Functional Servicing and Stormwater Management Design Report - 32 Grand Avenue

City of Cambridge, Ontario

Submitted to:
Grand Ave Developments (Cambridge) LP
10 Weaver Street
Cambridge, ON N3C 1V8

Submitted by:
GEI Consultants Canada Limited
330 Trillium Drive, Unit D
Kitchener, ON N2E 3J2
519.748.1440

December 9, 2024
Project No. 2407802

Sarah Primmer, P.Eng.
Senior Project Manager

Patricia Wiebe, P.Eng.
Project Engineer

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PW/SP

B:\Working\GRAND AVENUE DEVELOPMENTS\2407802 32 Grand Ave Cambridge\Design Phase\Reports - SWM, FSR, Design Brief, etc\2407802 - Functional Servicing and SWM Design Report_2024-12-09.docx

Certification

PREPARED BY:
GEI Consultants Canada Limited

Sarah Primmer, P.Eng.
Senior Project Manager

Patricia Wiebe, P.Eng.
Project Engineer

1. Introduction

This report has been prepared to document the servicing design and the stormwater management system design for the proposed development of 32 Grand Avenue in the City of Cambridge. The Owner is required to have a Professional Engineer design a stormwater management system and have the said Engineer supervise and certify that the stormwater management system was installed in accordance with the approvals given under Section 41 of the Planning Act.

The legal and topographic survey was completed by J.D. Barnes Limited (dated February 24, 2023). The Site Plan was prepared by NEO Architecture Inc. (dated September 17th, 2024). The existing and proposed site details are provided on the drawings prepared by GEI.

The site is bound by Hood Street to the north, Grand Avenue to the east, and existing residential lands to the south and west. At this time, the intent of the Owner is to develop the 0.20 ha site into the construction of a 28-storey residential building with driveways and landscaping.

2. Site Grading

As illustrated on the topographic survey completed for the proposed development, the site generally slopes towards Grand Avenue South in a west to east direction. The centerline road elevation on Grand Avenue South along the frontage of the property ranges from approximately 266.75m to 266.50m. The centerline road elevation on Hood Street along the frontage of the property ranges from approximately 266.75m to 266.90m.

The grade and elevations of the site are controlled by the elevation of the existing centerline road elevation of Grand Avenue South and Hood Street. The site will be graded to match the existing elevations along the property limits.

3. Site Services

3.1. Water Supply

Water supply is proposed to be provided via the extension of a 250mm diameter water service lateral from the existing 300mm diameter watermain on the Grand Avenue South right-of-way.

There is an existing nearby municipal fire hydrants on Grand Avenue South (at the intersection with St. Andrews Street south of the proposed development) and Hood Street (at the intersection with George Street South).

Table 3-1. Anticipated Water Demands from Site

	Anticipated Water Demand
Average Water Demand (328 Units @ 2.4 ppl/unit @ 225 Lcd)	2.05 L/s
Maximum Day (Peak Factor of 2)	4.10 L/s

We estimate the fire flow demand for the proposed development with noncombustible construction is 267 L/s, per the FUS approach. A copy of the fire flow demands has been included in Appendix A. A hydrant test was completed at the intersection of St. Andrews Street and Grand Avenue South on October 30th, 2024. Based on the results of the hydrant test, we estimate that there is an available fire flow of 500 L/s in this location. A copy of the hydrant test has been provided in Appendix A.

3.2. Sanitary Service

Sanitary service for the site will be provided by a 200mm diameter sanitary sewer service lateral extended from the existing 1200mm diameter sanitary sewer on Grand Avenue South. The capacity of the existing 1200mm diameter sanitary sewer on Grand Avenue South is 1.9265 m^3/s (approximately), based on a grade of 0.22%.

The following table summarizes the flows discharging from the site to the municipal sanitary sewer. The sanitary sewer design sheet is provided in Appendix B.

Table 3-2. Anticipated Sanitary Design Flows to Grand Avenue South

	Anticipated Sanitary Design Flow
Peak Sanitary Sewer Flow (328 Units @ 2.4 ppl/unit @ 275 Lcd)	0.0100 m^3/s
Extraneous Flow (0.20 ha site @ 0.25 L/s/ha)	0.0001 m^3/s
Total Sanitary Flow	0.0101 m^3/s
Existing 1200mm Diameter Sanitary Sewer Capacity	1.9265 m^3/s

The peak sanitary sewer flow from the development to Grand Avenue South represents approximately 0.50% of the existing sanitary sewer capacity. Therefore, in our opinion the existing 1200mm sanitary

sewer on Grand Avenue South has sufficient capacity to convey the anticipated design flows from the proposed development.

3.3. Storm Service

Storm services for the site will be provided via a 250mm diameter storm sewer service lateral discharging to the existing 250mm diameter storm sewer on Grand Avenue South. The storm sewer design sheet can be found in Appendix B.

4. Stormwater Management Design

The City of Cambridge Chicago Storm parameters used to model the design rainfall events for the site are summarized in the following table. These parameters are consistent with the City of Cambridge Engineering Standards and Development Manual (dated September 2023). The Chicago Rainfall Distribution parameters and the total depth of rainfall for the analysis are as follows:

Table 4-1. City of Cambridge – Chicago Storm Parameters

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
A	573.1	1219.8	1728.6	2226.9	2640.0	3015.1
B	5.0	10.5	14.0	17.0	19.0	21.0
C	0.761	0.823	0.849	0.865	0.866	0.870
r	0.400	0.400	0.400	0.400	0.400	0.400
Duration (min.)	180	180	180	180	180	180
Total Depth (mm)	32.362	48.647	59.221	69.200	80.894	89.669

The Horton infiltration method was used in the MIDUSS model. The parameters used in MIDUSS are as follows:

Table 4-2. MIDUSS Horton Parameters

	Impervious Areas	Pervious Areas
Maximum Infiltration (mm/hr)	0.0	75.0
Minimum Infiltration (mm/hr)	0.0	12.5
Lag Constant (hr)	0.05	0.25
Depression Storage (mm)	1.5	5.0

The hydrologic model MIDUSS was used to create runoff hydrographs and to route the flows through the storage structures.

4.1. Stormwater Management Criteria

The following are the criteria used to design the stormwater management system for the proposed development:

1. The post-development peak runoff generated from the site is to be attenuated to the existing condition levels, for the full range of design storm events up to and including the 100-year design storm.
2. Enhanced water quality treatment (80% TSS total suspended solids removal) is to be provided prior to the discharge of runoff from the site.
3. Provide extended detention storage of the 25mm event.
4. Major storm flows are to be routed overland to an appropriate outlet.

4.2. Existing Condition Drainage Areas

For the existing condition analysis, the site was analyzed as one (1) drainage catchment. The existing condition drainage catchment is shown on Figure No. 1.

Catchment 101 (0.20-hectares, 90% impervious) represents the existing site, consisting of three detached houses with associated driveways and landscaped areas. Runoff generated from Catchment 10 sheetflows overland, uncontrolled, to the Grand Avenue South right-of-way.

The following table summarizes the existing condition flow rates.

Table 4-3. Existing Condition Peak Flow Rates

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Catchment 10 (uncontrolled)	0.035 m^3/s	0.049 m^3/s	0.057 m^3/s	0.064 m^3/s	0.071 m^3/s	0.076 m^3/s
Total	**0.035 m^3/s**	**0.049 m^3/s**	**0.057 m^3/s**	**0.064 m^3/s**	**0.071 m^3/s**	**0.076 m^3/s**

4.3. Allowable Release Rates

The post-development flows are to be attenuated to the existing condition levels, for the full range of design storm events up to and including the 100-year design storm. Therefore, the allowable release rate under post-development conditions are as follows:

Table 4-4. Allowable Release Rates

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Total Flows from Site	0.035 m^3/s	0.049 m^3/s	0.057 m^3/s	0.064 m^3/s	0.071 m^3/s	0.076 m^3/s

4.4. Post-Development Condition Drainage Areas

For the post-development condition analysis, the site was analyzed as two (2) drainage catchments. The post-development drainage catchments are shown on Figure No. 2.

Catchment 201 (0.16-hectares, 100% impervious) represents the rooftop of the proposed development. Clean runoff from Catchment 100 is proposed to drain via roof drains to the proposed storm sewer service lateral, ultimately discharging to the existing 250mm diameter storm sewer in the Grand Avenue South right-of-way.

Since the rooftop of the proposed building is flat, and roof drains are provided under the Ontario Building Code, natural storage and attenuation of stormwater will occur. As such, rooftop storage will be used to attenuate flows to a depth of 0.1 metres, with a maximum storage depth of 0.15 m at the roof drains. Runoff will be attenuated through the use of six (6) roof drains with six (6) weirs per drain before being routed to the storm sewer service lateral, ultimately discharging to the existing 250mm diameter storm sewer on Grand Avenue South.

32 GRANDE AVE S
CITY OF CAMBRIDGE

CB3
T/G=266.69
S=265.21

STM MH1
T/G=266.89
E=265.31
W=265.35
NW=265.29
S=264.52
N=265.29

BM-2407802-1

SAN MH1
T/G=266.76
S=262.99
N=262.99

CB2
T/G=265.53
E=265.60

CB4
T/G=266.55
SE=265.67

1.5 STOREY BRICK BUILDING NO. 32
FF=297.82

1.5 STOREY BRICK BUILDING NO. 36
FF=297.78

1.5 STOREY BRICK BUILDING NO. 38
FF=297.77

ASPHALT

EDGE OF ASPHALT

101
0.20 | 90

N

LEGEND

DRAINAGE AREA BOUNDARY

101 — CATCHMENT NUMBER
0.20 | 90 — PERCENT IMPERVIOUS
CATCHMENT AREA IN HECTARES

4 2 0 5 10 15
1:300 (m)

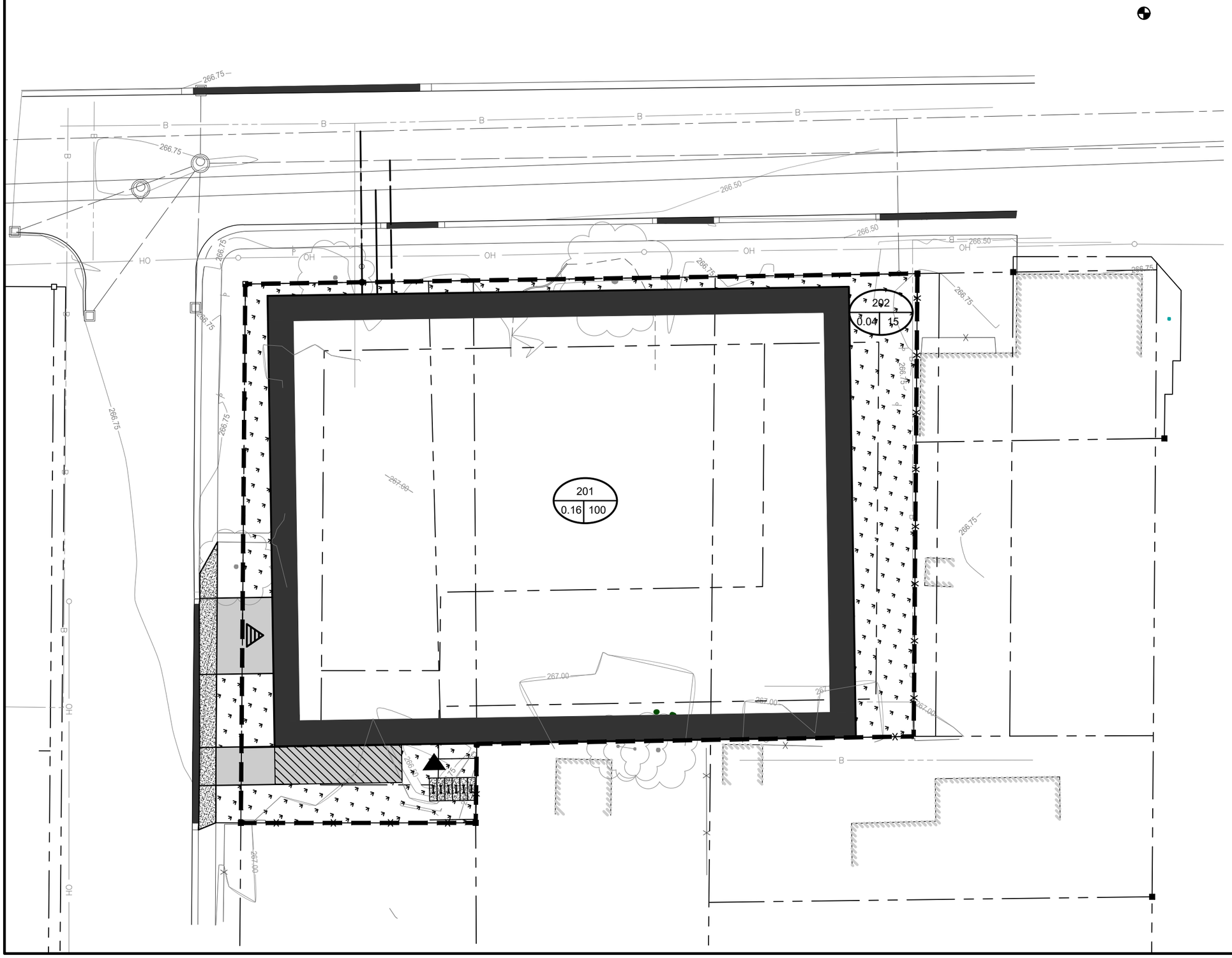
PRE-DEVELOPMENT STORM DRAINAGE AREA FIGURE

Figure No. 1

2407802
OCT 2024
Scale: 1:300 | NAD 1983 UTM Zone 17N

FILE:B:\Working\GRAND AVENUE DEVELOPMENTS\2407802 32 Grand Ave Cambridge\Design Phase\Drawings\2407802 EXISTING SWM FIGURE.dwg LAYOUT:Layout2
LAST SAVED BY:Sunali3936, 11/1/2024 11:10:28 AM PLOTTED BY:Alif, Sunjar 11/1/2024 11:11:18 AM

32 GRANDE AVE S
CITY OF CAMBRIDGE



N

LEGEND

DRAINAGE AREA BOUNDARY

202
0.04 | 15

CATCHMENT NUMBER
PERCENT IMPERVIOUS
CATCHMENT AREA IN HECTARES

4 2 0 5 10 15
1:300 (m)

POST-DEVELOPMENT STORM DRAINAGE AREA FIGURE

Figure No. 2

2407802
OCT 2024
Scale: 1:300 | NAD 1983 UTM Zone 17N

FILE:B:\Working\GRAND AVENUE DEVELOPMENTS\2407802 32 Grand Ave Cambridge\Design Phase\Drawings\2407802 POST DEVELOPMENT SWM FIGURE.dwg LAYOUT:Layout2
LAST SAVED BY:Sunali3936, 11/1/2024 11:26:48 AM PLOTTED BY:Alif, Sunjar 11/1/2024 11:27:02 AM

Catchment 202 (0.04-hectares, 15% impervious) represents the landscaped area of the site. Runoff generated from Catchment 200 will sheetflow overland, uncontrolled, north and east towards the Hood Street and Grand Avenue South rights-of-way.

Quality control measures will not be needed for the proposed development as the majority of runoff will be on the rooftop which is considered “clean” runoff.

4.4.1. Routing

The Hydrologic model MIDUSS was used to create the 2-100-year design storm runoff hydrographs and to route the hydrographs. A copy of the modelling results of the post-development analysis is appended.

The results of the routing analysis are as follows:

Table 4-5. Catchment 201 Rooftop Storage Stage/Storage/Discharge Capacities

	Available Capacity			**Actual Capacity Used**		
	Peak Flow m^3/s	**Storage Volume m^3**	**Storage Elevation m**	**Peak Flow m^3/s**	**Storage Volume m^3**	**Storage Elevation m**
Rooftop	0.000	0.0	0.000	---	---	---
2-Year	---	---	---	0.012	20.7	0.013
5-Year	---	---	---	0.017	31.2	0.019
10-Year	---	---	---	0.021	37.3	0.023
25-Year	---	---	---	0.024	42.7	0.026
50-Year	---	---	---	0.027	48.8	0.030
100-Year	---	---	---	0.030	53.1	0.033
Overflow	0.090	163.0	0.100	---	---	---

A summary of the post-development peak flow from the site for all design storm events are provided in the table below.

Table 4-6. Summary of Post-Development Peak Flow Rates

	2-Year	**5-Year**	**10-Year**	**25-Year**	**50-Year**	**100-Year**
Catchment 201 (controlled)	0.012 m^3/s	0.017 m^3/s	0.021 m^3/s	0.024 m^3/s	0.027 m^3/s	0.030 m^3/s
Catchment 202 (uncontrolled)	0.001 m^3/s	0.005 m^3/s	0.008 m^3/s	0.010 m^3/s	0.012 m^3/s	0.014 m^3/s
Total	**0.012 m^3/s**	**0.021 m^3/s**	**0.026 m^3/s**	**0.031 m^3/s**	**0.036 m^3/s**	**0.039 m^3/s**

Table 4-7. Comparison of Allowable Release Rates and Post-Development Flow Rates

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Allowable Release Rate	0.035 m^3/s	0.049 m^3/s	0.057 m^3/s	0.064 m^3/s	0.071 m^3/s	0.076 m^3/s
Post-Development Flow Rate	0.012 m^3/s	0.021 m^3/s	0.026 m^3/s	0.031 m^3/s	0.036 m^3/s	0.039 m^3/s

Therefore, the post-development peak flow rates are attenuated to allowable release rates during the 2-year to 100-year design storm events.

5. Maintenance Plan

To ensure that the stormwater management system continues to function as designed and constructed, we recommend that the following inspections and maintenance activities be completed on an annual basis:

1. Is there any noticeable damage to the asphalt (i.e. erosion, blockages)? If yes, complete any necessary repairs.
2. Is there any indication of a spill (i.e. frothy water, oily sheen)? If yes, investigate, inform the appropriate agencies and complete the necessary clean-up and restoration.
3. Inspect all roof drains and associated piping. Remove and dispose of any accumulated sediment, trash/litter, debris (i.e. leaves).

Please note that any structures identified during the annual inspection to be worn, missing or damaged are to be repaired or replaced within 48 hours.

6. Erosion and Sediment Control Plan

A silt fence is to be installed along the perimeter of the property. The silt fence serves to minimize the opportunity for sediment to leave the site. The on-site catch basin is to have silt sacs placed under the grate until all on-site construction has been completed.

Inspection and maintenance of all silt fencing will start after installation is complete. The silt fence will be inspected on a weekly basis during active construction or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the silt fence found to need repair.

Once construction and landscaping has been substantially completed, the silt fence will be removed, any accumulated sediment will be removed, and the landscaping will be completed.

After construction of the complete development, erosion will not occur, and sediment transport will be minimal.

7. Conclusions

In summary, the features of the design for the proposed development are as follows:

1. It is proposed that the development will be accessed by Hood Street, and that the grading of the development is controlled by the existing elevations of Grand Avenue South and Hood Street across the frontages of the site.
2. Water supply for the proposed development will be provided via the extension of a 200 mm diameter water service lateral to the existing 300mm diameter watermain on Grand Avenue South.
3. The water service lateral for the development will provide both fire protection and domestic supply.
4. Sanitary service for the development will be provided by a 300mm diameter sanitary sewer service lateral extended from the existing 1200mm diameter sanitary sewer on Grand Avenue South.
5. Storm service for the development will be provided via a 250mm diameter storm sewer service lateral discharging to the existing 250mm diameter storm sewer on Grand Avenue South.
6. Stormwater quality control is not required as the runoff from the majority of the site is from roof area and is considered clean.
7. Prior to construction, a silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. This will minimize the transport of sediment off-site during the construction period.
8. The Owner/Agent is to provide the Mechanical and Structural Engineers with copies of the Stormwater Management Report and the Site Grading and Servicing Plan for their use in the design of the rooftop stormwater management measures.
9. A qualified Structural Engineer must review and verify that the roof of the proposed building has the structural capacity to carry the loading of the stored rainfall and all other loading in accordance with OBC 2024.
10. To ensure that the average depth of water storage on the rooftop of the proposed building does not exceed the design criteria of 100 mm, with a maximum storage depth of 150 mm at the roof drains, we recommend that a qualified Mechanical Engineer review and verify the requirement for overflow structures to be included in the design.

Appendix A Fire Flow Demands Analysis

Project No: 2407802
Designed By: PW
Checked By: SP

FIRE UNDERWRITERS SURVEY CALCULATIONS

32 Grand Avenue
City of Cambridge

Date: 12/9/2024

Parameters from Water Supply for Public Fire Protection, Fire Underwriters Survey (2020)

Type of Construction	
Wood	1.5
Ordinary	1.0
Noncombustible	0.8
Fire-Resistive	0.6

Fire Hazard	
Non-Combustible	-0.25
Limited Combustibility	-0.15
Combustible	0
Free Burning	0.15
Rapid Burning	0.25

Sprinklers	
No	0
System	-30%
Standard Water Supply	-40%
Fully Supervised	-50%

Proximity to closest structure (m)	
0 to 3	25%
3 to 10	20%
10 to 20	15%
20 to 30	10%
Greater than 30	0%

Building	Gross Floor Area (m2)	Construction Coefficient	NFF 220*C*(A)**0.5	Rounded NFF (to nearest 1000L/min)	Occupancy Factor	NFF adjusted for occupancy	Sprinkler Adjustment	Sprinkler Credit	Exposure Coefficient					Exposure Flow Debit	RFF	Rounded RFF (to nearest 1000L/min)	Required Fire Flow (L/s)
									N	S	E	W	Total (max 0.75)				
Multi-Residential	8076	0.8	15817	16000	-0.15	13600	-0.4	-5440	0.15	0.2	0	0.25	0.6	8160	16320	16000	267

SPIRA FIRE PROTECTION LTD.
31 HAYES AVE., GUELPH, ONTARIO N1E 5V6 Phone: (519) 823-1150 Fax: (519) 822-7752
www.spira.ca

WATER SUPPLY TEST

Facility Name: Proposed Development

File/Project #: 56704

Facility Address: 42 Grand Ave S, Cambridge, Ontario

Tested by: Ron Van Hulst

Witnessed by: Cambridge Waterworks

Size of Main: ø12"

☐ Dead End
☐ Two Ways
☒ Loop

Comments:

Flow Hydrant Location: Hydrant Located On East Side Of Grand Ave S North Of St Andrews St

Residual Hydrant Location: Hydrant Located On East Side Of Grand Ave S South Of St Andrews St

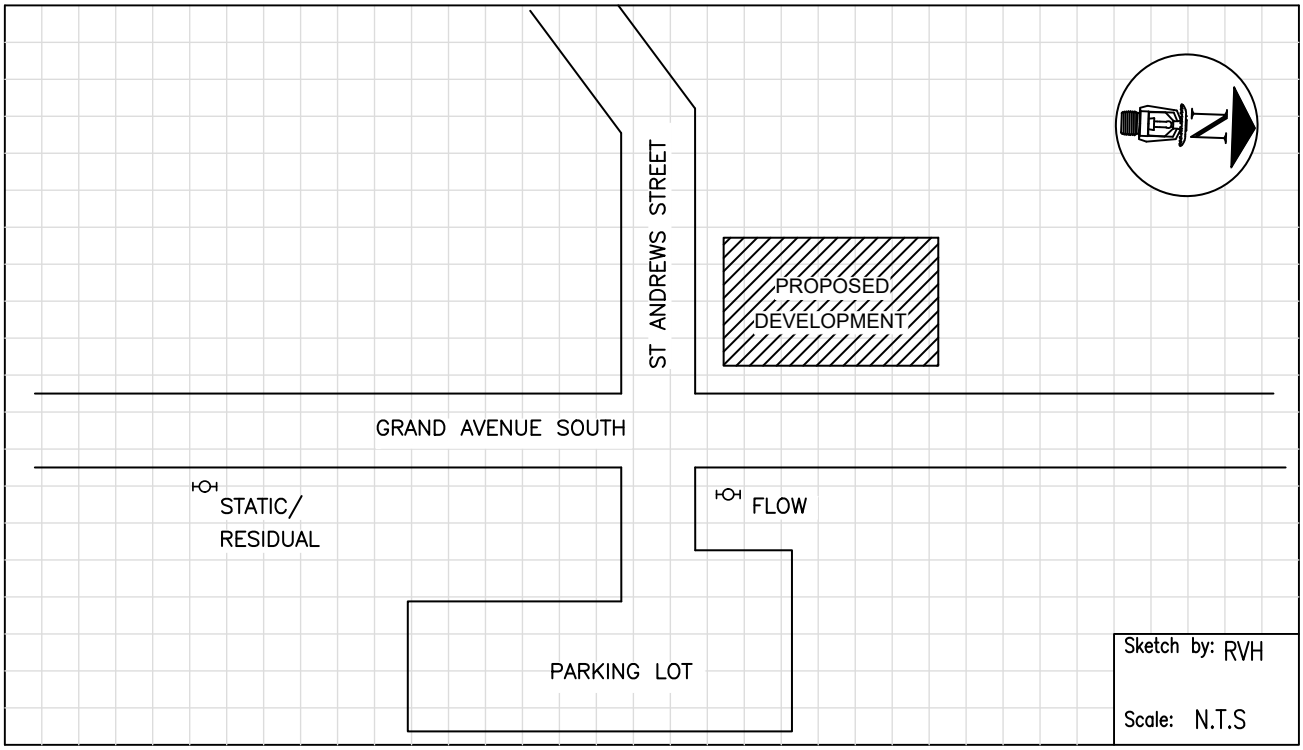
Static Pressure: 86 psi

Date: Oct 30, 2024

Time: 9:00 ☐ AM ☒ PM

Test No.	No. of Outlets	Orifice Size (in.)	Pitot Reading (psi)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psi)	Comments
1	1	2½"	54	1371	1371	84	
2	2	2½"	34	2(1088)	2176	80	
3							
4							

Site Map:



Name and Address of authority who should recieve a copy.

City Of Cambridge Waterworks Dept. Att: Jesse Koczynasz

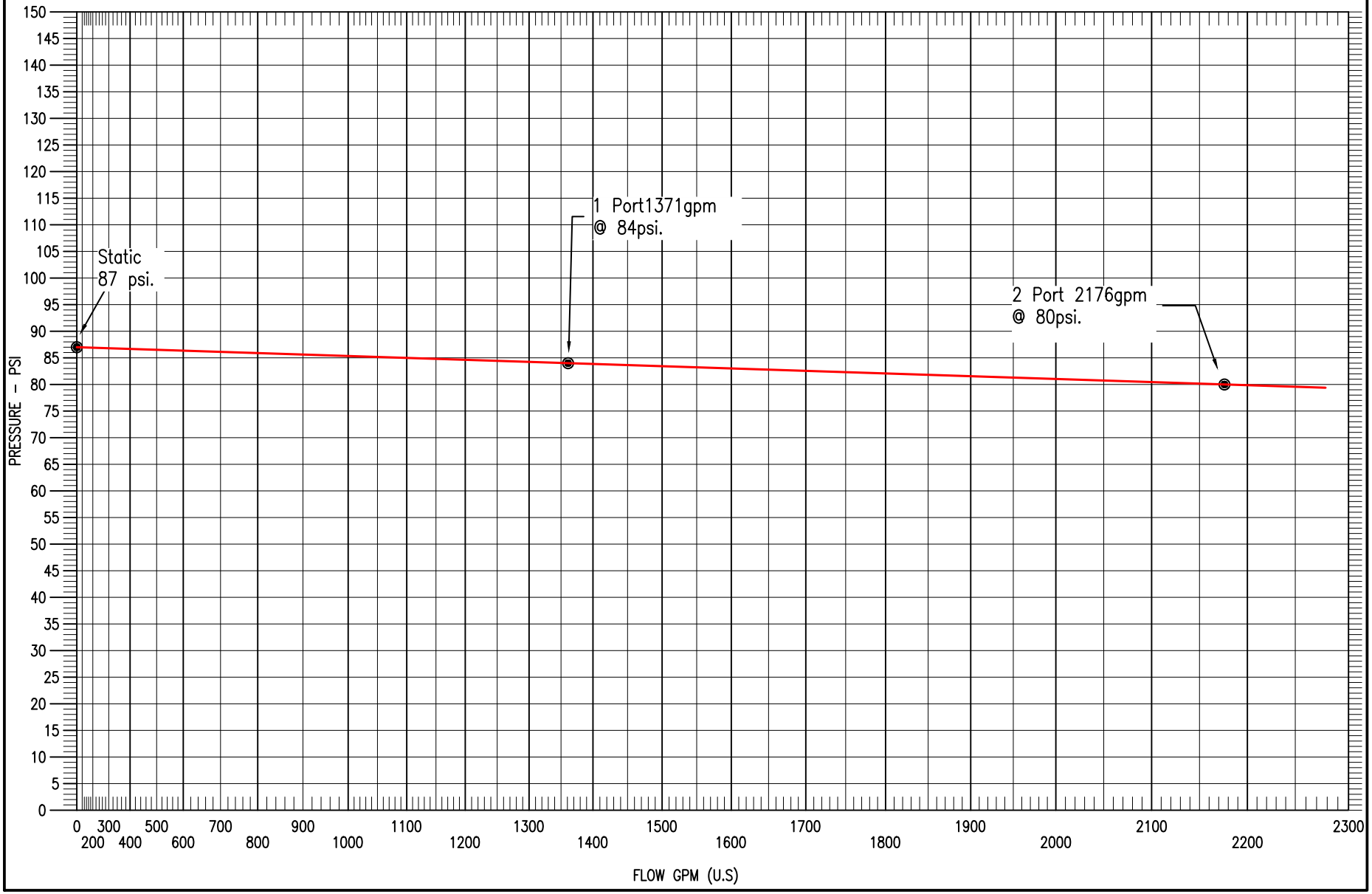
SPIRA FIRE PROTECTION LTD.

31 HAYES AVE., GUELPH, ONTARIO N1E 5V6 Phone: (519) 823-1150 Fax: (519) 822-7752

Facility Name: Proposed Development File/Project # 56704

Facility Address: 42 Grand Ave S, Cambridge, Ontario

Tested by: Ron Van Hulst Date: Oct 30, 2024



Appendix B Sewer Design Sheets

PROJECT: 32 Grand Avenue
City of Cambridge
DATE: December 9, 2024
DESIGNED BY: P.W.
CHECKED BY: S.P.

STORM SEWER DESIGN

5-Year Design Storm
City of Cambridge

Chicago Storm Parameters
Intensity = A / (t + B) ^ C
5-Year
A = 1219.800
B = 10.5
C = 0.823

From	To	Area (ha)	Runoff Coefficient	A x C	Cumulative A x C	TC (min.)	Intensity (mm/hr)		Flow (m^3/s)	Proposed Sewer						
							5-Year	100-Year		Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (m^3/s)	Full Flow Velocity (m/s)	Time of Flow (min.)
BLDG	EX.STM	0.17	0.90	0.15	0.11	10.00	101.56		0.030	10.5	250	0.013	1.00	0.059	1.21	0.14

The Cumulative A x C at BLDG to EX.STM has been reduced to represent the 100-year flow rate attenuated from rooftop controls (0.030 m3/s).

PROJECT: 32 Grand Avenue
City of Cambridge
DATE: December 9, 2024
DESIGNED BY: P.W.
CHECKED BY: S.P.

SANITARY SEWER DESIGN

City of Cambridge

Average Daily Flow
Residential 275 L/c/d

Peaking Factor = 4

Q(i) = Cum. Area (ha) * Infiltration Rate / 1000
Infiltration Rate: 0.25 L/s/ha

Manning Equation:
Full Cap.= (D/2/1000)^2*Pi*(D/4/1000)^0.667*(1/n)*(S/100)^0.5
D = Diameter (mm)
S = Slope (%)
n = 0.013 (PVC & Concrete), 01016 (Vitrified Clay)

n = 0.013

Peaking Factor : F = 1 + (14/(4+P^0.5)) P = Population/1000

Minimum Full Velocity = 0.80 m/s

From	To	RESIDENTIAL AREA AND POPULATION						Commercial			Industrial		Institutional		C+I+I	Infiltration	Total Flow	Pipe					
		Area	Pop.	Cumulative		Peak Factor	Peak Flow	Bed Space	Area	Cum. Area	Area	Cum. Area	Area	Cum. Area	Peak Flow			Distance	Diameter	Slope	Capacity (Full)	Velocity	
		(ha)		Area (ha)	Pop.		(m^3/s)		(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(m^3/s)	Q(i) = (m^3/s)	(m^3/s)	(m)	(mm)	(%)	(m^3/s)	Full (m/s)	Actual (m/s)
BLDG	EX.SAN.	0.20	787	0.20	787	3.865	0.0097								0.0000	0.000050	0.0097	8.20	200	1.00	0.0328	1.044	0.919

Appendix C Stormwater Management Analysis

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
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"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Ex__2yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                 11/4/2024 at 8:19:59 AM"
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"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      573.100   Coefficient A"
"        5.000   Constant B"
"        0.761   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            99.364    mm/hr"
"             Total depth                  32.362    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.035     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  52.257     3.512      3.629      minutes"
"             Time to Centroid       118.875    91.724     91.790     minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        6.47       58.25      64.72      c.m"
"             Rainfall losses        31.702     2.093      5.054      mm"
"             Runoff depth           0.660      30.268     27.308     mm"
"             Runoff volume          0.13       54.48      54.62      c.m"
"             Runoff coefficient     0.020      0.935      0.844      "
"             Maximum flow           0.000      0.035      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.035     0.035     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Ex__5yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                  11/4/2024 at 8:21:20 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1219.800   Coefficient A"
"       10.500   Constant B"
"        0.823   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           127.834    mm/hr"
"             Total depth                  48.647    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.049     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  23.659     3.175      3.674      minutes"
"             Time to Centroid       101.634    89.657     89.949     minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        9.73       87.56      97.29      c.m"
"             Rainfall losses        38.238     2.336      5.927      mm"
"             Runoff depth           10.409     46.311     42.720     mm"
"             Runoff volume          2.08       83.36      85.44      c.m"
"             Runoff coefficient     0.214      0.952      0.878      "
"             Maximum flow           0.001      0.049      0.049      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.049     0.049     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Ex__10yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                 11/4/2024 at 8:22:43 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1728.600   Coefficient A"
"       14.000   Constant B"
"        0.849   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           141.916    mm/hr"
"             Total depth                  59.221    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.057     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  19.292     3.045      3.603      minutes"
"             Time to Centroid       100.805    89.071     89.474     minutes"
"             Rainfall depth         59.221     59.221     59.221     mm"
"             Rainfall volume        11.84      106.60     118.44     c.m"
"             Rainfall losses        41.100     2.653      6.498      mm"
"             Runoff depth           18.121     56.568     52.723     mm"
"             Runoff volume          3.62       101.82     105.45     c.m"
"             Runoff coefficient     0.306      0.955      0.890      "
"             Maximum flow           0.002      0.057      0.057      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.057     0.057     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Ex__25yr.out"
"                Licensee name:                                                  "
"                Company                                                         "
"                Date & Time last used:                  11/4/2024 at 8:24:41 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2226.900   Coefficient A"
"       17.000   Constant B"
"        0.865   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           153.640    mm/hr"
"             Total depth                  69.200    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.064     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  17.077     2.950      3.541      minutes"
"             Time to Centroid       100.857    88.751     89.257     minutes"
"             Rainfall depth         69.200     69.200     69.200     mm"
"             Rainfall volume        13.84      124.56     138.40     c.m"
"             Rainfall losses        43.183     3.018      7.034      mm"
"             Runoff depth           26.017     66.183     62.166     mm"
"             Runoff volume          5.20       119.13     124.33     c.m"
"             Runoff coefficient     0.376      0.956      0.898      "
"             Maximum flow           0.003      0.063      0.064      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.064     0.064     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Ex__50yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                  11/4/2024 at 8:26:30 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2640.000   Coefficient A"
"       19.000   Constant B"
"        0.866   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           168.400    mm/hr"
"             Total depth                  80.894    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.071     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  16.232     2.844      3.486      minutes"
"             Time to Centroid       100.966    88.571     89.166     minutes"
"             Rainfall depth         80.894     80.894     80.894     mm"
"             Rainfall volume        16.18      145.61     161.79     c.m"
"             Rainfall losses        45.689     3.220      7.467      mm"
"             Runoff depth           35.206     77.674     73.428     mm"
"             Runoff volume          7.04       139.81     146.86     c.m"
"             Runoff coefficient     0.435      0.960      0.908      "
"             Maximum flow           0.004      0.070      0.071      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.071     0.071     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                   Ex__100yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                  11/4/2024 at 8:28:40 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3015.100   Coefficient A"
"       21.000   Constant B"
"        0.870   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           177.123    mm/hr"
"             Total depth                  89.669    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"           10   Catchment 10"
"       90.000   % Impervious"
"        0.200   Total Area"
"       38.000   Flow length"
"        0.700   Overland Slope"
"        0.020   Pervious Area"
"       38.000   Pervious length"
"        0.700   Pervious slope"
"        0.180   Impervious Area"
"       38.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.076     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           0.020      0.180      0.200      hectare"
"             Time of concentration  15.808     2.787      3.462      minutes"
"             Time to Centroid       100.956    88.482     89.129     minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        17.93      161.40     179.34     c.m"
"             Rainfall losses        47.158     3.342      7.724      mm"
"             Runoff depth           42.511     86.327     81.945     mm"
"             Runoff volume          8.50       155.39     163.89     c.m"
"             Runoff coefficient     0.474      0.963      0.914      "
"             Maximum flow           0.004      0.075      0.076      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.076     0.076     0.000     0.000"
" 38          START/RE-START TOTALS 10"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.180    hectare"
"             Total % impervious                       90.000"
" 19          EXIT"
```

32 GRAND AVENUE SOUTH
CITY OF CAMBRIDGE
Our File: 2407802
December 9, 2024

Catchment 100: Proposed Rooftop Storage

Design Discharge Rate =	1.50	l/min/mm/weir	2.50E-05	m^3/s/mm/weir
Max. Average Storage Depth =	100	mm		
Design Discharge =	150.0	l/min/weir	0.0025	m^3/s/weir
No. of Drains =	6			
No. Weirs/Drain =	6			
Allowable Release Rate =	5400.0	l/min	0.090	m^3/s
Rooftop Area =	1,630	m^2	(flat rooftop area that is available for storage)	

Therefore: 464.5 sq m/Roof Drain or 5000 sq ft/Roof Drain as per OBC

STAGE-STORAGE-DISCHARGE TABLE

Stage (m)	Storage (m^3)	Discharge (m^3/s)
0.000	0.0	0.000
0.025	40.8	0.023
0.050	81.5	0.045
0.075	122.3	0.068
0.100	163.0	0.090

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                    Post__2yr.out"
"                Licensee name:                                                  "
"                Company                                                         "
"                Date & Time last used:                  11/4/2024 at 8:30:07 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      573.100   Coefficient A"
"        5.000   Constant B"
"        0.761   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            99.364    mm/hr"
"             Total depth                  32.362    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.035     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  26.882     1.806      1.806      minutes"
"             Time to Centroid       100.265    88.968     88.968     minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        0.00       51.78      51.78      c.m"
"             Rainfall losses        31.702     1.955      1.955      mm"
"             Runoff depth           0.660      30.406     30.406     mm"
"             Runoff volume          0.00       48.65      48.65      c.m"
"             Runoff coefficient     0.000      0.940      0.940      "
"             Maximum flow           0.000      0.035      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.035     0.035     0.000     0.000"
" 54          POND DESIGN"
"         0.035   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"          48.7   Hydrograph volume    c.m"
"            5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.012    c.m/sec"
"             Maximum level                 0.013    metre"
"             Maximum storage              20.741    c.m"
"             Centroidal lag                1.976   hours"
"                  0.035     0.035     0.012     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.035     0.012     0.012     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.001     0.012     0.012     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  8.580      0.577      1.502      minutes"
"             Time to Centroid       86.832     87.712     87.611     minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        11.00      1.94       12.94      c.m"
"             Rainfall losses        31.703     3.801      27.517     mm"
"             Runoff depth           0.659      28.561     4.845      mm"
"             Runoff volume          0.22       1.71       1.94       c.m"
"             Runoff coefficient     0.020      0.883      0.150      "
"             Maximum flow           0.000      0.001      0.001      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.001     0.012     0.012     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.012    c.m/sec"
"             Hydrograph volume            50.588    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                   Post__5yr.out"
"                Licensee name:                                                 "
"                Company                                                        "
"                Date & Time last used:                  11/4/2024 at 8:35:17 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1219.800   Coefficient A"
"       10.500   Constant B"
"        0.823   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           127.834    mm/hr"
"             Total depth                  48.647    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.048     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  12.170     1.633      1.633      minutes"
"             Time to Centroid       91.003     87.310     87.310     minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        0.00       77.84      77.84      c.m"
"             Rainfall losses        38.262     2.182      2.183      mm"
"             Runoff depth           10.385     46.465     46.464     mm"
"             Runoff volume          0.00       74.34      74.34      c.m"
"             Runoff coefficient     0.000      0.955      0.955      "
"             Maximum flow           0.000      0.048      0.048      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.048     0.048     0.000     0.000"
" 54          POND DESIGN"
"         0.048   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"          74.3   Hydrograph volume    c.m"
"            5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.017    c.m/sec"
"             Maximum level                 0.019    metre"
"             Maximum storage              31.154    c.m"
"             Centroidal lag                1.948   hours"
"                  0.048     0.048     0.017     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.048     0.017     0.017     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.005     0.017     0.017     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  3.885      0.521      2.449      minutes"
"             Time to Centroid       83.305     86.252     84.563     minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        16.54      2.92       19.46      c.m"
"             Rainfall losses        38.516     5.869      33.619     mm"
"             Runoff depth           10.131     42.778     15.028     mm"
"             Runoff volume          3.44       2.57       6.01       c.m"
"             Runoff coefficient     0.208      0.879      0.309      "
"             Maximum flow           0.004      0.002      0.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.005     0.021     0.017     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                  0.021    c.m/sec"
"             Hydrograph volume            80.354    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                  Post__10yr.out"
"                Licensee name:                                                  "
"                Company                                                         "
"                Date & Time last used:                  11/4/2024 at 8:36:43 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1728.600   Coefficient A"
"       14.000   Constant B"
"        0.849   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           141.916    mm/hr"
"             Total depth                  59.221    mm"
"            6   010hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.055     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  9.924      1.566      1.566      minutes"
"             Time to Centroid       91.257     86.881     86.881     minutes"
"             Rainfall depth         59.221     59.221     59.221     mm"
"             Rainfall volume        0.00       94.75      94.75      c.m"
"             Rainfall losses        41.222     2.333      2.333      mm"
"             Runoff depth           17.998     56.888     56.888     mm"
"             Runoff volume          0.00       91.02      91.02      c.m"
"             Runoff coefficient     0.000      0.961      0.961      "
"             Maximum flow           0.000      0.055      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.055     0.055     0.000     0.000"
" 54          POND DESIGN"
"         0.055   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"          91.0   Hydrograph volume    c.m"
"            5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.021    c.m/sec"
"             Maximum level                 0.023    metre"
"             Maximum storage              37.293    c.m"
"             Centroidal lag                1.941   hours"
"                  0.055     0.055     0.021     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.055     0.021     0.021     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.008     0.021     0.021     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  3.168      0.500      2.255      minutes"
"             Time to Centroid       84.339     85.846     84.855     minutes"
"             Rainfall depth         59.221     59.221     59.221     mm"
"             Rainfall volume        20.13      3.55       23.69      c.m"
"             Rainfall losses        41.583     7.230      36.430     mm"
"             Runoff depth           17.638     51.990     22.791     mm"
"             Runoff volume          6.00       3.12       9.12       c.m"
"             Runoff coefficient     0.298      0.878      0.385      "
"             Maximum flow           0.007      0.002      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.008     0.026     0.021     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.026    c.m/sec"
"             Hydrograph volume          100.137    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                  Post__25yr.out"
"                Licensee name:                                                  "
"                Company                                                         "
"                Date & Time last used:                  11/4/2024 at 8:38:04 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2226.900   Coefficient A"
"       17.000   Constant B"
"        0.865   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           153.640    mm/hr"
"             Total depth                  69.200    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.060     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  8.785      1.517      1.517      minutes"
"             Time to Centroid       91.772     86.678     86.678     minutes"
"             Rainfall depth         69.200     69.200     69.200     mm"
"             Rainfall volume        0.00       110.72     110.72     c.m"
"             Rainfall losses        43.201     2.495      2.495      mm"
"             Runoff depth           25.999     66.705     66.705     mm"
"             Runoff volume          0.00       106.73     106.73     c.m"
"             Runoff coefficient     0.000      0.964      0.964      "
"             Maximum flow           0.000      0.060      0.060      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.060     0.060     0.000     0.000"
" 54          POND DESIGN"
"         0.060   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"         106.7   Hydrograph volume    c.m"
"           5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.024    c.m/sec"
"             Maximum level                 0.026    metre"
"             Maximum storage              42.706    c.m"
"             Centroidal lag                1.937   hours"
"                  0.060     0.060     0.024     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.060     0.024     0.024     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.010     0.024     0.024     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  2.804      0.484      2.117      minutes"
"             Time to Centroid       85.102     85.659     85.267     minutes"
"             Rainfall depth         69.200     69.200     69.200     mm"
"             Rainfall volume        23.53      4.15       27.68      c.m"
"             Rainfall losses        43.775     8.577      38.495     mm"
"             Runoff depth           25.425     60.623     30.705     mm"
"             Runoff volume          8.64       3.64       12.28      c.m"
"             Runoff coefficient     0.367      0.876      0.444      "
"             Maximum flow           0.009      0.002      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.010     0.031     0.024     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.031    c.m/sec"
"             Hydrograph volume          119.009    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                  Post__50yr.out"
"                Licensee name:                                                  "
"                Company                                                         "
"                Date & Time last used:                 11/4/2024 at 8:39:26 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2640.000   Coefficient A"
"       19.000   Constant B"
"        0.866   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           168.400    mm/hr"
"             Total depth                  80.894    mm"
"            6   050hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.067     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  8.350      1.463      1.463      minutes"
"             Time to Centroid       92.163     86.608     86.608     minutes"
"             Rainfall depth         80.894     80.894     80.894     mm"
"             Rainfall volume        0.00       129.43     129.43     c.m"
"             Rainfall losses        45.675     2.718      2.718      mm"
"             Runoff depth           35.220     78.177     78.176     mm"
"             Runoff volume          0.00       125.08     125.08     c.m"
"             Runoff coefficient     0.000      0.966      0.966      "
"             Maximum flow           0.000      0.067      0.067      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.067     0.067     0.000     0.000"
" 54          POND DESIGN"
"         0.067   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"         125.1   Hydrograph volume    c.m"
"           5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.027    c.m/sec"
"             Maximum level                 0.030    metre"
"             Maximum storage              48.765    c.m"
"             Centroidal lag                1.937   hours"
"                  0.067     0.067     0.027     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.067     0.027     0.027     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.012     0.027     0.027     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  2.665      0.467      2.084      minutes"
"             Time to Centroid       85.741     85.618     85.708     minutes"
"             Rainfall depth         80.894     80.894     80.894     mm"
"             Rainfall volume        27.50      4.85       32.36      c.m"
"             Rainfall losses        46.214     10.217     40.815     mm"
"             Runoff depth           34.680     70.678     40.080     mm"
"             Runoff volume          11.79      4.24       16.03      c.m"
"             Runoff coefficient     0.429      0.874      0.495      "
"             Maximum flow           0.011      0.002      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.012     0.036     0.027     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.036    c.m/sec"
"             Hydrograph volume          141.116    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                          Sunday, February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:              B:\Working\GRAND AVENUE DEVELOPMENTS\"
"                2407802 32 Grand Ave Cambridge\Design Phase\Design Data\Modelling
Files"
"                Output filename:                                  Post__100yr.out"
"                Licensee name:                                                   "
"                Company                                                          "
"                Date & Time last used:                  11/4/2024 at 8:40:39 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3015.100   Coefficient A"
"       21.000   Constant B"
"        0.870   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           177.123    mm/hr"
"             Total depth                  89.669    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          100   Catchment 100"
"      100.000   % Impervious"
"        0.160   Total Area"
"       15.000   Flow length"
"        1.000   Overland Slope"
"        0.000   Pervious Area"
"       15.000   Pervious length"
"        1.000   Pervious slope"
"        0.160   Impervious Area"
"       15.000   Impervious length"
"        1.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
```

```
"        1.500   Impervious Depression storage"
"                     0.071     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.160      0.160      hectare"
"             Time of concentration  8.132      1.434      1.434      minutes"
"             Time to Centroid       92.531     86.587     86.587     minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        0.00       143.47     143.47     c.m"
"             Rainfall losses        47.191     2.905      2.905      mm"
"             Runoff depth           42.478     86.764     86.764     mm"
"             Runoff volume          0.00       138.82     138.82     c.m"
"             Runoff coefficient     0.000      0.968      0.968      "
"             Maximum flow           0.000      0.071      0.071      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.071     0.071     0.000     0.000"
" 54          POND DESIGN"
"         0.071   Current peak flow    c.m/sec"
"         0.018   Target outflow    c.m/sec"
"         138.8   Hydrograph volume    c.m"
"           5.   Number of stages"
"         0.000   Minimum water level    metre"
"         0.100   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"
"                 0.02500   0.02300    40.800"
"                 0.05000   0.04500    81.500"
"                 0.07500   0.06800   122.300"
"                  0.1000   0.09000   163.000"
"             Peak outflow                  0.030    c.m/sec"
"             Maximum level                 0.033    metre"
"             Maximum storage              53.144    c.m"
"             Centroidal lag                1.937   hours"
"                  0.071     0.071     0.030     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                     0.071     0.030     0.030     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            2   Horton equation"
"          200   Catchment 200"
"       15.000   % Impervious"
"         0.040   Total Area"
"         5.000   Flow length"
"         5.000   Overland Slope"
"         0.034   Pervious Area"
"         5.000   Pervious length"
```

```
"        5.000   Pervious slope"
"        0.006   Impervious Area"
"        5.000   Impervious length"
"        5.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious Max.infiltration"
"       12.500   Pervious Min.infiltration"
"        0.250   Pervious Lag constant (hours)"
"        5.000   Pervious Depression storage"
"        0.015   Impervious Manning 'n'"
"        0.000   Impervious Max.infiltration"
"        0.000   Impervious Min.infiltration"
"        0.050   Impervious Lag constant (hours)"
"        1.500   Impervious Depression storage"
"                    0.014     0.030     0.030     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           0.034      0.006      0.040      hectare"
"             Time of concentration  2.596      0.458      2.063      minutes"
"             Time to Centroid       86.244     85.611     86.086     minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        30.49      5.38       35.87      c.m"
"             Rainfall losses        48.047     11.503     42.565     mm"
"             Runoff depth           41.622     78.166     47.104     mm"
"             Runoff volume          14.15      4.69       18.84      c.m"
"             Runoff coefficient     0.464      0.872      0.525      "
"             Maximum flow           0.011      0.002      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.014     0.039     0.030     0.000"
" 64          SHOW TABLE"
"            2   Flow hydrograph"
"            4   Inflow Hydrograph"
"             Maximum flow                 0.039    c.m/sec"
"             Hydrograph volume          157.660    c.m"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      0.200    hectare"
"             Total Impervious area                     0.166    hectare"
"             Total % impervious                       83.000"
" 19          EXIT"
```