Appendix 1 – Calculation

TP108 Calculations

MAVEN ASSOCIATES	Job Number 215010	Sheet 1	Rev A
Job Title / Calc Title: Sunfield FAA / TP108 Calculation - Pre-Development Wetland 4	Author AO	Date 19/12/2024	Checked

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		0.00
C	Road pavement	98		0.00
C	Carpark	98		0.00
C	Open space (Pervious)	74	53.5004	3959.03
* from Appendix B		Totals =	53.5004	3959.03

CN (weighted) = total product / total area = 3959.03 / 53.500 = 74.0

Ia (average) = 5 x pervious area / total area = 5 x 53.5004 / 53.500 = 5.0 mm

2. Time of Concentration

Contours level in meters — High Level: | Lower level:

Channelisation factor — C = 1 (From Table 4.2)

Catchment length — L = 0.1 km (along drainage path)

Catchment Slope — Sc= 0.016 m/m (by equal area method)

Runoff factor, CN / (200 - CN) = 74.0 / (200- 74.0) = 0.59

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

= 0.14 1 0.22 1.34 3.48 = 0.17 hrs

SCS Lag for HEC-HMS.... $t_p = 2/3\ t_c$ = 0.11 hrs = 6.71 mins

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 215010	Sheet 2	Rev A
Job Title: Sunfield FAA Calc Title: TP108 Calculation - Pre-Development Wetland 4	Author AO	Date 19/12/2024	Checked 0

1. Data

Catchment Area	A=	0.53500	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89.2 mm

	90th %	95th %	2	10	100	
3. Average recurrence interval, ARI						(yr)
4. 24 hour rainfall depth	25	33	80	140	228	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.08	0.11	0.28	0.42	0.55	
6. Specific peak flow rate q*	0.020	0.028	0.065	0.090	0.110	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	0.268	0.494	2.782	6.741	13.418	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	3.7	6.7	34.2	81.3	159.3	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	1958.94	3577.54	18322.79	43481.53	85206.62	(m3)

MAVEN ASSOCIATES		Job Number 215010	Sheet 3	Rev A
Job Title	Sunfield FAA	Author	Date	Checked
Calc Title	TP108 Calculation - Post Development Wetland 4 - Pervious	AO	19/12/2024	0

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		0.00
C	Road pavement	98		0.00
C	Berms + Footpath	85		0.00
C	Open space (Pervious)	74	7.7132	570.78
* from Appendix B		Totals =	7.7132	570.78

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{570.78}{7.713} = \frac{74.0}{}$ 23.7400

Ia (average) = $\frac{5 \times \text{pervious area}}{\text{total area}} = \frac{5 \times 7.7132}{7.713}$ 5.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.5 km (along drainage path)

Catchment Slope Sc= 0.016 m/m (by equal area method)

Runoff factor, $\frac{CN}{200 - CN} = \frac{74.0}{200- 74.0} = \frac{0.59}{}$

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

= 0.14 0.6 0.63 1.34 3.48 = $\frac{0.17}{10.0}$ hrs

SCS Lag for HEC-HMS.... $t_p = 2/3\ t_c$ = $\frac{0.11}{6.71}$ hrs mins

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 215010	Sheet 4	Rev A
Job Title: Sunfield FAA Calc Title: TP108 Calculation - Post Development Wetland 4 - Pervious	Author AO	Date 19/12/2024	Checked 0

1. Data

Catchment Area	A=	0.07713	km2(100ha =1km2)
Runoff curve number	CN=	74.0	(from worksheet 1)
Initial abstraction	Ia=	5.0	mm (from worksheet 1)
Time of concentration	tc=	0.17	hrs (from worksheet 1)

2. Calculate storage, S =(1000/CN - 10)25.4 = 89.2 mm

	PWV	SMAF				
3. Average recurrence interval, ARI	90th %	95th %	2	10	100	(yr)
4. 24 hour rainfall depth	25	33	80	140	228	(mm)
Percentage Increase			15.1	17.0	32.7	(%)
4. 24 hour rainfall depth, P24	25	33	92.08	163.8	302.556	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.08	0.11	0.32	0.46	0.62	
6. Specific peak flow rate q*	0.170	0.170	0.170	0.170	0.170	
7. Peak flow rate, $q_p=q^*A^*P_{24}$	0.328	0.433	1.207	2.148	3.967	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	3.7	6.7	43.0	101.7	228.9	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	282.42	515.78	3317.14	7841.69	17655.81	(m3)
10. Retention volume, imp*5mm	0	0				m^3

MAVEN ASSOCIATES		Job Number 215010	Sheet 5	Rev A
Job Title	Sunfield FAA	Author	Date	Checked
Calc Title	TP108 Calculation - Post Development Wetland 4 - Impervious	AO	19/12/2024	0

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		0.00
C	Road pavement	98	45.7901	4487.43
C	Berms + Footpath	85		0.00
C	Open space (Pervious)	74		0.00
* from Appendix B		Totals =	45.7901	4487.43

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4487.43}{45.790} =$ 98.0 23.7400

Ia (average) = $\frac{\text{5 x pervious area}}{\text{total area}} = \frac{5 \times 0.0000}{45.790}$ 0.0 mm

2. Time of Concentration

Channelisation factor C = 0.6 (From Table 4.2)

Catchment length L = 0.5 km (along drainage path)

Catchment Slope Sc= 0.016 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 0.63 1.02 3.48 = $\frac{0.17}{10.0}$ hrs

SCS Lag for HEC-HMS.... $t_p = 2/3\ t_c$ = $\frac{0.11}{6.71}$ hrs mins

NO GOOD
use
0.17 hrs

Worksheet 1: Runoff Parameters and Time of Concentration

MAVEN ASSOCIATES	Job Number 215010	Sheet 6	Rev A
Job Title: Sunfield FAA Calc Title: TP108 Calculation - Post Development Wetland 4 - Impervious	Author AO	Date 19/12/2024	Checked 0

1. Data

Catchment Area	A=	0.45790	km2(100ha =1km2)
Runoff curve number	CN=	98.0	(from worksheet 1)
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

	PWV - SMA\ Live - SMAF1					
3. Average recurrence interval, ARI	90th %	95th %	2	10	100	(yr)
4. 24 hour rainfall depth	25	33	80	140	228	(mm)
Percentage Increase			15.1	17.0	32.7	(%)
4. 24 hour rainfall depth, P24	25	33	92.08	163.8	302.556	(mm)
5. Compute c* = P24 - 2Ia/P24 - 2Ia+2S	0.71	0.76	0.90	0.94	0.97	
6. Specific peak flow rate q*	0.170	0.170	0.170	0.170	0.170	
7. Peak flow rate, $q_p=q*A*P_{24}$	**1.946**	**2.569**	**7.168**	**12.751**	**23.552**	m3/s
8. Runoff depth, $Q_{24} = (P_{24}-Ia)^2/(P_{24}-Ia)+S$	20.7	28.5	87.2	158.8	297.5	mm
9. Runoff volume, $V_{24} = 1000xQ_{24}A$	9481.56	13059.36	39916.44	72703.43	136207.16	(m3)
10 Retention volume, imp*5mm	2290					m^3
Combined v24	9764	13575.14	43233.58	80545.12	153862.97	
Post V24- Pre V24	**7805**	**9998**	**24911**	**37064**	**68656**	m^3
Recharge pit		6868.52				
Detention volume	5516	3129				m^3
				checks		
50% PWV - Live storage provided	3903		4968.48	1,065.96		m^3
Ponding Depth Coefficient	0.5					m
Minimum Wetland Area	7805		10310	2,504.96		m^2
Forebay volume	585		1,311.00	725.62		m^2
Live Storage Required		**3129**				m^2

Length	230	Ratio 1:	5
Width	**46.00**	Area	**10580.00**

Worksheet 2: Graphical Peak Flow Rate

MAVEN ASSOCIATES		Job Number 215010	Sheet 7	Rev A
Job Title Calc Title	Sunfield Stage 2 Catchment Summary for Wetland Design 4	Author AO	Date 19/12/2024	Checked 0

Total Area (ha)	Pervious (ha)	%	Impervious (ha)	%
Pre Developmnet	53.5004	100%	0	0%
Post Development	7.7132	14%	45.7901	86%

	Runoff Volume V24 (m3)		Peak Flow Rate (m3/s)		Volume Required
	Pre	Post	Pre	Post	
90th %	1959	9764	0.27	2.27	7805.0
95th %	3578	13575	0.49	0.43	9997.6
2yr	18323	43234	2.78	1.21	24910.8
10yr	43482	80545	6.74	2.15	37063.6
100yr	85207	153863	13.42	3.97	68656.4

Maven Associates	Job Number 215010	Sheet 1	Rev A
Job Title: Sunfield Calc Title: SW Pond 4 SMAF Orifice Size Calc	Author YW	Date 13/01/2025	Checked

Detention Volume

3129.00 m^3 *(See SMAF Summary)*

Flow Rate (Q_p) if released over 24 hours

0.03622 m^3/sec (Average Discharge Flow-Rate)

Tank Details

Tank Height 0.130 m
Orifice Height 0.000 m (Above tank base)

Orifice Sizing (to atmo)

$Q_P=0.62*A*(2*G*H_{2/3})^{1/2}$

Q_P 0.03622 m^3/sec (Peak Discharge Flow-Rate)
G= 9.810 m^2/sec
H_T= 0.130 m (Height of water above Discharge Point)
$H_{2/3}$= 0.087 m (Average Head of Water in pond = Two-Thirds of H_T)

A= 0.0447945 m^2 (Cross-Sectional of the Discharge Pipe)

Circular Area Formula

$A=(\pi*D^2)/4$

A= 0.0447945 m^2 (Cross-Sectional of the Discharge Pipe)
D= 0.2388182 m (Diameter of Discharge Pipe)

Use 10mm Orifice (minimum size)

238.81816 (Diameter of Discharge Orifice in mm)

Qmax = 0.0724 m^3/sec
Qi (265mm) 0.0446 m^3/sec