

TP108: WORKSHEET 1 & 2

Runoff Parameters and T_c / Graphical Peak Flow Rate



Job Name:	496/06 - Ambridge Rose Retirement Village	Job No.:	496/03
Calculations By:	JF	Date:	18/04/2025
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File:	4-01 TP 108 calc rev2.xlsx	Rev.:	A
Pre-Development			



Post-Development



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Worksheet 1: Runoff Parameters and Time of Concentration

Select: **Post Development**

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) 1000m ² = 1ha	Product of CN x area
Group C	<i>lawn, parks in good condition</i>	74	0.093	6.87
Group A	<i>permeable pavers</i>	74	0.027	1.99
.	<i>Unconnected impervious</i>	98		0.00
.	<i>Connected impervious</i>	98	0.179	17.53
.		0		0.00
.		0		0.00
Totals =			0.299	26.40

* from Table 24

CN (weighted) = total product / total area =

88.4

Ia (weighted) = $\frac{5 \times \text{pervious area}}{\text{total area}}$ = $\frac{5 \times 0.1198}{0.2987}$ mm

2.0

2. Time of Concentration

Channelisation factor, C = 0.6 (From Table 4.2)

Catchment length, L = 0.042 km (along drainage path)

Catchment Slope, S_c = 0.03 m/m (by equal area method)

Runoff factor, $\frac{CN}{(200-CN)}$ = $\frac{88.4}{111.6}$ = 0.79

$t_c = 0.14 C L^{0.66} \left(\frac{CN}{200-CN} \right)^{-0.55} S_c^{-0.30}$ = 0.034 hrs

SCS Lag for HEC-HMS.... $t_p = 2/3 t_c$ = 0.023 hrs

Worksheet 2: Graphical Peak Flow Rate

1. Data

Catchment Area A = 0.00299 km² (100ha = 1km²)
 Runoff curve number CN = 88 (from worksheet 1)
 Initial abstraction Ia = 2.0 mm (from worksheet 1)
 Time of concentration tc = 0.17 hrs (from worksheet 1)

2. Calculate storage, $S = (1000/CN - 10)25.4$ = 33 mm

3. Average recurrence interval, ARI (yr)

4. 24 hour rainfall depth, P_{24} (mm)

5. Compute, $c^* = \frac{P_{24} - 2Ia}{P_{24} + 2Ia + 2S}$

6. Specific peak flow rate q^*
(from figure 5.1)

7. Peak flow rate, $q_p = q^* A P_{24}$ (m³/s)

8. Runoff depth, $Q_{24} = \frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$ (mm)

9. Runoff volume, $V_{24} = 1000 \times Q_{24} A$ (m³)

Storm #1	Storm #2	Storm #3	Storm #4
	2 yr	10 yr	100 yr
	98.1	181.81	285.31
	0.585	0.727	0.808
	0.137	0.154	0.161
	0.040	0.084	0.137
	71.3	151.6	253.4
	213	453	757

DEPTH-DURATION-FREQUENCY Climate Change - Rainfall Depth (mm) & Intensity (mm/h)

(using Daily Rainfall Depth maps TP108 with climate change adjustments)



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ARI	AEP - Design Catchment Maps: Appendix A of TP108	24hr
2	0.5	77
5	0.2	116
10	0.1	139
20	0.05	162
50	0.02	194
100	0.01	215

Table 4.1: Percentage Increase in 24-hour Design Rainfall Depth
(inclusive of climate change as per Auckland Council SW CoP Version 4 dated March 2024)

API	AEP	Percentage increase in 24hr design rainfall depth due to future climate change - 2.1°	Percentage increase in 24hr design rainfall depth due to future climate change - 3.8°
2	50%	15.1	27.4
5	20%	16.4	29.6
10	10%	17	30.8
20	5%	17.2	31.2
50	2%	17.6	31.9
100	1%	18.1	32.7



Rainfall Depth (mm)

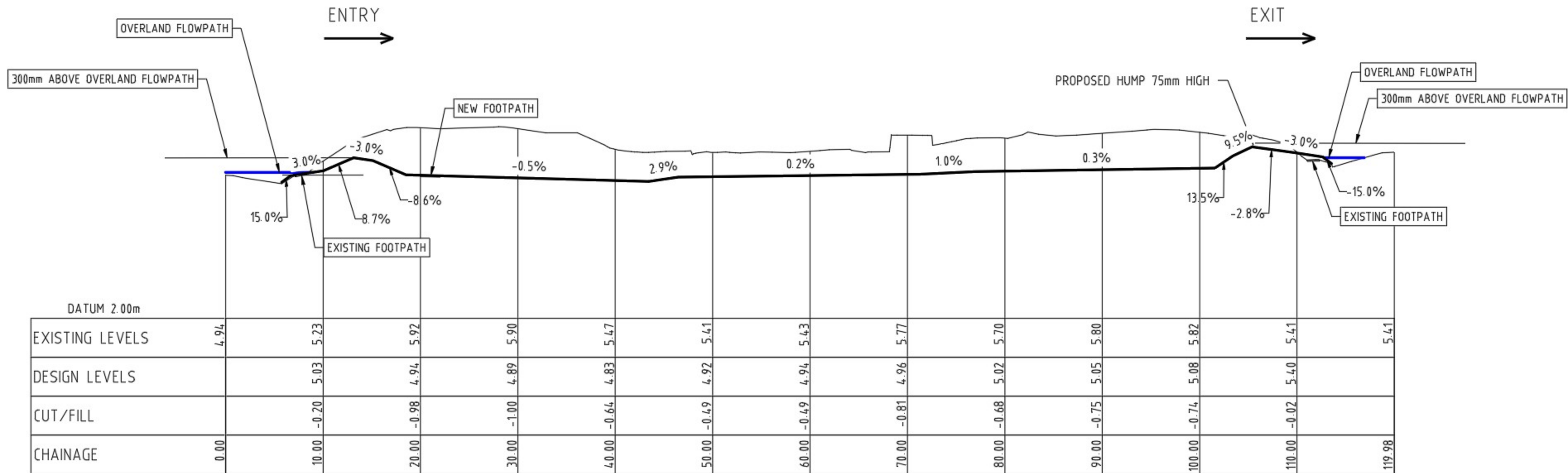
Duration/ARI	24hr (2.1°)	24hr (3.8°)
2 yr (50%)	88.63	98.10
5 yr (20%)	135.02	150.34
10 yr (10%)	162.63	181.81
20 yr (5%)	189.86	212.54
50 yr (2%)	228.14	255.89
100 yr (1%)	253.92	285.31

Table 2: Ratio to convert 24-hour Rainfall Depth to Intensities

Duration	24hr without climate change	24hr with climate change allowances
10min	67.5	69.4
20min	51.9	53.2
30min	42.8	43.7
1hr	30.3	30.8
2hr	20.5	20.8
6hr	10.5	10.6
12hr	6.8	6.8
20hr	4.2	4.2

Rainfall Intensity (mm/h)

	10min	20min	30min	1hr	2hr	6hr	12hr	24hr
2 yr (50%)	61.5	47.1	38.7	27.3	18.4	9.4	6.0	3.7
5 yr (20%)	93.7	71.8	59.0	41.6	28.1	14.3	9.2	5.7
10 yr (10%)	112.9	86.5	71.1	50.1	33.8	17.2	11.1	6.8
20 yr (5%)	131.8	101.0	83.0	58.5	39.5	20.1	12.9	8.0
50 yr (2%)	158.3	121.4	99.7	70.3	47.5	24.2	15.5	9.6
100 yr (1%)	176.2	135.1	111.0	78.2	52.8	26.9	17.3	10.7



DRIVEWAY LONGSECTION

SCALE 1:500 HORI 1:100 VERT @ A3

