OVERLAND FLOWPATH ANALYSIS

MEMORANDUM

PROPOSED DEVELOPMENT

538 KARANGAHAPE ROAD

NEWTON

Maven Associates		Job Number 274001		Rev B
Job Title	538 Karangahape Road, Newton	**Author**	**Date**	**Checked**
Title	Overland Flow Path Analysis Memorandum	VM	22/07/2024	AS

1 Introduction And Background

This memo is prepared to analyse the overland flow paths during a 1% AEP storm event and assess their potential impact on the development of the subject site. The flows from the relevant catchment areas will be identified and evaluated to determine whether they will be contained within the road carriageway or overflow the kerb and channel towards the site.

2 Site Address

The subject site address is 538 Karangahape Road, it is located at the intersection of Karangahape Road and Gundry Street (refer to **Figure 1** below).

- Legal Description: LOT 1 DP 570848
- Area: 1597m^2 (From GIS)

Figure 1 – Site Location (Auckland Council GIS maps)

3 Assumptions and Considerations

- 100 year rainfall event: 182mm
- Mannings value for concrete: 0.013
- Catchment areas and slopes measured on GIS.
- Analysis on Two sections: Gundry Street and Abbey Street.
- The depth of the flow was determined by Mannings equation through Hydraflow.
- Type 3 Standard Kerb and Channel was considered on both Gundry Street and Abbey Street

4 OVERLAND FLOW PATH ANALYSIS

This analysis considered three main points of interest: the site entrance to the basement via Gundry Street and the foot traffic entrance to the shops via Abbey Street, and also how the site effects on downstream areas, using as a reference 11 Gundry Street. Refer to Figure 2 and 3 below for the considered catchments A, B and C.

Figure 2 – OLFP Catchments A and B

Figure 3 – OLFP Catchments C

- **Gundry Street (Basement)**

Catchment A, as shown in Figure 2, covers an area of 3,768m². The sheet flow within Gundry Street, which has a slope of 6.2%, results in an estimated flow of 0.072m³/s and does not exceed depths of 0.043m, as illustrated in the road section below. Please refer to the TP108 calculation in Appendix A for more details.

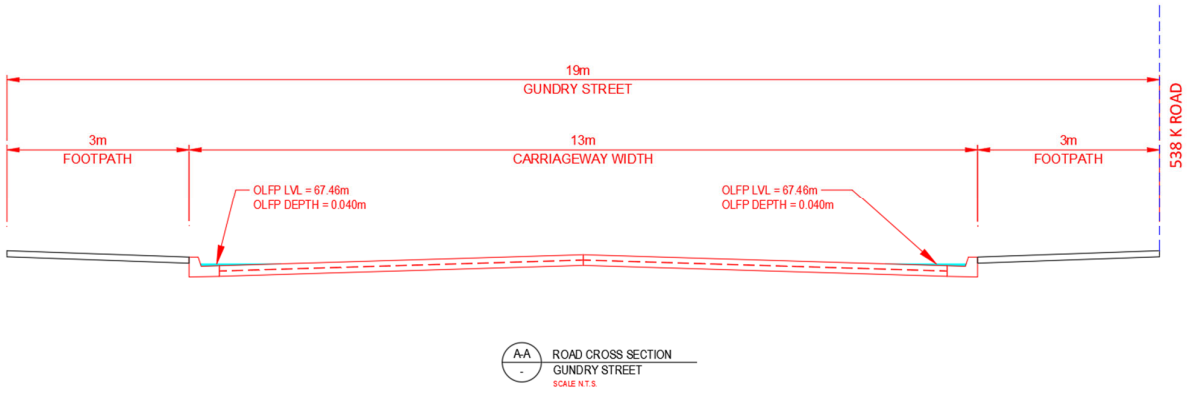


Figure 4 - Gundry Street Section

- **Abbey Street**

Catchment B, as depicted in Figure 2, covers an area of 2,438m². The sheet flow within Gundry Street, which has a slope of 1%, results in an estimated flow of 0.047m³/s and does not exceed depths of 0.049m, as illustrated in the road section below. Please refer to the TP108 calculation in Appendix A for more details.

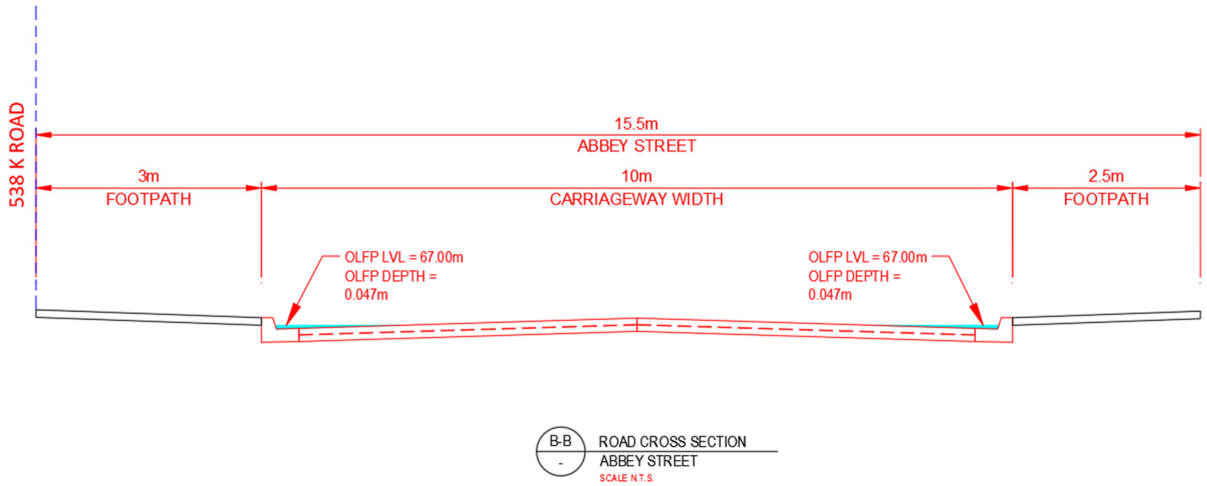


Figure 5 - Abbey Street Section

- **11 Gundry Street**

Catchment C, as shown in Figure 3, covers an area of 15,765m². The sheet flow within Gundry Street, which has a slope of 10.5%, results in an estimated flow of 0.303m³/s and does not exceed depths of 0.064m, as illustrated in the road section below. Please refer to the TP108 calculation in Appendix A for more details

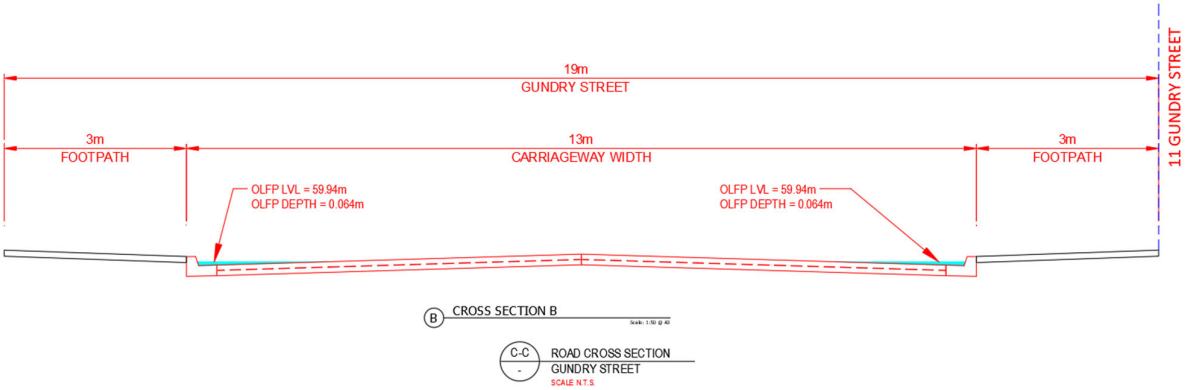


Figure 6 - 11 Gundry Street Section

5 FURTHER CONSIDERATIONS

There are some site-specific factors important to consider on this analysis. Those are listed below.

- The subject development does not propose changes to the impermeable area when compared to existing scenario, both being 100% impermeable, and thus, does not alter the flow downstream for up to a 100y event.
- The grades presented are considerably high on Gundry Street, varying from 6.2% to 10.5%, and, therefore, no ponding is expected.

6 CONCLUSION

Based on the above calculations, it is confirmed that the overland flow path will be contained within the road carriageways. The basement entrance from Gundry Street and the footpath entrances from Abbey Street to the subject site are not prone to flooding and do not pose any risk of stormwater flowing onto the subject site. Also, the subject site is not expected to cause any noticeable worsening effects downstream.

APPENDIX A
TP108 CALCULATIONS

MAVEN ASSOCIATES	Job Number -	Sheet 3	Rev A
Job Title Calc Title	538 Karangahape Road TP108 Calculation - Post Development Catchment A	Author VM	Date 14/06/2024	Checked AS

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2=1 ha	Product of CN x area
C	Urban-commercial and bussiness	98	0.0000	0.00
C	Road pavement	98	0.3768	36.93
C	Bems + Footpath	85	0.0000	0.00
C	Open space (Pervious)	74	0.0000	0.00
* from Appendix B		Totals =	0.3768	36.93

CN (weighted) = total product / total area = 36.93 / 0.377 = 98.0

Ia (average) = 5 x pervious area / total area = 5 x 0.0000 / 0.377 = 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.098 km (along drainage path)

Catchment Slope Sc= 0.062 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 98.0 / (200- 98.0) = 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.6 0.22 1.02 2.30 = 0.04 / 2.6 hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.03 hrs = 1.72 mins

NO GOOD

use

0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

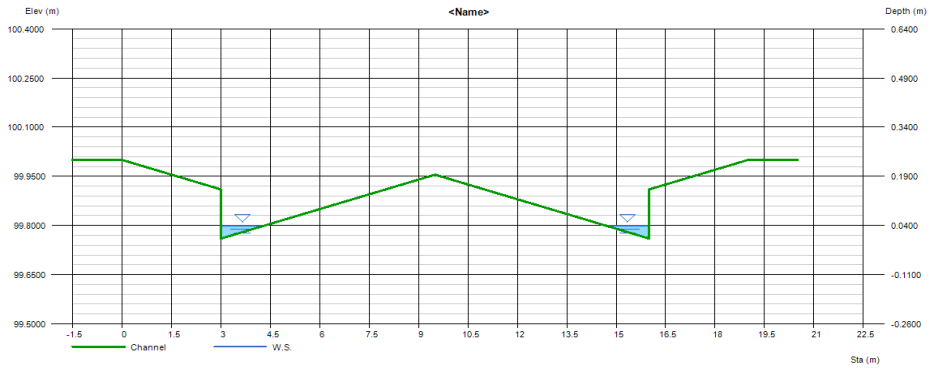
MAVEN ASSOCIATES	Job Number -	Sheet 5	Rev A
Job Title Calc Title 538 Karangahape Road TP108 Calculation - Post Development Catchment A	Author VM	Date 14/06/2024	Checked AS

1. Data

Catchment Area	A=	0.00377	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
			0.35066
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5.2 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth	183	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.95	
6. Specific peak flow rate q*	0.105	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.072**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	178.0	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	670.55	(m3)



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(m)	(cms)	(sqm)	(m/s)	(m)	(m)	(m)	(m)
0.0396	0.072	0.052	1.3755	2.7224	0.0640	2.6419	0.1361

Worksheet 2: Graphical Peak Flow Rate

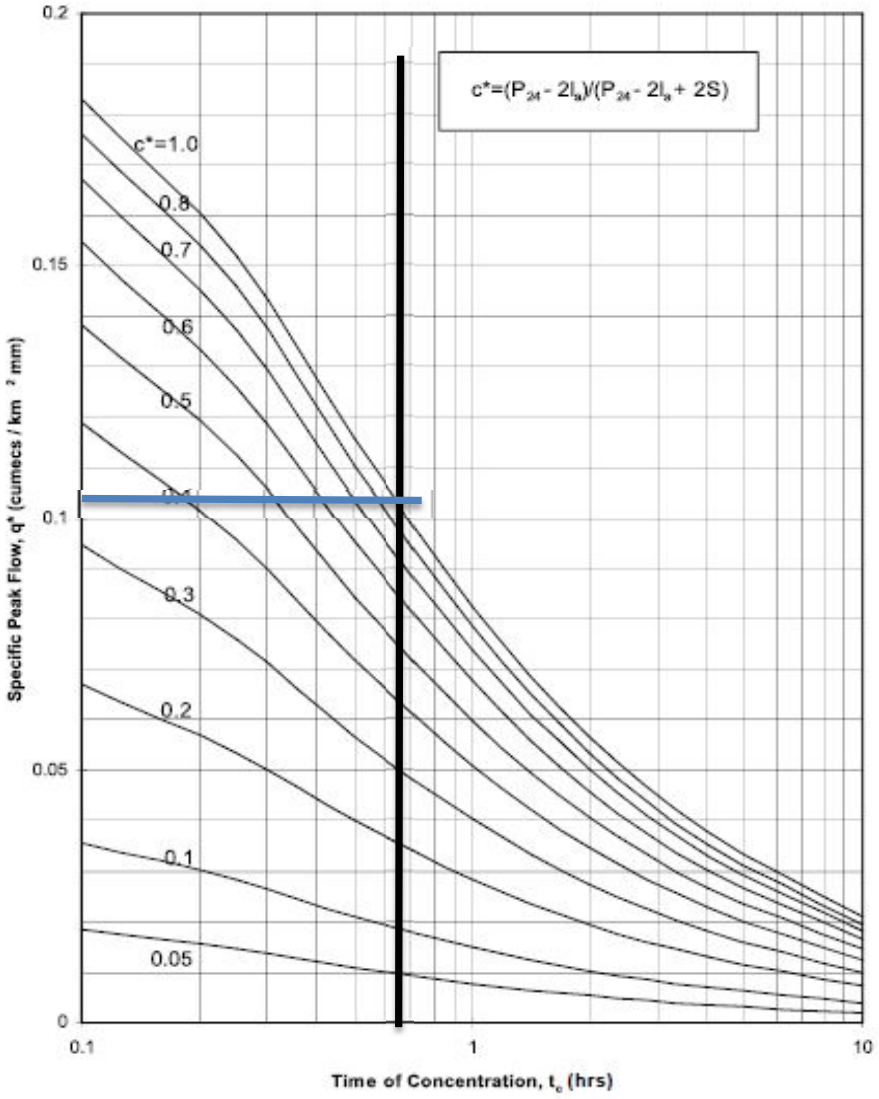


Figure 5.1 – Specific Peak Flow Rate

MAVEN ASSOCIATES	Job Number -	Sheet 3	Rev A
Job Title Calc Title 538 Karangahape Road TP108 Calculation - Post Development Catchment B	Author VM	Date 14/06/2024	Checked AS

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2=1 ha	Product of CN x area
C	Urban-commercial and bussiness	98	0.0000	0.00
C	Road pavement	98	0.2438	23.89
C	Bems + Footpath	85	0.0000	0.00
C	Open space (Pervious)	74	0.0000	0.00
* from Appendix B		Totals =	0.2438	23.89

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{23.89}{0.244} =$ 98.0

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.0000}{0.244}$ 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.056 km (along drainage path)

Catchment Slope Sc= 0.010 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{98.0}{200-98.0} =$ 0.96

$t_c = 0.14\ C\ L^{0.66}\ (CN/200\text{-}CN)^{-0.55}\ Sc^{-0.30}$

= 0.14 0.6 0.15 1.02 3.98 = 0.05 hrs

3.1

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.03 hrs

2.05 mins

NO GOOD

use

0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

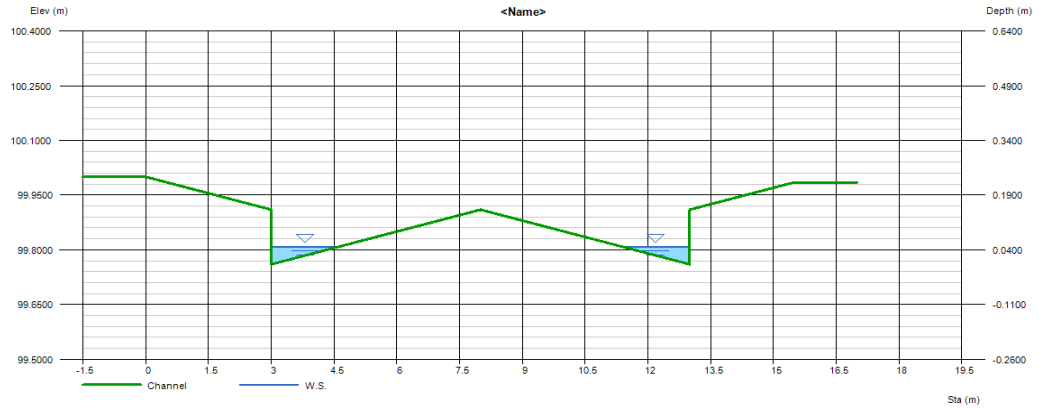
MAVEN ASSOCIATES	Job Number -	Sheet 5	Rev A
Job Title Calc Title 538 Karangahape Road TP108 Calculation - Post Development Catchment B	Author VM	Date 14/06/2024	Checked AS

1. Data

Catchment Area	A=	0.00244	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
			0.35066
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5.2 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth	182	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.95	
6. Specific peak flow rate q*	0.105	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.047**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	177.0	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	431.46	(m3)



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(m)	(cms)	(sqm)	(m/s)	(m)	(m)	(m)	(m)
0.0488	0.047	0.079	0.5928	3.3503	0.0549	3.2513	0.0667

Worksheet 2: Graphical Peak Flow Rate

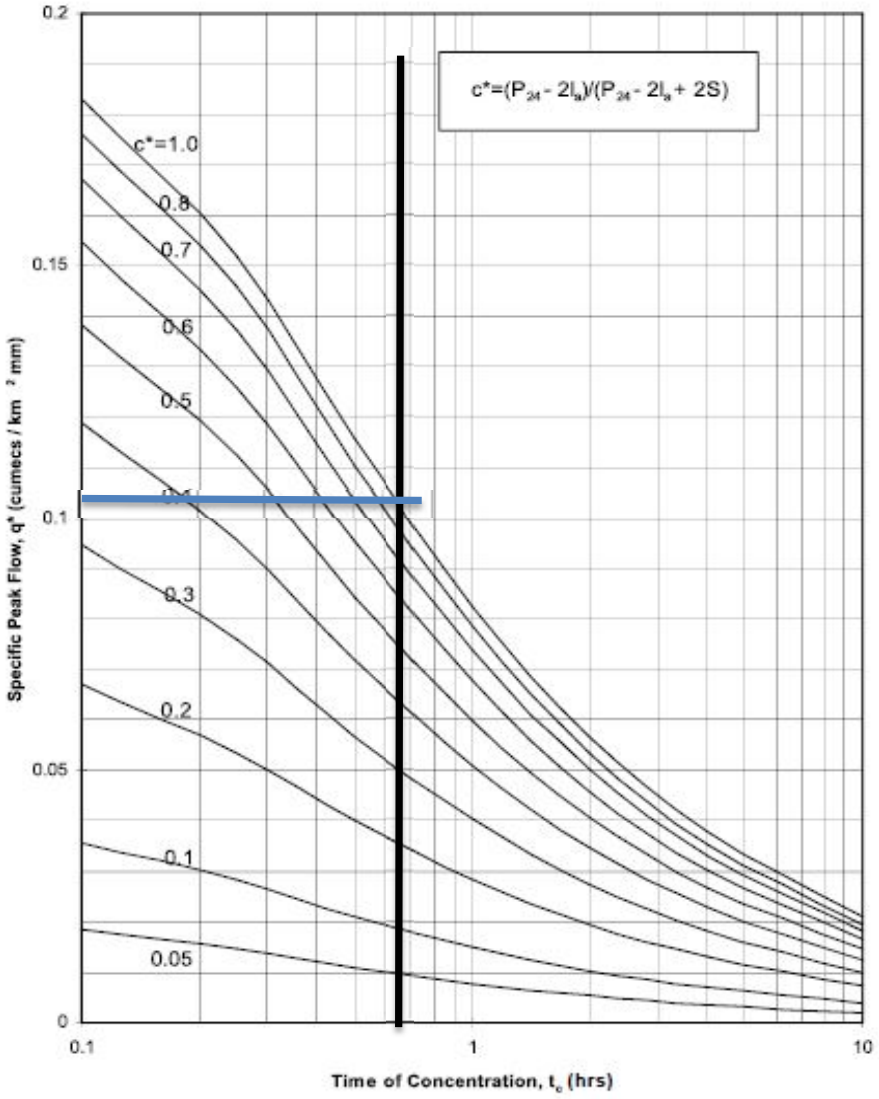


Figure 5.1 – Specific Peak Flow Rate

MAVEN ASSOCIATES	Job Number -	Sheet 1	Rev A
Job Title: 11 Gundry Street Calc Title: TP108 Calculation - Pre-Development Catchment C	Author: VM	Date: 14/06/2024	Checked: AS

1. Runoff Curve Number (CN) and initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN*	Area (ha) 10000m2= 1ha	Product of CN x area
C	Residential lots	89.6	0.0000	0.00
C	Road pavement	98	1.5765	154.50
C	Carpark	98	0.0000	0.00
C	Open space (Pervious)	74	0.0000	0.00
* from Appendix B		Totals =	1.5765	154.50

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{154.50}{1.577} = 98.0$

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 0.0000}{1.577} = 0.0$ mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.098 km (along drainage path)

Catchment Slope Sc= 0.105 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{98.0}{200-98.0} = 0.96$

$t_c = 0.14\ C\ L^{0.66}\ (CN/200-CN)^{-0.55}\ Sc^{-0.30}$

$= 0.14 \quad 0.6 \quad 0.22 \quad 1.02 \quad 1.97 = 0.04$ hrs

SCS Lag for HEC-HMS…. $t_p = 2/3\ t_c$ = 0.02 hrs

1.47 mins

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

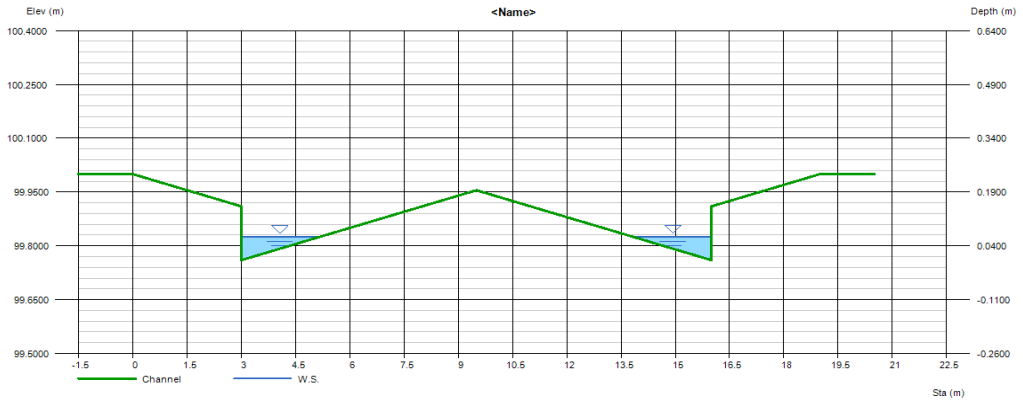
MAVEN ASSOCIATES	Job Number -	Sheet 2	Rev A
Job Title Calc Title 11 Gundry Street TP108 Calculation - Pre-Development Catchment C	Author VM	Date 14/06/2024	Checked AS

1. Data

Catchment Area	A=	0.01577	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
			0.35066
Initial abstraction	Ia=	0.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 5.2 mm

3. Average recurrence interval, ARI	100	(yr)
4. 24 hour rainfall depth	183	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.95	
6. Specific peak flow rate q*	0.105	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	**0.303**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	178.0	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	2805.53	(m3)



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(m)	(cms)	(sqm)	(m/s)	(m)	(m)	(m)	(m)
0.0640	0.303	0.137	2.2187	4.3973	0.1128	4.2674	0.3151

Worksheet 2: Graphical Peak Flow Rate

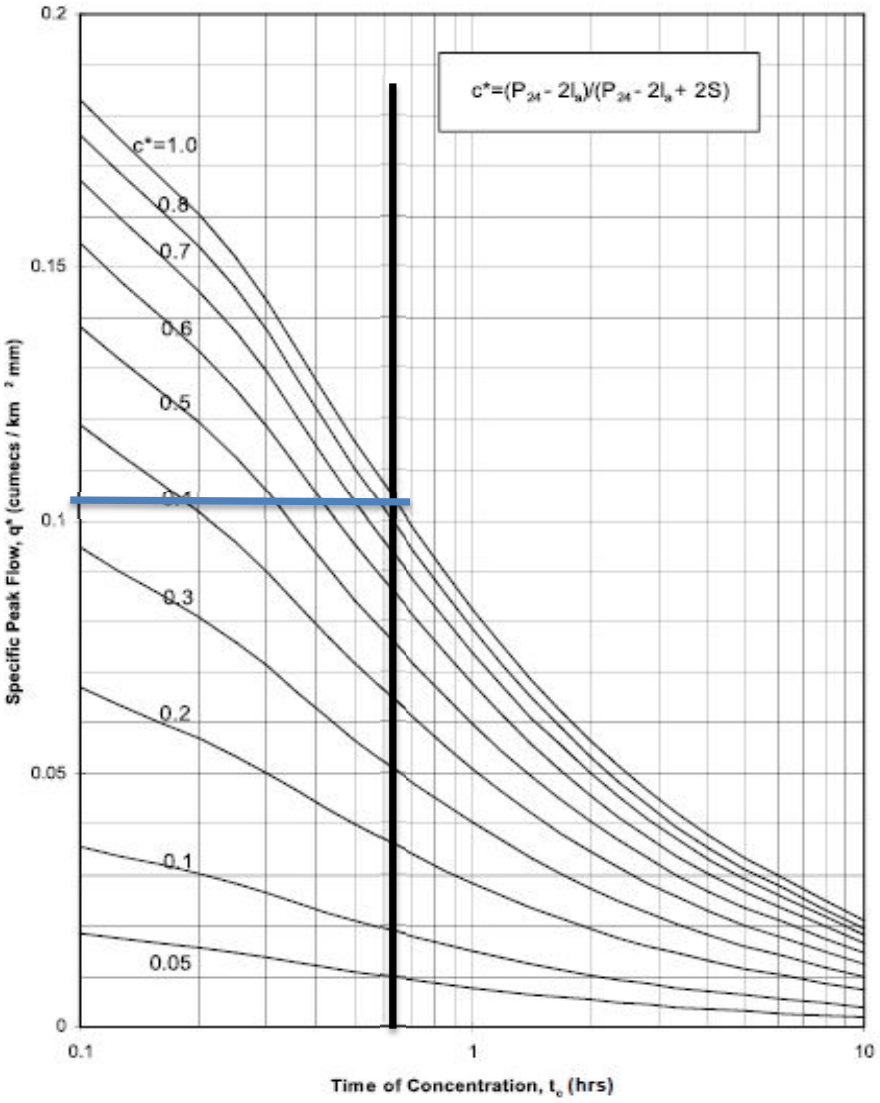


Figure 5.1 – Specific Peak Flow Rate