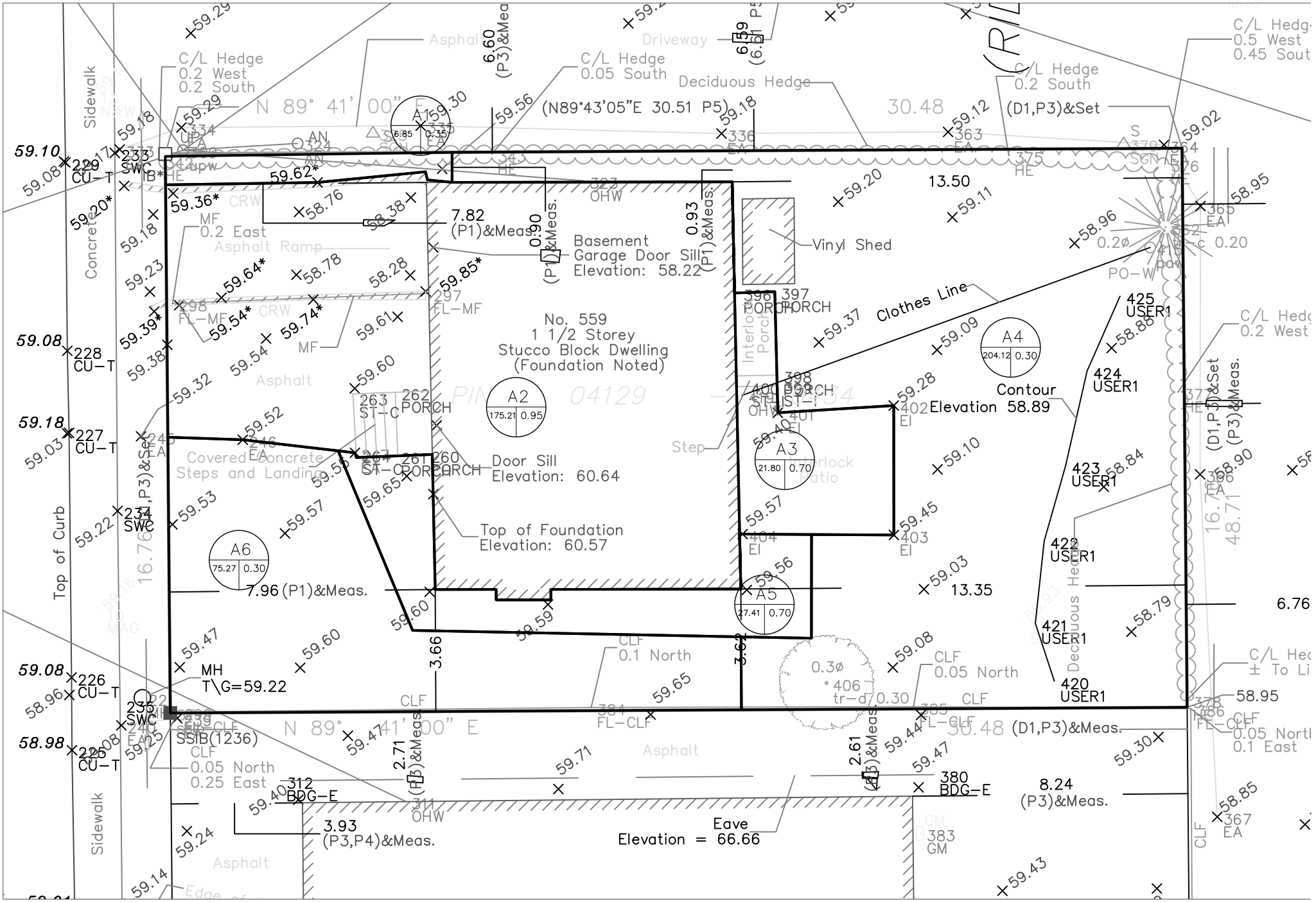
Surface Type	ID	Area (ha)	Percent of total Area	Required Storage 5 year	Required Storage 100 year	Max Allowed Drain Outflow l/s	Max Allowed Drain Outflow GPM
Roof	**A3**	0.0107	43.8%	1.7308	3.7246	2.07	32.82
Roof	**A4**	0.0085	35.0%	1.3806	2.9709	1.65	26.18
Roof	**A5**	0.0024	9.7%	0.3843	0.8270	0.46	7.29
Roof	**A7**	0.0010	4.1%	0.1622	0.3491	0.19	3.08
Roof	**A9**	0.0018	7.4%	0.2920	0.6284	0.35	5.54
TOTAL		0.0243	100.0%			4.73	74.90

Legend:	
data for 5-year event	
data for 100-year event	

Stage-Storage

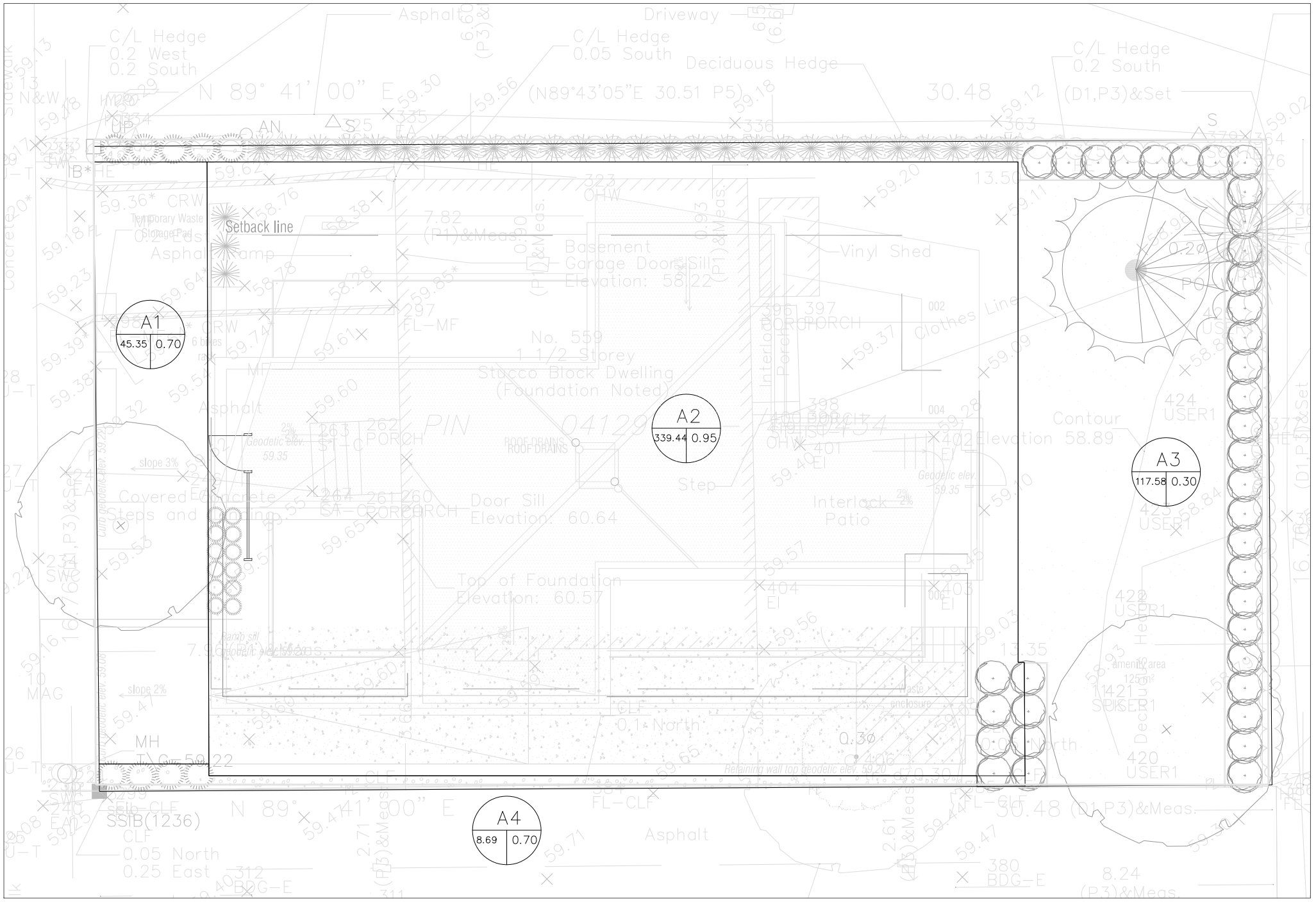
Roof A3 (Drain D3)			Roof A4 (Drain D4)			Roof A5 (Drain D5)			Roof A7 (Drain D7)			Roof A9 (Drain D9)		
Depth m	**Area** m^2	**Volume** m^3	**Depth** m	**Area** m^2	**Volume** m^3	**Depth** m	**Area** m^2	**Volume** m^3	**Depth** m	**Area** m^2	**Volume** m^3	**Depth** m	**Area** m^2	**Volume** m^3
0.020	6.42	0.06	0.020	8.34	0.08	0.020	3.2	0.03	0.020	1.05	0.01	0.020	2.1	0.02
0.040	10.02	0.20	0.040	12.8	0.26	0.040	6.5	0.13	0.040	2.2	0.04	0.040	4.2	0.08
0.060	18.60	0.56	0.060	21.2	0.64	0.060	12.7	0.38	0.065	4.8	0.16	0.065	9	0.29
0.070	48.50	1.70	0.070	41.2	1.44	0.065	16.3	0.53	0.070	5.5	0.19	0.070	11.9	0.42
0.075	57.00	2.14	0.075	59.2	2.22	0.080	21	0.84	0.100	7	0.35	0.100	14	0.70
0.110	71.50	3.93	0.090	65.9	2.97	0.150	22	1.65	0.150	9.9	0.74	0.150	17	1.28

Notes:
Roof drains with controlled flow to be specified by manufacturer using the allowable flow rates presented in this chart



559 RIVERDALE AVE.
SWM PREDEVELOPMENT

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-829-5722 contact@archnova.ca



559 RIVERDALE AVE.
SWM POSTDEVELOPMENT

ARCH-NOVA Design Inc.
45 Banner Road NEPEAN ON K2H 8X5
613-829-5722 contact@archnova.ca

Appendix B: Correspondence

zoran@archnova

From: White, Joshua <Joshua.White@ottawa.ca>
Sent: April 1, 2016 2:56 PM
To: 'gordana@archnova'
Cc: zoran@archnova.ca
Subject: RE: 559 Riverdale Ave: Boundary Conditions
Attachments: 559 Riverdale March 2016.pdf

Hello Zorn and Gordana,

Please find below the boundary conditions for your site. Please note that the maximum fire flow available is 85 L/s which is less than what has been requested, this may require either a change to the building design or the reconstruction of the watermain. Also due to the high pressure in the area a pressure reducing valve may be required.

I would recommend that you also get a copy of the hydrant pressure/flow tests for the hydrants in the area.

If you have any questions please let me know.

Josh

The following are boundary conditions, HGL, for hydraulic analysis at 559 Riverdale (zone 1W) assumed to be connected to the 152mm on Riverdale (see attached PDF for location).

Minimum HGL = 102.4m

Maximum HGL = 116.8m; *the maximum pressure is estimated to be more than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required*.

Available Flow = 85 L/s assuming a residual of 20 psi and a ground elevation of 59.2m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Joshua White, P.Eng.
Project Manager, Infrastructure Approvals
Development Review, Urban Services, City of Ottawa

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 15843
Email: joshua.white@ottawa.ca
ottawa.ca/planning / ottawa.ca/urbanisme

From: gordana@archnova [mailto:gordana@archnova.ca]
Sent: Friday, April 01, 2016 11:02 AM
To: White, Joshua
Cc: zoran@archnova.ca
Subject: FW: 559 Riverdale Ave: Boundary Conditions

Good morning Josh,

Our engineer Zoran Mrdja, has asked me to follow up with you regarding the 559 Riverdale Ave., boundary conditions. I have left a voice message this morning, but would like to follow up with an email.

Please advise if you need anything else from us, apart from the attached documents.

Best regards,

Gordana Mrdja, B.Sc.Arch.
Arch-Nova Design Inc.
45 Banner Road
Nepean, ON, K2H 8X5
613-829-5722
gordana@archnova.ca

From: zoran@archnova [mailto:zoran@archnova.ca]
Sent: March 21, 2016 1:29 PM
To: 'White, Joshua' <Joshua.White@ottawa.ca>
Subject: FW: 559 Riverdale Ave: Boundary Conditions

Hello Josh,

I am forwarding the email with attachments for 559 Riverdale Avenue.

Regards,

Zoran Mrdja, P.Eng., FEC
Arch-Nova Design Inc.
613-829-5722

From: zoran@archnova [mailto:zoran@archnova.ca]
Sent: March 20, 2016 10:23 PM
To: 'Kristin.bazinet@ottawa.ca' <Kristin.bazinet@ottawa.ca>
Subject: 559 Riverdale Ave: Boundary Conditions

Hello Kristin,

Please could you provide the boundary conditions for the location of 559 Riverdale Avenue. The owner is planning to construct a new apartment building at this location. Attached are the water and sewer calculations, water card, the site plan for proposed development and the City's updated UCC Central Registry plan

Type of development and the amount of fire flow required.

Average daily demand: 0.071 l/s.

Maximum daily demand: 0.67 l/s.

Maximum hourly daily demand: 1.01 l/s.

Also please could you provide the SWM requirements for this location?

Should you need more information please do not hesitate to contact us,

Zoran Mrdja, P.Eng., FEC
Arch-Nova Design Inc.
613-829-5722

Boundary Condition for 559 Riverdale