

9 Jan 25

286 Sydney Rd Balgowlah - Storm water drainage – Proposed discharge to Sydney Rd gutter
Additional Information requested by Vic Naidu at Transport for NSW

References

- A. TfNSW letter dated 4 October 2024 Reference: SYD24-01653
- B. 1606 286 SydRd Submission to TfNSW (rev Dec24)(1) dated 27 Dec 24 (11 Pages)

Discussion between Vic Naidu (TfNSW) and Richard Weber on 9 Jan 25, included a background to the stormwater management design for the subject property, and a TfNSW request for further information; in particular . . . the simple stormwater discharge rates from 286 Sydney Rd, to the street gutter, for storm frequencies . . .

- 1 in 100 yr (1% AEP)
- 1 in 20 yr (5%AEP) and
- 1 in 10 yr (10%AEP)

The rainfall rates used in providing these discharge rates are shown in the screen shots below, from Aust Rainfall and Runoff (ARR) generated data. The figures in RED (eg. **205**) are the average rates of rainfall (mm/hr) for the storm durations (5,10,15 minutes) and the storm frequencies (1%,5%,10% AEP)

This sheet presents 1% AEP ARR2016 and ARR1987 design rainfalls for							Balgowlah, NSW	Latitude					
Individual patterns for various durations are presented as column charts and cumulative plots .													
Intensities are also presented in blocks that can be imported into the DRAINS program. (Later, it will be possible to import the ten 2016 patterns from the 'rare' category, and the single 1987 pattern is from the '> 30 year ARI' category.)													
1% AEP, 5 Minute Rainfall Patterns													
Duration (minutes)		5	Original Depth (mm)		22.40								
			Climate Adjusted Depth (mm)		22.40	Intensity (mm/h)		268.80					
Time (minutes)	Depth (mm)												
0													
5	22.40	Enter this intensity into DRAINS											
1% AEP, 10 Minute Rainfall Patterns													
Duration (minutes)		10	Original Depth (mm)		36.30								
			Climate Adjusted Depth (mm)		36.30	Intensity (mm/h)		217.80					
Time (minutes)	Depth (mm) for Pattern:			1	2	3	4	5	6	7	8	9	10
0													
5	21.98	22.22	18.47	17.94	15.82	21.12	17.97	21.37	12.43	15.22			
10	14.32	14.08	17.83	18.36	20.48	15.18	18.33	14.93	23.87	21.08			
Check Sum	36.30	36.30	36.30	36.30	36.30	36.30	36.30	36.30	36.30	36.30			
1% AEP, 15 Minute Rainfall Patterns													
Duration (minutes)		15	Original Depth (mm)		45.50								
			Climate Adjusted Depth (mm)		45.50	Intensity (mm/h)		182.00					
Time (minutes)	Depth (mm) for Pattern:			1	2	3	4	5	6	7	8	9	10
0													
5	12.33	19.78	21.45	23.03	17.12	18.73	12.80	15.63	9.31	12.40			
10	16.40	15.82	14.30	10.11	16.67	13.47	17.77	17.71	12.28	10.47			
15	16.78	9.89	9.75	12.36	11.71	13.30	14.93	12.16	23.91	22.64			
Check	45.50	45.50	45.50	45.50	45.50	45.50	45.50	45.50	45.50	45.50			

This sheet presents 5% AEP ARR2016 and ARR1987 design rainfalls for Balgowlah, NSW

Individual patterns for various durations are presented as column charts and cumulative plots .

Intensities are also presented in blocks that can be imported into the DRAINS program. (Later, it will be possible to import the ten 2016 patterns from the 'intermediate' category, and the single 1987 pattern is from the '≥ 30 year ARI' category.)

The ten 2016 patterns are from the 'intermediate' category, and the single 1987 pattern is from the '≥ 30 year ARI' category.

5% AEP, 5 Minute Rainfall Patterns

Duration (minutes)	5	Original Depth (mm)	17.10	Climate Adjusted Depth (mm)	17.10	Intensity (mm/h)	205.20
Time (minutes)	Depth (mm)						
0							
5	17.10	Enter this intensity into DRAINS					

5% AEP, 10 Minute Rainfall Patterns

Duration (minutes)	10	Original Depth (mm)	27.60	Climate Adjusted Depth (mm)	27.60	Intensity (mm/h)	165.60			
Time (minutes)	Depth (mm) for Pattern:			4	5	6	7	8	9	10
0	1	2	3	4	5	6	7	8	9	10
5	15.24	17.70	13.95	11.79	13.23	13.50	13.64	12.83	14.43	16.36
10	12.36	9.90	13.65	15.81	14.37	14.10	13.96	14.77	13.17	11.24
Check	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.60
Sum										

5% AEP, 15 Minute Rainfall Patterns

Duration (minutes)	15	Original Depth (mm)	34.60	Climate Adjusted Depth (mm)	34.60	Intensity (mm/h)	138.40			
Time (minutes)	Depth (mm) for Pattern:			4	5	6	7	8	9	10
0	1	2	3	4	5	6	7	8	9	10
5	15.57	16.32	18.59	8.50	12.39	11.76	10.15	11.65	9.52	8.78
10	11.25	8.49	7.93	15.78	7.23	14.53	16.62	12.63	9.53	10.33
15	7.79	9.79	8.07	10.32	14.98	8.30	7.83	10.32	15.55	15.49
Check	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60	34.60
Sum										

This sheet presents 10% AEP ARR2016 and ARR1987 d Balgowlah, NSW										Latitude (°S)	
Individual patterns for various durations are presented as column charts and cumulative plots. Intensities are also presented in blocks that can be imported into the DRAINS program. (Later, it will be possible to import the 2016 patterns from the 'intermediate' category, and the single 1987 pattern is from the '30 year ARI' category.)											
10% AEP, 5 Minute Rainfall Patterns											
Duration (minutes)		5	Original Depth (mm)		14.90	Climate Adjusted Depth (mm)		14.90	Intensity (mm/h)	178.80	
Time (minutes)	Depth (mm)	Enter this intensity into DRAINS									
0											
5	14.90										
10% AEP, 10 Minute Rainfall Patterns											
Duration (minutes)		10	Original Depth (mm)		24.00	Climate Adjusted Depth (mm)		24.00	Intensity (mm/h)	144.00	
Time (minutes)	Depth (mm) for Pattern:	1	2	3	4	5	6	7	8	9	10
0											
5	13.25	15.39	12.13	10.25	11.50	11.74	11.86	11.15	12.54	14.23	
10	10.75	8.61	11.87	13.75	12.50	12.26	12.14	12.85	11.46	9.77	
Check Sum	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
10% AEP, 15 Minute Rainfall Patterns											
Duration (minutes)		15	Original Depth (mm)		30.00	Climate Adjusted Depth (mm)		30.00	Intensity (mm/h)	120.00	
Time (minutes)	Depth (mm) for Pattern:	1	2	3	4	5	6	7	8	9	10
0											
5	13.50	14.15	16.12	7.37	10.74	10.20	8.80	10.10	8.25	7.61	
10	9.75	7.36	6.88	13.68	6.27	12.60	14.41	10.95	8.27	8.96	
15	6.75	8.49	7.00	8.95	12.99	7.20	6.79	8.95	13.49	13.43	
Check Sum	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00

Storm Durations, Times of Concentration and Flow Velocities

It should be noted that

- the most onerous storm for a given catchment is the storm whose duration matches the time of flow (ie. the Time of Concentration . . (Tc)) to the point of interest.
- Short duration storms have higher average rates of rainfall than longer duration storms.

For the roof catchment at 286 Sydney Rd and the point of discharge at the gutter, the appropriate Tc would be up to 5 minutes (hydrological engineering does not generally consider any shorter Tc value). For the accumulation of catchments that concentrate at the west end of the 177m long piece of Sydney Rd between Boyle St and Condamine St, Tc would be about 8 minutes. By way of commentary . . .

- an average Mannings n value of about 0.035 would apply to most of the channel flow where the channel is below the road centre level, and the channel includes grassed verge and parked car tyres.
- The Hydraulic radius for a channel cross section below the road centre is $0.675 / 7.85 = 0.086\text{m}$
- the gutter channel slope over 177m is 1.9%.
- Mannings equation gives a channel velocity of about 0.8m/sec and a Tc (for channel flow only) of about 4 mins
- Tc for concentration of runoff to the gutter would be up to 5 mins – say about 4mins
- Total Tc for the catchment would therefore be about 8 minutes

Results


The rate of discharge to the gutter for the roof catchment at 286 Sydney Rd for a range of Storm Frequencies and for 2 storm durations (5mins and 10 mins) is tabulated below.

Runoff from 286 Sydney Rd Roof for several storm frequencies and storm durations						2.78					
	Storm Duration (Time of Concentration)	ARR Rain Rates (l mm/hr)	C	Roof Area (m ²)	286 Sydney rd Roof Area (ha)	Roof Runoff Q (l/sec)	Run off Q cumecs	Total North Side Area (ha)	Total Runoff to North Gutter Q (l/sec)		(g)/(j)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
AEP 10% (1 in 10 year)	5 min	178	1	251	0.025	12.42	0.0124	0.4	197.936		6%
	10 Min	144	1	251	0.025	10.05	0.0100	0.4	160.128		6%
AEP 5% (1 in 20 year)	5 min	205	1	251	0.025	14.30	0.0143	0.4	227.96		6%
	10 Min	165	1	251	0.025	11.51	0.0115	0.4	183.48		6%
AEP 1% (1 in 100 year)	5 min	268	1	251	0.025	18.70	0.0187	0.4	298.016		6%
	10 Min	217	1	251	0.025	15.14	0.0151	0.4	241.304		6%

This tabulation shows under column (g), a worst case gutter discharge of 18.7 litres per second (for a 100 year storm) and for a 10 Year storm, as discussed with Vic Naidu, a gutter discharge of 12.4 litres per second.

Note that the proposal for 286 Sydney Rd is for 2 outlets and that the discharge rates tabulated above, on a per outlet basis, would be halved to 9.4 litres per second for a 100 year storm.

As to whether these discharge rates are acceptable (quite apart from any other analysis that I have done), a simple, useful comparison is on page 45 of Northern Beaches Council Water Management for Development Policy (see extract below). It shows that the maximum allowable discharge into the kerb and gutter is 25 litres/sec and that no more than 2 outlets per property are allowed. This is typical of many local government standards in the Sydney Basin.



northern
beaches
council

- 35% or 250m² (whichever is the lessor) – if the total existing site impervious area exceeds either of these
- X% if the total existing site impervious area is less than 35% and where X is the percentage of the actual impervious area but less than 250m².

The maximum discharge into the kerb and gutter is 25l/s. This shall be the PSD if the total site's runoff is to be discharged at the kerb.

Note: No more than two outlets at a distance of 15m apart shall be permitted to discharge at any kerb along any one-property frontage.

The maximum discharge velocity to the **kerb** shall be restricted to 2.0m/s.

Conclusion

It is hoped that TfNSW will be in a position to approve roof water discharge from 286 Sydney Rd Balgowlah to the Sydney Rd gutter.



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