

FUNCTIONAL SERVICING REPORT

ROYAL GEORGE THEATRE RE-DEVELOPMENT

79-83 Queen Street
Niagara-on-The-Lake, Ontario

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1. *Drawing 22183-SSG-1 Site Servicing & Grading Plan, Rev. C*
2. *Drawing 22183-STM-PRE Pre-Development Storm Drainage Areas, Rev. A*
3. *Drawing 22183-STM-POST Post-Development Storm Drainage Areas, Rev. C*

1.0 Introduction

This functional servicing report (FSR) serves to demonstrate how servicing of the subject development will be appropriately achieved and provides design support for the drawings submitted for zoning amendment and site plan approval. This FSR addresses the following key aspects of municipal servicing design:

- Water Supply and Distribution
- Sanitary Sewerage
- Drainage and Stormwater Management
- Surface Works
- Utility Servicing
- Servicing Locations

2.0 Background

The Royal George theatre campus of the Shaw Festival Theatre is currently located at 79-83 Queen Street in Niagara-on-The-Lake. Additional property located at 178 & 188 Victoria Street has been acquired to facilitate the proposed facility. It is noted that older drawings indicate multiple parcels that are now consolidated under the single parcel with the address 83 Queen Street. The development proposal entails the re-development of The Royal George theatre (theatre and box office) and two residential dwellings (178-188 Victoria Street) with a three (3) storey theatre facility with loading area access on Victoria Street. The property area is approximately 0.285 ha in area.

Adjacent land uses include commercial (restaurant and retail) immediately adjacent to the east and west as well as south across Queen Street, and single family residential west across Victoria Street and along the north limit of the site,. Street parking spaces are located along both Queen Street and Victoria Street.

The subject property currently has $\pm 23\text{m}$ of frontage along Queen Street, and $\pm 44\text{m}$ of frontage on Victoria Street. Queen Street is a busy central business district collector road. Victoria Street is a local road. Both roads are under the jurisdiction of the Town of Niagara-on-the-Lake.

A proposed site servicing and grading drawing (SSG-1) is attached to this report. It is based on the currently proposed site plan prepared for by the project architects, Lett Architects Inc. Figure 2.1 is a key plan showing the subject property location and the site and surrounding environs, with Niagara Navigator aerial imagery from 2020.

Figure 2.1: Subject Lands Aerial View

(Source: Niagara Navigator)



3.0 Water Supply and Distribution

3.1 Existing Conditions

Based on the 'as-constructed' issue of Dwg. 11-010-PP3 (Kerry T. Howe Ltd.) provided by Town of Niagara-on-The-Lake engineering staff, a 150mm diameter City watermain along the Victoria Street frontage, newly constructed in 2012, replaced a 100mm diameter cast iron watermain that is now abandoned. 'As constructed' Dwg. A1-89987-P2 (Proctor & Redfern Limited) shows a 250mm diameter PVC watermain constructed in 1991 along the Queen Street frontage of the site.

As the subject site is comprised of several property parcels, there are multiple existing water services supplied to it. Town service location cards and the 'as-constructed' issue of Dwg. 11-010- shows one 19mm diameter water service to each of 178 and 188 Victoria Street from the new main on Victoria Street. Service location cards for 79 (main theatre) and 83 Queen Street (box office) show existing 19mm and 38mm diameter water services respectively,

There are 2 existing fire hydrants in very close proximity to the subject site. One is located in front of 164 Victoria Street, essentially at the north-west corner of the site, and only 25 metres from the face of the building. The 2nd hydrant is on the south-west corner of the Queen and Victoria Street intersection, approximately 66 metres from the principal entrance of the proposed building.

All of this existing infrastructure is shown on Quartek Dwg. 22183-SSG-1, Rev. A, attached hereto.

3.2 Proposed Works

All of the existing water services to the various former parcels comprising the consolidated site are much too small to address domestic or fire fighting water demands. It is proposed to cut, cap and abandon all existing services. As it will be very disruptive and costly to connect to the existing watermain in the Queen Street travelled roadway and as the mechanical room is proposed to be along the Victoria Street building face, it is proposed to connect a new 150mm diameter PVC service to the 150mm diameter PVC watermain that runs along the west boulevard of Victoria Street. The 100mm diameter domestic water supply will branch off the fire line outside the building with a separate valve control. The preferred location, with respect to the proposed building, is near the north-west corner of the building, where there will be mechanical room space available for metering and associated piping.

It is understood that the new building complex will be sprinklered and have a fire department connection on the west face of the building approximately 21 metres away from the loading area and 48 metres from the existing fire hydrant at the north-west corner of the site. This location is shown on Dwg. 22183-SSG-1 attached.

Given the proximity of two (2) existing fire hydrants very near the proposed development site and building, it is not proposed to provide any additional fire hydrants.

Existing and proposed water supply and distribution plant is shown on the attached Site Servicing and Grading Drawing 22183-SSG-1 Rev. B.

3.3 Design Analysis

Design criteria and calculation for water demand is shown in Table 3.1. Peak hour potable design demand for the building is calculated at ± 2.6 L/s.

Based on the building volume, the maximum fire demand under the O.B.C. methodology will be 150 L/s.

Accordingly, the estimated water demands are as follows:

Maximum Day + Fire -	151.7 L/s (150.0 L/s + 1.7 L/s)
Peak Hour -	1.8 L/s

Table 3.1 Water Demand Criteria

POTABLE WATER DEMAND ANALYSIS							
Royal George Theatre Niagara-on-the-Lake				04-Jan-2024			
Building	Suites/Units	Population	Patrons / Seats	Demand Criteria	POTABLE DEMAND		
					Avg. Daily Demand	Max. Day Demand ²	Peak Hour Demand ¹
					m ³	L/s	L/s
Audience		370		36 l/day/ capita	13.3	0.56	0.83
Staff / Performers		200		75 L/day/ capita	15.0	0.63	0.94
					0.0	0.00	0.00
					0.0	0.00	0.00
SUM LINE	0	570	0	0	28.3	1.2	1.8
Note ² : Peaking Factors: 3.6 Max Day Peaking Factor (MOECC Design Guideline DWS Table 3-3)							
5.4 Peak Hour Peaking Factor (MOECC Design Guideline DWS Table 3-3)							

The development site is located within the Region's 127m pressure zone fed by the DeCew Water Treatment Plant Gravity Feed pumping station. The design elevation of the finished building floor is 86.10 meters. The static pressure is estimated at between 60 and 80psi at the site.

Given a distance of ±17 metres from the municipal watermain to the building face, and assumed pipe sizes of 150mm diameter for the fire service and 100mm diameter for the domestic water take-off, velocity head loss between the main and the building is estimated to be approximately 6.4 kPa (1.0 psi) for peak hour domestic flows and 187 kPa (27.1 psi) in the maximum day plus fire condition. This degree of pressure loss is acceptable.

4.0 Sanitary Sewerage

4.1 Existing Conditions

Infrastructure drawings provided by Town of Niagara-on-The-Lake engineering staff, indicate an existing 375mm diameter Town sanitary sewer along the Queen Street frontage, constructed in 1991, and an existing 200mm diameter sanitary sewer running northerly along the centreline of Victoria Street fronting the subject site.

In addition, a 200mm diameter sanitary sewage forcemain under the jurisdiction of the Niagara Region runs along the northbound lane of Victoria Street in front of the subject site. This is not available for connection and must be protected from service interruption.

According to Town of Niagara-on-the-Lake records, the existing theatre building, associated box office building and 2 existing residences on Victoria Street are currently served by 4 individual 125mm Ø sanitary services.

Given the deemed need for a sanitary service of minimum 150mm diameter and the desire for a service alignment leading to the proposed mechanical room location along the west face of the building near the proposed loading driveway, it is proposed that one new connection will be made to the existing 200mm diameter sanitary sewer in the travelled portion of Victoria Street and that a 150mm diameter DR-35 PVC sanitary lateral will be extended by open cut to the west building face at a location as indicated on attached Site Servicing and Grading Drawing 22183-SSG-1 Rev. A.

Given the 'as-construction' information regarding the depth of the existing sewer main on Victoria Street, and the conceptual building design, it is assumed that there is not adequate depth to facilitate gravity service from the basement level of the proposed facility. Accordingly, it is anticipated that a sanitary sewage pit and grinder pump will be required in order to service the building. This will be designed and specified by mechanical designers at the time of building permit submission..

4.2 Proposed Works

The anticipated equivalent design population for the proposed development is estimated as follows:

Audience – 370 @ 36 L/day/person = 13,320 L/day

Performers and staff – 200 @ 75 L/day/person = 15,000

Total Average Design Flow = 28,320 L/day

Average daily domestic flow = 380 Lpcd

Equivalent Residential Population = 28,320/380 L/day = 75

Based on Town of Niagara-on-the-Lake criteria, total peak sanitary sewer flow is calculated as follows:

$$Q_T = Q_p + Q_i,$$

where Q_p = peak domestic sewage flow (L/s)

Q_i = peak infiltration (L/s)

$$Q_p = P \cdot Q_{avg} \cdot M / 86,400 \text{ s/day}$$

where P = equivalent population

M = Harmon peaking factor = $1 + 14/(4 + (P/1000)^{0.5})$, [2.0 min., 4.0 max.]

$$= 1 + 14/(4 + 0.075^{0.5}) = 4.28$$

Thus, $Q_p = 28,320 \cdot 4.28 / 86,400 = \mathbf{1.40 \text{ L/s}}$

$$Q_i = A \cdot I$$

where A = site area – 0.285 (ha)

I = infiltration allowance = 0.18 L/ha/s

Thus, $Q_i = 0.285 \cdot 0.18 = \mathbf{0.05 \text{ L/s}}$ and

$Q_T = 1.40 + 0.18 = 1.58 \text{ L/s}$

The proposed 150mm diameter sanitary lateral with a slope of the slope on the lateral is greater than 2.0% will have a capacity of 18.68 L/s, which is more than adequate for the anticipated peak sanitary sewage design flows.

Existing and proposed sanitary sewage servicing plant is shown on the attached Site Servicing and Grading Drawing 222183-SSG-1 Rev. A.

5.0 Drainage and Stormwater Management

5.1 Existing Conditions

The existing properties comprising the subject site are generally very flat and level. Surface runoff is generally contained on site, likely with a substantial component of the landscaped area draining to a pond behind the existing theatre on the property of 178 Victoria Street, and infiltrating into the soil. Roof areas and foundation drains for the 4 properties drain to existing municipal storm sewers through the following storm sewer laterals, according to municipal records:

- 100mm Ø from 79 Queen Street, likely shared with 83 Queen Street
- 125mm Ø to 178 Victoria Street

Ground elevations generally vary from ±85.60 metres along the south-west property line to ±85.02 metres along the north-west streetline.

5.2 Drainage System

The proposed site has been divided into seven catchment areas as per the attached post-development drainage area plan 22183-STM-POST.

Area 201 is mainly comprised of building roof but also contains the loading bay area. The building roof will collect runoff before it is transported to the proposed 300mmØ storm sewer lateral from the site. Runoff from rooftop Areas 202, 203 and 204 are to be collected on the building roof and temporarily stored on the roof using flow-restricting roof drains before being transmitted at reduced flow rates through the building to the proposed 300mmØ service. Area 205 along the Victoria Street frontage will flow overland towards Victoria Street right-of-way. Area 206 contains a narrow landscape strip along the south-east face of the building. This area utilizes an infiltration trench to encourage infiltration and groundwater re-charge. To help minimize flooding in extreme rainfall events, it is proposed to provide a perforated subdrain at the bottom of the trench, connecting to a subdrain underlying the swale along the north-east property limit. This swale is to outlet to a catchbasin which in turn will outlet to CBMH1 before discharging to the proposed 300mmØ lateral. The 300mmØ storm lateral will convey collected flows to the existing municipal 375mmØ storm sewer along Victoria Street. The remaining small landscape Area 207 along the Queen Street frontage will flow overland towards the Queen Street right-of-way.

Since both 2-year and 100-year storms outlet to municipal sewers, the cumulative peak flow leaving the site has been restricted to the pre-development peak flow rates.

5.3 Design Criteria

The stormwater drainage and management criteria used for the analysis of the site is as follows:

1. Peak post-development flow not to exceed peak pre-development flow for the range of storms from 2-year to 100-year return periods, and any detention required to achieve this to occur on site.

5.4 Stormwater Management

Minor system stormwater flows from the rooftop will be collected and transported through the building to the proposed storm drainage lateral. It is proposed that a portion of the rooftop will detain and store runoff, reducing the site's post-development outflow to pre-development conditions.

Preliminary software modelling for the 2-year and 100-year return period storm was performed using MIDUSS (Micro Interactive Design of Urban Storm Sewers) software. The MIDUSS output can be viewed in Appendix A. Post-development peak flows for the 2-year and 100-year return period storm are shown in Table 5.1.

Table 5.1: Post Development Peak Flow Summary

Outlet	Max. Allowed Release Rate (m ³ /s)		Design Peak Flow (m ³ /s)	
	1:2 Year	1:100 Year	1:2 Year	1:100 Year
Victoria St. 375mmØ Sewer	0.039	0.088	0.038	0.082

The storage volume provided in the rooftop in Catchments 202-204 are adequate to restrict the peak post-development flow to the cumulative peak pre-development flow for the 2-year and 100-year return period storms.

Major system flow will be detained temporarily on a portion of the rooftop. Flow can be detained and stored using restrictive roof drains. The storage volume provided on the roof is adequate to restrict the peak post-development flow to the maximum allowed release rate for the 2-year and 100-year return period storms. Modeling suggests on-site storage requirements for the major system stormwater storage as shown in Table 5.2 below.

Table 5.2: On Site Storage-Major System

Storm Return Period (years)	Post Development Peak Flow (m ³ /s)	Required Volume (m ³)
1:2	0.038	5.16
1:100	0.082	13.45

6.0 Parking and Roadways

There are no travelled roadways, driveways and parking areas proposed on site. There is proposed to be a single loading dock with access from Victoria Street, with access restricted using a sliding security gate. This is shown on the site servicing drawing, the current version of which is attached hereto.

Traffic and/or parking issues are to be addressed by others in separate reports if/as required.

7.0 Utilities

Existing hydro, gas, cable television and telephone services are located in the adjacent rights of way and are expected to be adequate to service the re-developed site. Utilities will be circulated in connection with the planning applications and will advise if there are any concerns in this regard.

8.0 Service Locations

Refer to attached Drawing 22183-SSG-1 for existing and conceptual proposed municipal services.

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Project Designer



FUNCTIONAL SERVICING REPORT

ROYAL GEORGE THEATRE RE-DEVELOPMENT

**79-83 Queen Street,
Niagara-on-The-Lake, Ontario**

APPENDIX A MIDUSS Model Output

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"          19.000  Pervious length"
"          2.000  Pervious slope"
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"          19.000  Impervious length"
"          2.000  Impervious slope"
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"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
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"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.018  0.000  0.000  0.000 c.m/sec"
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"          Surface Area          0.004  0.086  0.090  hectare"
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"	0.518	Impervious Initial abstraction"			
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"	5	Next link "			

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"          204  No description"
"          100.000 % Impervious"
"          0.024  Total Area"
"          5.000  Flow length"
"          2.000  Overland Slope"
"          0.000  Pervious Area"
"          5.000  Pervious length"
"          2.000  Pervious slope"
"          0.024  Impervious Area"
"          5.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.000 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.816 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.005    0.000    0.000    0.000 c.m/sec"
"          Catchment 204      Pervious  Impervious Total Area  "
"          Surface Area      0.000    0.024    0.024    hectare"
"          Time of concentration 9.248    0.780    0.780    minutes"

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```

"      Time to Centroid      117.353      90.710      90.710      minutes"
"      Rainfall depth        34.597      34.597      34.597      mm"
"      Rainfall volume       0.00      8.30      8.30      c.m"
"      Rainfall losses       28.464      6.366      6.366      mm"
"      Runoff depth          6.134      28.232      28.232      mm"
"      Runoff volume         0.00      6.78      6.78      c.m"
"      Runoff coefficient     0.000      0.816      0.816      "
"      Maximum flow          0.000      0.005      0.005      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.005      0.005      0.000      0.000"
" 54      POND DESIGN"
"      0.005      Current peak flow      c.m/sec"
"      0.004      Target outflow      c.m/sec"
"      6.8      Hydrograph volume      c.m"
"      11.      Number of stages"
"      0.000      Minimum water level      metre"
"      0.175      Maximum water level      metre"
"      0.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"              Level Discharge      Volume"
"              0.000      0.000      0.000"
"              0.01750      0.00044      0.02144"
"              0.03500      0.00088      0.1715"
"              0.05250      0.00132      0.5788"
"              0.07000      0.00177      1.372"
"              0.08750      0.00221      2.680"
"              0.1050      0.00265      4.630"
"              0.1225      0.00309      7.353"
"              0.1400      0.00353      10.976"
"              0.1575      0.00397      15.173"
"              0.1750      0.00442      19.373"
"      1.      ROOFTOP"
"              Roof area      Store area      Area/drain      Drain flow      Roof slope"
"              hectare      hectare      sq.metre      L/min/25mm      g H:1V"
"              0.024      0.024      200.000      37.850      50.000"
"      Using 1 roofdrains on roofstorage area of 240. square metre"
"      Peak outflow              0.002      c.m/sec"
"      Maximum level              0.075      metre"
"      Maximum storage              1.714      c.m"
"      Centroidal lag              1.647      hours"
"              0.005      0.005      0.002      0.000 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"              CBMH1"
"      Maximum flow              0.002      c.m/sec"
"      Hydrograph volume              6.760      c.m"
"              0.005      0.005      0.002      0.002"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"              0.005      0.000      0.002      0.002"
" 33      CATCHMENT 203"
"      1      Triangular SCS"

```

```

"          1   Equal length"
"          1   SCS method"
"         203   No description"
"    100.000   % Impervious"
"         0.025   Total Area"
"         5.000   Flow length"
"         2.000   Overland Slope"
"         0.000   Pervious Area"
"         5.000   Pervious length"
"         2.000   Pervious slope"
"         0.025   Impervious Area"
"         5.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"    75.000   Pervious SCS Curve No."
"         0.000   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"   98.000   Impervious SCS Curve No."
"         0.816   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"           0.006   0.000   0.002   0.002 c.m/sec"
"      Catchment 203      Pervious   Impervious Total Area "
"      Surface Area      0.000   0.025   0.025   hectare"
"      Time of concentration 9.248   0.780   0.780   minutes"
"      Time to Centroid    117.353  90.710   90.710   minutes"
"      Rainfall depth     34.597   34.597   34.597   mm"
"      Rainfall volume     0.00   8.65   8.65   c.m"
"      Rainfall losses     28.464   6.366   6.366   mm"
"      Runoff depth        6.134   28.232   28.232   mm"
"      Runoff volume        0.00   7.06   7.06   c.m"
"      Runoff coefficient   0.000   0.816   0.816   "
"      Maximum flow        0.000   0.006   0.006   c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"         4      Add Runoff "
"           0.006   0.006   0.002   0.002"
" 54      POND DESIGN"
"         0.006   Current peak flow   c.m/sec"
"         0.004   Target outflow   c.m/sec"
"          7.1   Hydrograph volume   c.m"
"         11.   Number of stages"
"         0.000   Minimum water level   metre"
"         0.175   Maximum water level   metre"
"         0.000   Starting water level   metre"
"          0   Keep Design Data: 1 = True; 0 = False"
"           Level Discharge   Volume"
"           0.000   0.000   0.000"
"           0.01750   0.00044   0.02233"
"           0.03500   0.00088   0.1786"
"           0.05250   0.00132   0.6029"
"           0.07000   0.00177   1.429"
"           0.08750   0.00221   2.791"

```

"	0.1050	0.00265	4.823"		
"	0.1225	0.00309	7.659"		
"	0.1400	0.00353	11.433"		
"	0.1575	0.00397	15.805"		
"	0.1750	0.00442	20.180"		
"	1.	ROOFTOP"			
"	Roof area	Store area	Area/drain	Drain flow	Roof slope"
"	hectare	hectare	sq.metre	L/min/25mm	g H:1V"
"	0.025	0.025	200.000	37.850	50.000"
"	Using 1 roofdrains on roofstorage area of 250. square metre"				
"	Peak outflow		0.002	c.m/sec"	
"	Maximum level		0.075	metre"	
"	Maximum storage		1.844	c.m"	
"	Centroidal lag		1.658	hours"	
"	0.006	0.006	0.002	0.002 c.m/sec"	
" 40	HYDROGRAPH	Combine	1"		
"	6	Combine "			
"	1	Node #"			
"	CBMH1"				
"	Maximum flow		0.004	c.m/sec"	
"	Hydrograph volume		13.811	c.m"	
"	0.006	0.006	0.002	0.004"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"	0.006	0.000	0.002	0.004"	
" 33	CATCHMENT 202"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	202	No description"			
"	100.000	% Impervious"			
"	0.030	Total Area"			
"	6.000	Flow length"			
"	2.000	Overland Slope"			
"	0.000	Pervious Area"			
"	6.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.030	Impervious Area"			
"	6.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.000	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.822	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"	0.007	0.000	0.002	0.004 c.m/sec"	
"	Catchment 202	Pervious	Impervious	Total Area	"
"	Surface Area	0.000	0.030	0.030	hectare"
"	Time of concentration	10.317	0.871	0.871	minutes"

```

"           Time to Centroid      118.637      90.620      90.620      minutes"
"           Rainfall depth        34.597      34.597      34.597      mm"
"           Rainfall volume        0.00       10.38       10.38       c.m"
"           Rainfall losses        28.457      6.164       6.164       mm"
"           Runoff depth           6.141      28.434      28.434      mm"
"           Runoff volume           0.00       8.53        8.53        c.m"
"           Runoff coefficient      0.000      0.822       0.822       "
"           Maximum flow           0.000      0.007       0.007       c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"           4      Add Runoff "
"                   0.007      0.007      0.002      0.004"
" 54      POND DESIGN"
"           0.007      Current peak flow      c.m/sec"
"           0.004      Target outflow      c.m/sec"
"           8.5      Hydrograph volume      c.m"
"           11.      Number of stages"
"           0.000      Minimum water level      metre"
"           0.200      Maximum water level      metre"
"           0.000      Starting water level      metre"
"           0      Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge      Volume"
"                   0.000      0.000      0.000"
"                   0.02000      0.00101      0.05333"
"                   0.04000      0.00202      0.4267"
"                   0.06000      0.00303      1.440"
"                   0.08000      0.00404      3.413"
"                   0.1000      0.00505      6.667"
"                   0.1200      0.00606      11.520"
"                   0.1400      0.00707      17.505"
"                   0.1600      0.00807      23.505"
"                   0.1800      0.00908      29.505"
"                   0.2000      0.01009      35.505"
"           1.      ROOFTOP"
"                   Roof area      Store area      Area/drain      Drain flow      Roof slope"
"                   hectare      hectare      sq.metre      L/min/25mm      g H:1V"
"                   0.030      0.030      150.000      37.850      50.000"
"                   Using 2 roofdrains on roofstorage area of 300. square metre"
"                   Peak outflow      0.003      c.m/sec"
"                   Maximum level      0.062      metre"
"                   Maximum storage      1.604      c.m"
"                   Centroidal lag      1.584      hours"
"                   0.007      0.007      0.003      0.004 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"           6      Combine "
"           1      Node #"
"                   CBMH1"
"                   Maximum flow      0.007      c.m/sec"
"                   Hydrograph volume      22.360      c.m"
"                   0.007      0.007      0.003      0.007"
" 40      HYDROGRAPH Start - New Tributary"
"           2      Start - New Tributary"
"                   0.007      0.000      0.003      0.007"
" 33      CATCHMENT 201"
"           1      Triangular SCS"

```

"	1	Equal length"
"	1	SCS method"
"	201	No description"
"	100.000	% Impervious"
"	0.125	Total Area"
"	29.000	Flow length"
"	2.000	Overland Slope"
"	0.000	Pervious Area"
"	29.000	Pervious length"
"	2.000	Pervious slope"
"	0.125	Impervious Area"
"	29.000	Impervious length"
"	2.000	Impervious slope"
"	0.250	Pervious Manning 'n' "
"	75.000	Pervious SCS Curve No."
"	0.000	Pervious Runoff coefficient"
"	0.100	Pervious Ia/S coefficient"
"	8.467	Pervious Initial abstraction"
"	0.015	Impervious Manning 'n' "
"	98.000	Impervious SCS Curve No."
"	0.842	Impervious Runoff coefficient"
"	0.100	Impervious Ia/S coefficient"
"	0.518	Impervious Initial abstraction"
"	0.025	0.000 0.003 0.007 c.m/sec"
"	Catchment 201	Pervious Impervious Total Area "
"	Surface Area	0.000 0.125 0.125 hectare"
"	Time of concentration	26.552 2.240 2.240 minutes"
"	Time to Centroid	138.044 92.627 92.627 minutes"
"	Rainfall depth	34.597 34.597 34.597 mm"
"	Rainfall volume	0.00 43.25 43.25 c.m"
"	Rainfall losses	28.439 5.469 5.469 mm"
"	Runoff depth	6.159 29.128 29.128 mm"
"	Runoff volume	0.00 36.41 36.41 c.m"
"	Runoff coefficient	0.000 0.842 0.842 "
"	Maximum flow	0.000 0.025 0.025 c.m/sec"
" 40	HYDROGRAPH Add Runoff "	
"	4 Add Runoff "	
"	0.025 0.025 0.003 0.007"	
" 40	HYDROGRAPH Copy to Outflow"	
"	8 Copy to Outflow"	
"	0.025 0.025 0.025 0.007"	
" 40	HYDROGRAPH Combine 1"	
"	6 Combine "	
"	1 Node #"	
"	CBMH1"	
"	Maximum flow	0.031 c.m/sec"
"	Hydrograph volume	58.771 c.m"
"	0.025 0.025 0.025 0.031"	
" 40	HYDROGRAPH Start - New Tributary"	
"	2 Start - New Tributary"	
"	0.025 0.000 0.025 0.031"	
" 33	CATCHMENT 206"	
"	1 Triangular SCS"	
"	1 Equal length"	

"	1	SCS method"				
"	206	No description"				
"	26.500	% Impervious"				
"	0.050	Total Area"				
"	4.000	Flow length"				
"	2.000	Overland Slope"				
"	0.037	Pervious Area"				
"	4.000	Pervious length"				
"	2.000	Pervious slope"				
"	0.013	Impervious Area"				
"	4.000	Impervious length"				
"	2.000	Impervious slope"				
"	0.250	Pervious Manning 'n'"				
"	75.000	Pervious SCS Curve No."				
"	0.178	Pervious Runoff coefficient"				
"	0.100	Pervious Ia/S coefficient"				
"	8.467	Pervious Initial abstraction"				
"	0.015	Impervious Manning 'n'"				
"	98.000	Impervious SCS Curve No."				
"	0.806	Impervious Runoff coefficient"				
"	0.100	Impervious Ia/S coefficient"				
"	0.518	Impervious Initial abstraction"				
"		0.003	0.000	0.025	0.031 c.m/sec"	
"		Catchment 206	Pervious	Impervious	Total Area "	
"		Surface Area	0.037	0.013	0.050 hectare"	
"		Time of concentration	8.089	0.683	3.491 minutes"	
"		Time to Centroid	115.973	90.765	100.324 minutes"	
"		Rainfall depth	34.597	34.597	34.597 mm"	
"		Rainfall volume	12.71	4.58	17.30 c.m"	
"		Rainfall losses	28.454	6.702	22.690 mm"	
"		Runoff depth	6.143	27.895	11.908 mm"	
"		Runoff volume	2.26	3.70	5.95 c.m"	
"		Runoff coefficient	0.178	0.806	0.344 "	
"		Maximum flow	0.001	0.003	0.003 c.m/sec"	
" 40		HYDROGRAPH Add Runoff "				
"	4	Add Runoff "				
"		0.003	0.003	0.025	0.031"	
" 40		HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"				
"		0.003	0.003	0.003	0.031"	
" 40		HYDROGRAPH Combine 1"				
"	6	Combine "				
"	1	Node #"				
"		CBMH1"				
"		Maximum flow	0.034	c.m/sec"		
"		Hydrograph volume	64.724	c.m"		
"		0.003	0.003	0.003	0.034"	
" 40		HYDROGRAPH Confluence 1"				
"	7	Confluence "				
"	1	Node #"				
"		CBMH1"				
"		Maximum flow	0.034	c.m/sec"		
"		Hydrograph volume	64.724	c.m"		
"		0.003	0.034	0.003	0.000"	

" 51	PIPE DESIGN"				
"	0.034	Current peak flow	c.m/sec"		
"	0.013	Manning 'n'"			
"	0.300	Diameter	metre"		
"	2.000	Gradient	%"		
"		Depth of flow	0.101	metre"	
"		Velocity	1.601	m/sec"	
"		Pipe capacity	0.137	c.m/sec"	
"		Critical depth	0.141	metre"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.003	0.034	0.034	0.000"
" 40	HYDROGRAPH Combine 2"				
"	6	Combine "			
"	2	Node #"			
"	OFF SITE"				
"		Maximum flow	0.034	c.m/sec"	
"		Hydrograph volume	64.724	c.m"	
"		0.003	0.034	0.034	0.034"
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"		0.003	0.000	0.034	0.034"
" 33	CATCHMENT 205"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	205	No description"			
"	34.300	% Impervious"			
"	0.026	Total Area"			
"	3.000	Flow length"			
"	2.000	Overland Slope"			
"	0.017	Pervious Area"			
"	3.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.009	Impervious Area"			
"	3.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.176	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.790	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.002	0.000	0.034	0.034 c.m/sec"
"	Catchment 205				
"	Surface Area	0.017	0.009	0.026	hectare"
"	Time of concentration	6.807	0.574	2.441	minutes"
"	Time to Centroid	114.583	90.755	97.890	minutes"
"	Rainfall depth	34.597	34.597	34.597	mm"
"	Rainfall volume	5.91	3.09	9.00	c.m"

"	Rainfall losses	28.496	7.255	21.210	mm"
"	Runoff depth	6.101	27.343	13.387	mm"
"	Runoff volume	1.04	2.44	3.48	c.m"
"	Runoff coefficient	0.176	0.790	0.387	"
"	Maximum flow	0.000	0.002	0.002	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.002 0.002 0.034 0.034"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.002 0.002 0.002 0.034"				
" 40	HYDROGRAPH Combine 2"				
"	6 Combine "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.036	c.m/sec"		
"	Hydrograph volume	68.205	c.m"		
"	0.002 0.002 0.002 0.036"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	0.002 0.000 0.002 0.036"				
" 33	CATCHMENT 207"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	207 No description"				
"	91.700 % Impervious"				
"	0.010 Total Area"				
"	2.000 Flow length"				
"	1.000 Overland Slope"				
"	0.001 Pervious Area"				
"	2.000 Pervious length"				
"	1.000 Pervious slope"				
"	0.009 Impervious Area"				
"	2.000 Impervious length"				
"	1.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	75.000 Pervious SCS Curve No."				
"	0.176 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	8.467 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No."				
"	0.787 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.002 0.000 0.002 0.036 c.m/sec"				
"	Catchment 207 Pervious Impervious Total Area "				
"	Surface Area 0.001 0.009 0.010 hectare"				
"	Time of concentration 6.570 0.554 0.674 minutes"				
"	Time to Centroid 114.277 90.743 91.211 minutes"				
"	Rainfall depth 34.597 34.597 34.597 mm"				
"	Rainfall volume 0.29 3.17 3.46 c.m"				
"	Rainfall losses 28.494 7.381 9.134 mm"				

"	Runoff depth	6.103	27.216	25.464	mm"
"	Runoff volume	0.05	2.50	2.55	c.m"
"	Runoff coefficient	0.176	0.787	0.736	"
"	Maximum flow	0.000	0.002	0.002	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.002 0.002 0.002 0.036"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.002 0.002 0.002 0.036"				
" 40	HYDROGRAPH Combine 2"				
"	6 Combine "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.038			c.m/sec"
"	Hydrograph volume	70.751			c.m"
"	0.002 0.002 0.002 0.038"				
" 40	HYDROGRAPH Confluence 2"				
"	7 Confluence "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.038			c.m/sec"
"	Hydrograph volume	70.751			c.m"
"	0.002 0.038 0.002 0.000"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.002 0.038 0.038 0.000"				
" 38	START/RE-START TOTALS 2"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.290		hectare"
"	Total Impervious area		0.235		hectare"
"	Total % impervious		81.151"		
" 19	EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      February 7, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                        P:\2022 Projects\
"          22183 Shaw Royal George Theatre\Design\Preliminary\SWM\MIDUSS"
"          Output filename:                    100YR PRE.out"
"          Licensee name:                      Quartek"
"          Company                            "
"          Date & Time last used:              2023-12-21 at 3:47:35 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          980.000 Coefficient A"
"          3.700  Constant B"
"          0.732  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          201.140    mm/hr"
"          Total depth                64.717    mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 101"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          101  No description"
"          95.700  % Impervious"
"          0.090  Total Area"
"          19.000  Flow length"
"          2.000  Overland Slope"
"          0.004  Pervious Area"
"          19.000  Pervious length"
"          2.000  Pervious slope"
"          0.086  Impervious Area"
"          19.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious SCS Curve No."
"          0.346  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000  Impervious SCS Curve No."
"          0.898  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.039    0.000    0.000    0.000 c.m/sec"
"          Catchment 101          Pervious  Impervious Total Area "
"          Surface Area          0.004    0.086    0.090    hectare"
"          Time of concentration  10.750    1.290    1.451    minutes"

```

"	Time to Centroid	115.375	89.286	89.730	minutes"
"	Rainfall depth	64.717	64.717	64.717	mm"
"	Rainfall volume	2.50	55.74	58.25	c.m"
"	Rainfall losses	42.319	6.614	8.150	mm"
"	Runoff depth	22.398	58.103	56.567	mm"
"	Runoff volume	0.87	50.04	50.91	c.m"
"	Runoff coefficient	0.346	0.898	0.874	"
"	Maximum flow	0.000	0.039	0.039	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.039 0.039 0.000 0.000"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.039 0.039 0.039 0.000"				
" 40	HYDROGRAPH Next link "				
"	5 Next link "				
"	0.039 0.039 0.039 0.000"				
" 33	CATCHMENT 102"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	102 No description"				
"	73.000 % Impervious"				
"	0.040 Total Area"				
"	14.000 Flow length"				
"	2.000 Overland Slope"				
"	0.011 Pervious Area"				
"	14.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.029 Impervious Area"				
"	14.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	75.000 Pervious SCS Curve No."				
"	0.346 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	8.467 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n'"				
"	98.000 Impervious SCS Curve No."				
"	0.890 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.014 0.039 0.039 0.000 c.m/sec"				
"	Catchment 102 Pervious Impervious Total Area "				
"	Surface Area 0.011 0.029 0.040 hectare"				
"	Time of concentration 8.950 1.074 2.065 minutes"				
"	Time to Centroid 112.905 88.790 91.824 minutes"				
"	Rainfall depth 64.717 64.717 64.717 mm"				
"	Rainfall volume 6.99 18.90 25.89 c.m"				
"	Rainfall losses 42.312 7.125 16.626 mm"				
"	Runoff depth 22.405 57.592 48.091 mm"				
"	Runoff volume 2.42 16.82 19.24 c.m"				
"	Runoff coefficient 0.346 0.890 0.743 "				
"	Maximum flow 0.001 0.013 0.014 c.m/sec"				

" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.014	0.053	0.039	0.000"
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.014	0.053	0.053	0.000"
" 40	HYDROGRAPH Next link "				
"	5	Next link "			
"		0.014	0.053	0.053	0.000"
" 33	CATCHMENT 103"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	103	No description"			
"	62.300	% Impervious"			
"	0.090	Total Area"			
"	15.000	Flow length"			
"	2.000	Overland Slope"			
"	0.034	Pervious Area"			
"	15.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.056	Impervious Area"			
"	15.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.346	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.892	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.027	0.053	0.053	0.000 c.m/sec"
"	Catchment 103	Pervious	Impervious	Total Area	"
"	Surface Area	0.034	0.056	0.090	hectare"
"	Time of concentration	9.328	1.119	2.679	minutes"
"	Time to Centroid	113.447	88.886	93.552	minutes"
"	Rainfall depth	64.717	64.717	64.717	mm"
"	Rainfall volume	21.96	36.29	58.25	c.m"
"	Rainfall losses	42.348	7.002	20.327	mm"
"	Runoff depth	22.369	57.715	44.390	mm"
"	Runoff volume	7.59	32.36	39.95	c.m"
"	Runoff coefficient	0.346	0.892	0.686	"
"	Maximum flow	0.003	0.026	0.027	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.027	0.080	0.053	0.000"
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.027	0.080	0.080	0.000"
" 40	HYDROGRAPH Next link "				
"	5	Next link "			

"		0.027	0.080	0.080	0.000"
" 33	CATCHMENT 104"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	104	No description"			
"	22.600	% Impervious"			
"	0.060	Total Area"			
"	14.000	Flow length"			
"	2.000	Overland Slope"			
"	0.046	Pervious Area"			
"	14.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.014	Impervious Area"			
"	14.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.346	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.890	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.008	0.080	0.080	0.000 c.m/sec"
"	Catchment 104	Pervious	Impervious	Total Area	"
"	Surface Area	0.046	0.014	0.060	hectare"
"	Time of concentration	8.950	1.074	5.573	minutes"
"	Time to Centroid	112.905	88.790	102.566	minutes"
"	Rainfall depth	64.717	64.717	64.717	mm"
"	Rainfall volume	30.05	8.78	38.83	c.m"
"	Rainfall losses	42.312	7.125	34.360	mm"
"	Runoff depth	22.405	57.592	30.357	mm"
"	Runoff volume	10.40	7.81	18.21	c.m"
"	Runoff coefficient	0.346	0.890	0.469	"
"	Maximum flow	0.005	0.006	0.008	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"		0.008	0.088	0.080	0.000"
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.008	0.088	0.088	0.000"
" 38	START/RE-START TOTALS 104"				
"	3	Runoff Totals on EXIT"			
"	Total Catchment area			0.280	hectare"
"	Total Impervious area			0.185	hectare"
"	Total % impervious			66.057"	
" 19	EXIT"				

```

"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 465"
"          MIDUSS created                      February 5, 2008"
"          10  Units used:                      ie METRIC"
"          Job folder:                          P:\2022 Projects\
"          22183 Shaw Royal George Theatre\Design\Preliminary\SWM\MIDUSS"
"          Output filename:                    100YR POST_D.out"
"          Licensee name:                      Quartek"
"          Company                            Quartek_2"
"          Date & Time last used:              2025-05-13 at 8:36:20 AM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          980.000 Coefficient A"
"          3.700  Constant B"
"          0.732  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    201.140    mm/hr"
"          Total depth                          64.717    mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 204"
"          1  Triangular SCS"
"          1  Equal length"
"          1  SCS method"
"          204  No description"
"          100.000 % Impervious"
"          0.024  Total Area"
"          5.000  Flow length"
"          2.000  Overland Slope"
"          0.000  Pervious Area"
"          5.000  Pervious length"
"          2.000  Pervious slope"
"          0.024  Impervious Area"
"          5.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.000  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          8.467  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.852  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"          0.011  0.000  0.000  0.000 c.m/sec"
"          Catchment 204      Pervious  Impervious Total Area "
"          Surface Area      0.000      0.024      0.024      hectare"
"          Time of concentration 4.825      0.579      0.579      minutes"

```



```

"      Time to Centroid      107.319      88.791      88.791      minutes"
"      Rainfall depth        64.717      64.717      64.717      mm"
"      Rainfall volume        0.00      15.53      15.53      c.m"
"      Rainfall losses        42.407      9.585      9.585      mm"
"      Runoff depth           22.310      55.132      55.132      mm"
"      Runoff volume           0.00      13.23      13.23      c.m"
"      Runoff coefficient      0.000      0.852      0.852      "
"      Maximum flow           0.000      0.011      0.011      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.011      0.011      0.000      0.000"
" 54      POND DESIGN"
"      0.011      Current peak flow      c.m/sec"
"      0.004      Target outflow      c.m/sec"
"      13.2      Hydrograph volume      c.m"
"      11.      Number of stages"
"      0.000      Minimum water level      metre"
"      0.175      Maximum water level      metre"
"      0.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"              Level Discharge      Volume"
"              0.000      0.000      0.000"
"              0.01750      0.00044      0.02144"
"              0.03500      0.00088      0.1715"
"              0.05250      0.00132      0.5788"
"              0.07000      0.00177      1.372"
"              0.08750      0.00221      2.680"
"              0.1050      0.00265      4.630"
"              0.1225      0.00309      7.353"
"              0.1400      0.00353      10.976"
"              0.1575      0.00397      15.173"
"              0.1750      0.00442      19.373"
"      1.      ROOFTOP"
"              Roof area      Store area      Area/drain      Drain flow      Roof slope"
"              hectare      hectare      sq.metre      L/min/25mm      g H:1V"
"              0.024      0.024      200.000      37.850      50.000"
"      Using 1 roofdrains on roofstorage area of 240. square metre"
"      Peak outflow              0.003      c.m/sec"
"      Maximum level              0.103      metre"
"      Maximum storage              4.356      c.m"
"      Centroidal lag              1.751      hours"
"              0.011      0.011      0.003      0.000 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"              CBMH1"
"      Maximum flow              0.003      c.m/sec"
"      Hydrograph volume              13.227      c.m"
"              0.011      0.011      0.003      0.003"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"              0.011      0.000      0.003      0.003"
" 33      CATCHMENT 203"
"      1      Triangular SCS"

```

```

"          1   Equal length"
"          1   SCS method"
"         203   No description"
"    100.000   % Impervious"
"         0.025   Total Area"
"         5.000   Flow length"
"         2.000   Overland Slope"
"         0.000   Pervious Area"
"         5.000   Pervious length"
"         2.000   Pervious slope"
"         0.025   Impervious Area"
"         5.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"    75.000   Pervious SCS Curve No."
"         0.000   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"   98.000   Impervious SCS Curve No."
"         0.852   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"           0.012       0.000       0.003       0.003 c.m/sec"
"      Catchment 203      Pervious      Impervious Total Area "
"      Surface Area      0.000      0.025      0.025      hectare"
"      Time of concentration 4.825      0.579      0.579      minutes"
"      Time to Centroid    107.319    88.791    88.791      minutes"
"      Rainfall depth      64.717    64.717    64.717      mm"
"      Rainfall volume      0.00      16.18    16.18      c.m"
"      Rainfall losses      42.407    9.585    9.585      mm"
"      Runoff depth        22.310    55.132    55.132      mm"
"      Runoff volume        0.00      13.78    13.78      c.m"
"      Runoff coefficient    0.000    0.852    0.852      "
"      Maximum flow        0.000    0.012    0.012      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"           0.012       0.012       0.003       0.003"
" 54      POND DESIGN"
"      0.012      Current peak flow      c.m/sec"
"      0.004      Target outflow      c.m/sec"
"      13.8      Hydrograph volume      c.m"
"      11.      Number of stages"
"      0.000      Minimum water level      metre"
"      0.175      Maximum water level      metre"
"      0.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"           Level Discharge      Volume"
"           0.000      0.000      0.000"
"           0.01750    0.00044    0.02233"
"           0.03500    0.00088    0.1786"
"           0.05250    0.00132    0.6029"
"           0.07000    0.00177    1.429"
"           0.08750    0.00221    2.791"

```

"	0.1050	0.00265	4.823"		
"	0.1225	0.00309	7.659"		
"	0.1400	0.00353	11.433"		
"	0.1575	0.00397	15.805"		
"	0.1750	0.00442	20.180"		
"	1.	ROOFTOP"			
"		Roof area	Store area	Area/drain	Drain flow
"		hectare	hectare	sq.metre	L/min/25mm
"		0.025	0.025	200.000	37.850
"					50.000"
"		Using 1 roofdrains on roofstorage area of 250. square metre"			
"		Peak outflow		0.003	c.m/sec"
"		Maximum level		0.103	metre"
"		Maximum storage		4.639	c.m"
"		Centroidal lag		1.769	hours"
"		0.012	0.012	0.003	0.003 c.m/sec"
" 40		HYDROGRAPH	Combine	1"	
"	6	Combine "			
"	1	Node #"			
"		CBMH1"			
"		Maximum flow		0.005	c.m/sec"
"		Hydrograph volume		26.992	c.m"
"		0.012	0.012	0.003	0.005"
" 40		HYDROGRAPH Start - New Tributary"			
"	2	Start - New Tributary"			
"		0.012	0.000	0.003	0.005"
" 33		CATCHMENT 202"			
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	202	No description"			
"	100.000	% Impervious"			
"	0.030	Total Area"			
"	6.000	Flow length"			
"	2.000	Overland Slope"			
"	0.000	Pervious Area"			
"	6.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.030	Impervious Area"			
"	6.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.000	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.862	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.014	0.000	0.003	0.005 c.m/sec"
"		Catchment 202	Pervious	Impervious	Total Area "
"		Surface Area	0.000	0.030	0.030 hectare"
"		Time of concentration	5.383	0.646	0.646 minutes"

```

"      Time to Centroid      108.061      88.812      88.812      minutes"
"      Rainfall depth       64.717      64.717      64.717      mm"
"      Rainfall volume      0.00      19.42      19.42      c.m"
"      Rainfall losses      42.401      8.902      8.902      mm"
"      Runoff depth         22.316      55.815      55.815      mm"
"      Runoff volume        0.00      16.74      16.74      c.m"
"      Runoff coefficient    0.000      0.862      0.862      "
"      Maximum flow         0.000      0.014      0.014      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"      4      Add Runoff "
"              0.014      0.014      0.003      0.005"
" 54      POND DESIGN"
"      0.014      Current peak flow      c.m/sec"
"      0.004      Target outflow      c.m/sec"
"      16.7      Hydrograph volume      c.m"
"      11.      Number of stages"
"      0.000      Minimum water level      metre"
"      0.200      Maximum water level      metre"
"      0.000      Starting water level      metre"
"      0      Keep Design Data: 1 = True; 0 = False"
"              Level Discharge      Volume"
"              0.000      0.000      0.000"
"              0.02000      0.00101      0.05333"
"              0.04000      0.00202      0.4267"
"              0.06000      0.00303      1.440"
"              0.08000      0.00404      3.413"
"              0.1000      0.00505      6.667"
"              0.1200      0.00606      11.520"
"              0.1400      0.00707      17.505"
"              0.1600      0.00807      23.505"
"              0.1800      0.00908      29.505"
"              0.2000      0.01009      35.505"
"      1.      ROOFTOP"
"              Roof area      Store area      Area/drain      Drain flow      Roof slope"
"              hectare      hectare      sq.metre      L/min/25mm      g H:1V"
"              0.030      0.030      150.000      37.850      50.000"
"      Using 2 roofdrains on roofstorage area of 300. square metre"
"      Peak outflow      0.004      c.m/sec"
"      Maximum level      0.086      metre"
"      Maximum storage      4.450      c.m"
"      Centroidal lag      1.628      hours"
"              0.014      0.014      0.004      0.005 c.m/sec"
" 40      HYDROGRAPH      Combine      1"
"      6      Combine "
"      1      Node #"
"              CBMH1"
"      Maximum flow      0.010      c.m/sec"
"      Hydrograph volume      43.711      c.m"
"              0.014      0.014      0.004      0.010"
" 40      HYDROGRAPH Start - New Tributary"
"      2      Start - New Tributary"
"              0.014      0.000      0.004      0.010"
" 33      CATCHMENT 201"
"      1      Triangular SCS"

```

"	1	Equal length"
"	1	SCS method"
"	201	No description"
"	100.000	% Impervious"
"	0.125	Total Area"
"	29.000	Flow length"
"	2.000	Overland Slope"
"	0.000	Pervious Area"
"	29.000	Pervious length"
"	2.000	Pervious slope"
"	0.125	Impervious Area"
"	29.000	Impervious length"
"	2.000	Impervious slope"
"	0.250	Pervious Manning 'n' "
"	75.000	Pervious SCS Curve No."
"	0.000	Pervious Runoff coefficient"
"	0.100	Pervious Ia/S coefficient"
"	8.467	Pervious Initial abstraction"
"	0.015	Impervious Manning 'n' "
"	98.000	Impervious SCS Curve No."
"	0.904	Impervious Runoff coefficient"
"	0.100	Impervious Ia/S coefficient"
"	0.518	Impervious Initial abstraction"
"	0.054	0.000 0.004 0.010 c.m/sec"
"	Catchment 201	Pervious Impervious Total Area "
"	Surface Area	0.000 0.125 0.125 hectare"
"	Time of concentration	13.855 1.662 1.662 minutes"
"	Time to Centroid	119.624 89.866 89.866 minutes"
"	Rainfall depth	64.717 64.717 64.717 mm"
"	Rainfall volume	0.00 80.90 80.90 c.m"
"	Rainfall losses	42.296 6.225 6.225 mm"
"	Runoff depth	22.421 58.492 58.492 mm"
"	Runoff volume	0.00 73.11 73.11 c.m"
"	Runoff coefficient	0.000 0.904 0.904 "
"	Maximum flow	0.000 0.054 0.054 c.m/sec"
" 40	HYDROGRAPH Add Runoff "	
"	4 Add Runoff "	
"	0.054 0.054 0.004 0.010"	
" 40	HYDROGRAPH Copy to Outflow"	
"	8 Copy to Outflow"	
"	0.054 0.054 0.054 0.010"	
" 40	HYDROGRAPH Combine 1"	
"	6 Combine "	
"	1 Node #"	
"	CBMH1"	
"	Maximum flow	0.062 c.m/sec"
"	Hydrograph volume	116.826 c.m"
"	0.054 0.054 0.054 0.062"	
" 40	HYDROGRAPH Start - New Tributary"	
"	2 Start - New Tributary"	
"	0.054 0.000 0.054 0.062"	
" 33	CATCHMENT 206"	
"	1 Triangular SCS"	
"	1 Equal length"	

"	1	SCS method"			
"	206	No description"			
"	26.500	% Impervious"			
"	0.050	Total Area"			
"	4.000	Flow length"			
"	2.000	Overland Slope"			
"	0.037	Pervious Area"			
"	4.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.013	Impervious Area"			
"	4.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.343	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.839	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.009	0.000	0.054	0.062 c.m/sec"
"		Catchment 206	Pervious	Impervious	Total Area "
"		Surface Area	0.037	0.013	0.050 hectare"
"		Time of concentration	4.221	0.506	2.481 minutes"
"		Time to Centroid	106.538	88.707	98.185 minutes"
"		Rainfall depth	64.717	64.717	64.717 mm"
"		Rainfall volume	23.78	8.58	32.36 c.m"
"		Rainfall losses	42.506	10.430	34.006 mm"
"		Runoff depth	22.211	54.287	30.711 mm"
"		Runoff volume	8.16	7.19	15.36 c.m"
"		Runoff coefficient	0.343	0.839	0.475 "
"		Maximum flow	0.005	0.006	0.009 c.m/sec"
" 40		HYDROGRAPH Add Runoff "			
"	4	Add Runoff "			
"		0.009	0.009	0.054	0.062"
" 40		HYDROGRAPH Copy to Outflow"			
"	8	Copy to Outflow"			
"		0.009	0.009	0.009	0.062"
" 40		HYDROGRAPH Combine 1"			
"	6	Combine "			
"	1	Node #"			
"		CBMH1"			
"		Maximum flow	0.072		c.m/sec"
"		Hydrograph volume	132.181		c.m"
"		0.009	0.009	0.009	0.072"
" 40		HYDROGRAPH Confluence 1"			
"	7	Confluence "			
"	1	Node #"			
"		CBMH1"			
"		Maximum flow	0.072		c.m/sec"
"		Hydrograph volume	132.181		c.m"
"		0.009	0.072	0.009	0.000"

" 51	PIPE DESIGN"				
"	0.072	Current peak flow	c.m/sec"		
"	0.013	Manning 'n'"			
"	0.300	Diameter	metre"		
"	2.000	Gradient	%"		
"		Depth of flow	0.154	metre"	
"		Velocity	1.957	m/sec"	
"		Pipe capacity	0.137	c.m/sec"	
"		Critical depth	0.209	metre"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"		0.009	0.072	0.072	0.000"
" 40	HYDROGRAPH Combine 2"				
"	6	Combine "			
"	2	Node #"			
"	OFF SITE"				
"		Maximum flow	0.072	c.m/sec"	
"		Hydrograph volume	132.181	c.m"	
"		0.009	0.072	0.072	0.072"
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"		0.009	0.000	0.072	0.072"
" 33	CATCHMENT 205"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	1	SCS method"			
"	205	No description"			
"	34.300	% Impervious"			
"	0.026	Total Area"			
"	3.000	Flow length"			
"	2.000	Overland Slope"			
"	0.017	Pervious Area"			
"	3.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.009	Impervious Area"			
"	3.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious SCS Curve No."			
"	0.340	Pervious Runoff coefficient"			
"	0.100	Pervious Ia/S coefficient"			
"	8.467	Pervious Initial abstraction"			
"	0.015	Impervious Manning 'n'"			
"	98.000	Impervious SCS Curve No."			
"	0.827	Impervious Runoff coefficient"			
"	0.100	Impervious Ia/S coefficient"			
"	0.518	Impervious Initial abstraction"			
"		0.006	0.000	0.072	0.072 c.m/sec"
"	Catchment 205	Pervious	Impervious	Total Area	"
"	Surface Area	0.017	0.009	0.026	hectare"
"	Time of concentration	3.552	0.426	1.802	minutes"
"	Time to Centroid	105.790	88.471	96.095	minutes"
"	Rainfall depth	64.717	64.717	64.717	mm"
"	Rainfall volume	11.05	5.77	16.83	c.m"

"	Rainfall losses	42.738	11.180	31.914	mm"
"	Runoff depth	21.979	53.538	32.803	mm"
"	Runoff volume	3.75	4.77	8.53	c.m"
"	Runoff coefficient	0.340	0.827	0.507	"
"	Maximum flow	0.002	0.004	0.006	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.006 0.006 0.072 0.072"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.006 0.006 0.006 0.072"				
" 40	HYDROGRAPH Combine 2"				
"	6 Combine "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.077	c.m/sec"		
"	Hydrograph volume	140.710	c.m"		
"	0.006 0.006 0.006 0.077"				
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"	0.006 0.000 0.006 0.077"				
" 33	CATCHMENT 207"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	1 SCS method"				
"	207 No description"				
"	91.700 % Impervious"				
"	0.010 Total Area"				
"	2.000 Flow length"				
"	1.000 Overland Slope"				
"	0.001 Pervious Area"				
"	2.000 Pervious length"				
"	1.000 Pervious slope"				
"	0.009 Impervious Area"				
"	2.000 Impervious length"				
"	1.000 Impervious slope"				
"	0.250 Pervious Manning 'n' "				
"	75.000 Pervious SCS Curve No."				
"	0.340 Pervious Runoff coefficient"				
"	0.100 Pervious Ia/S coefficient"				
"	8.467 Pervious Initial abstraction"				
"	0.015 Impervious Manning 'n' "				
"	98.000 Impervious SCS Curve No."				
"	0.825 Impervious Runoff coefficient"				
"	0.100 Impervious Ia/S coefficient"				
"	0.518 Impervious Initial abstraction"				
"	0.004 0.000 0.006 0.077 c.m/sec"				
"	Catchment 207 Pervious Impervious Total Area "				
"	Surface Area	0.001	0.009	0.010	hectare"
"	Time of concentration	3.428	0.411	0.520	minutes"
"	Time to Centroid	105.568	88.418	89.035	minutes"
"	Rainfall depth	64.717	64.717	64.717	mm"
"	Rainfall volume	0.54	5.93	6.47	c.m"
"	Rainfall losses	42.718	11.355	13.958	mm"

"	Runoff depth	21.999	53.362	50.759	mm"
"	Runoff volume	0.18	4.89	5.08	c.m"
"	Runoff coefficient	0.340	0.825	0.784	"
"	Maximum flow	0.000	0.004	0.004	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"	0.004 0.004 0.006 0.077"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.004 0.004 0.004 0.077"				
" 40	HYDROGRAPH Combine 2"				
"	6 Combine "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.082			c.m/sec"
"	Hydrograph volume	145.786			c.m"
"	0.004 0.004 0.004 0.082"				
" 40	HYDROGRAPH Confluence 2"				
"	7 Confluence "				
"	2 Node #"				
"	OFF SITE"				
"	Maximum flow	0.082			c.m/sec"
"	Hydrograph volume	145.786			c.m"
"	0.004 0.082 0.004 0.000"				
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"	0.004 0.082 0.082 0.000"				
" 38	START/RE-START TOTALS 2"				
"	3 Runoff Totals on EXIT"				
"	Total Catchment area		0.290		hectare"
"	Total Impervious area		0.235		hectare"
"	Total % impervious		81.151"		
" 19	EXIT"				



24"x36" Metric - Meters

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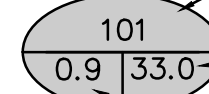
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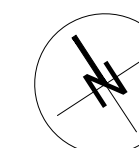
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project title

ROYAL GEORGE THEATRE

85 Queen St, Niagara-on-the-Lake,

drawing title

POST-DEVELOPMENT DRAINAGE AREAS

drawn by **CJM** designed by **CJM/DP**

scale	date
1:200	08 DEC 2023

job number	issue
22183	C

drawing number
STM-POST