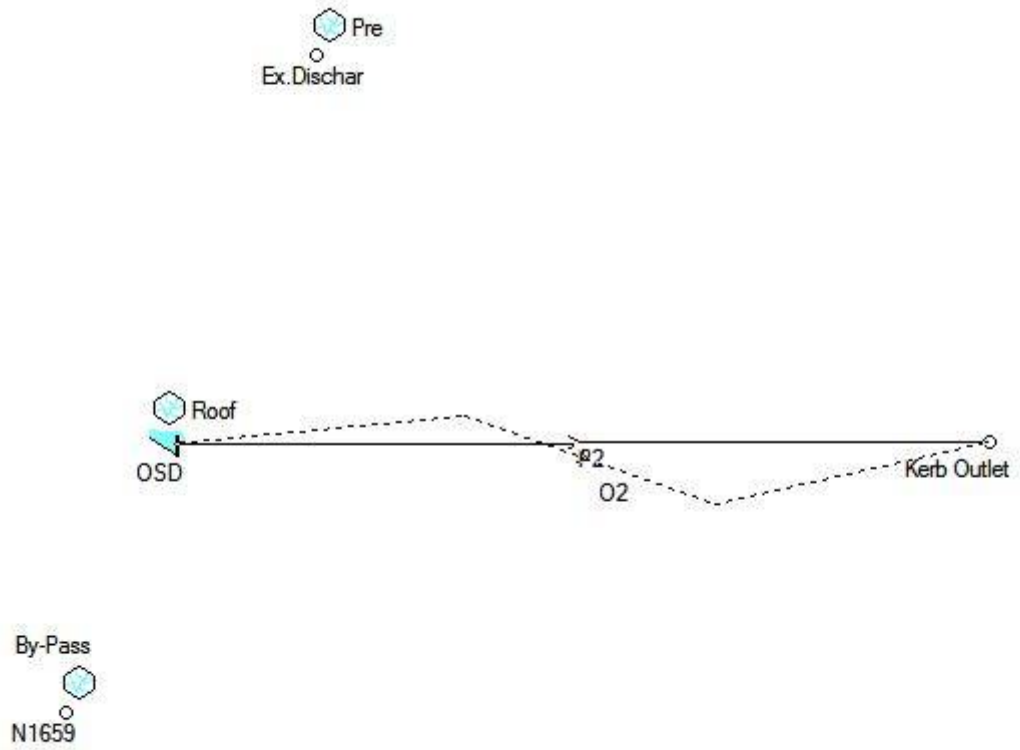
DRAINS ANALYSIS

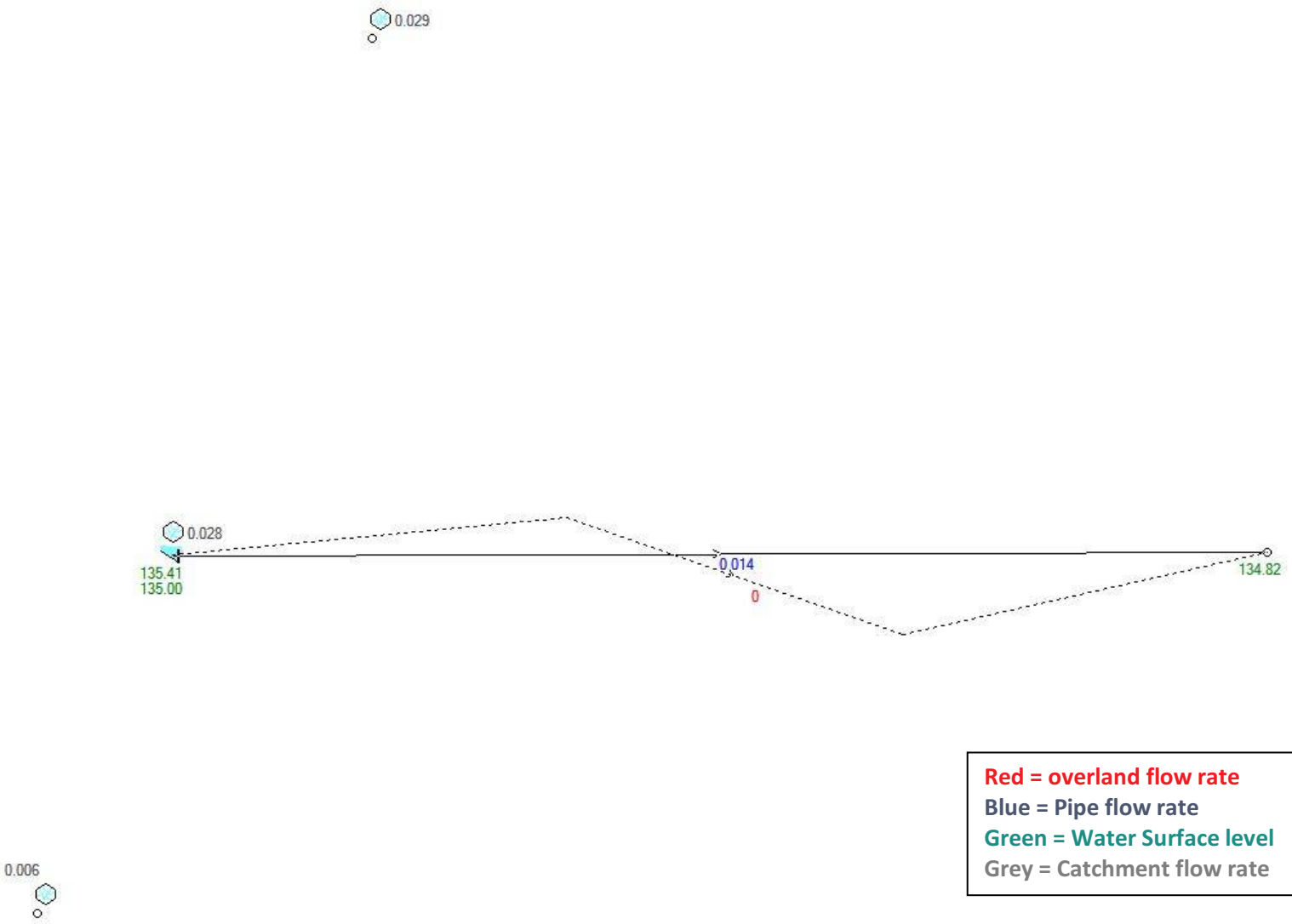
Proposed boarding house at
242 Warringah Road, Beacon Hill
Council: Northern Beaches Council
Date: 22nd November 2019

Objective of this report is to demonstrate that the post development flows for the 20% AEP (5 year Average Recurrence Interval (ARI)) 5% AEP (20 year ARI) and 1% AEP (100 year ARI) storm events are restricted to the pre development flows and subsequently to determine an OSD storage requirement for this development.

1. DRAINS Model input layout

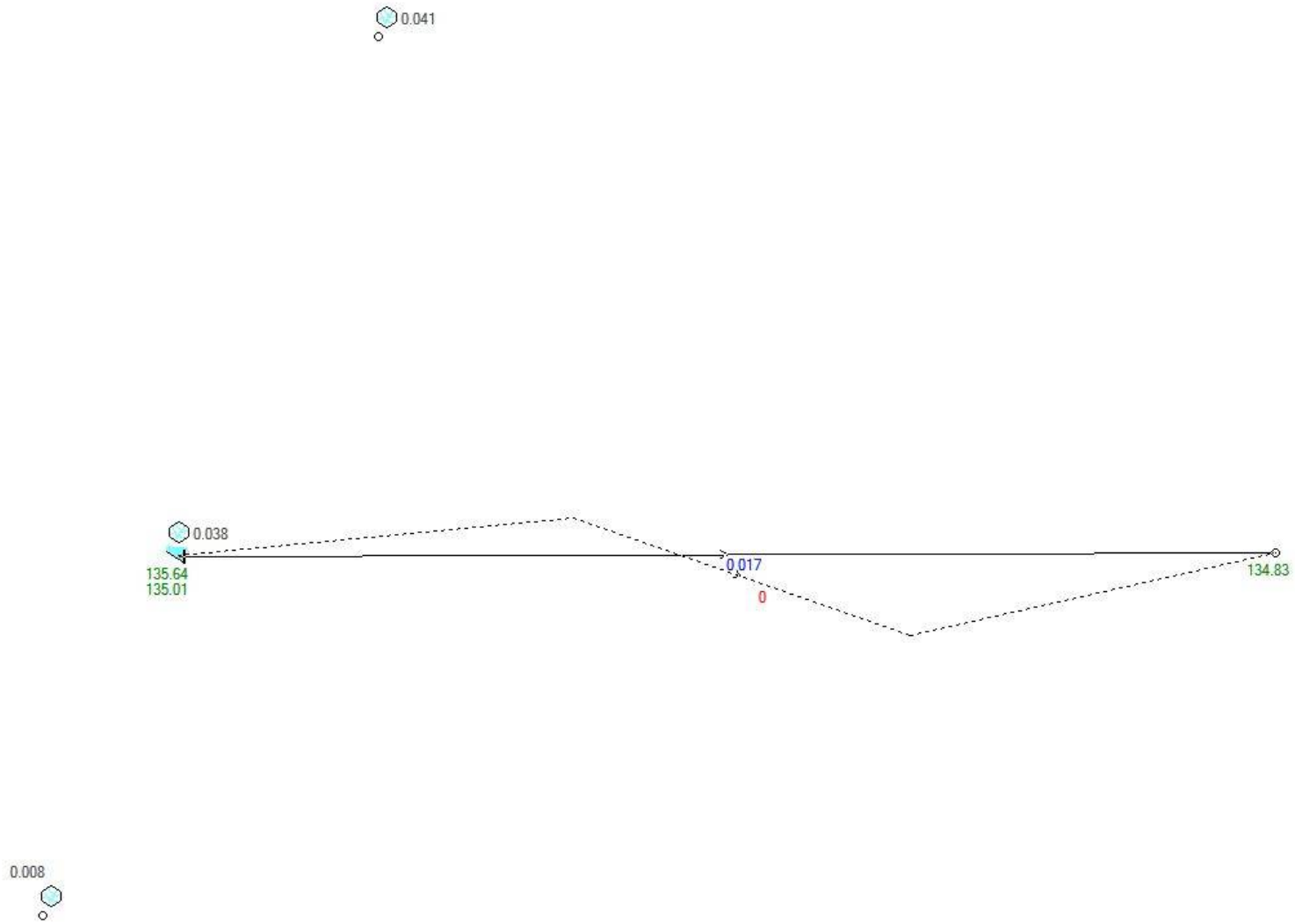


2. Drains Analysis for 20% AEP (5 years ARI)



- Max WL in OSD 1 = 135.41m (Approximate)
- Max Vol in OSD 1 = 7.4m^3 (Approximate)

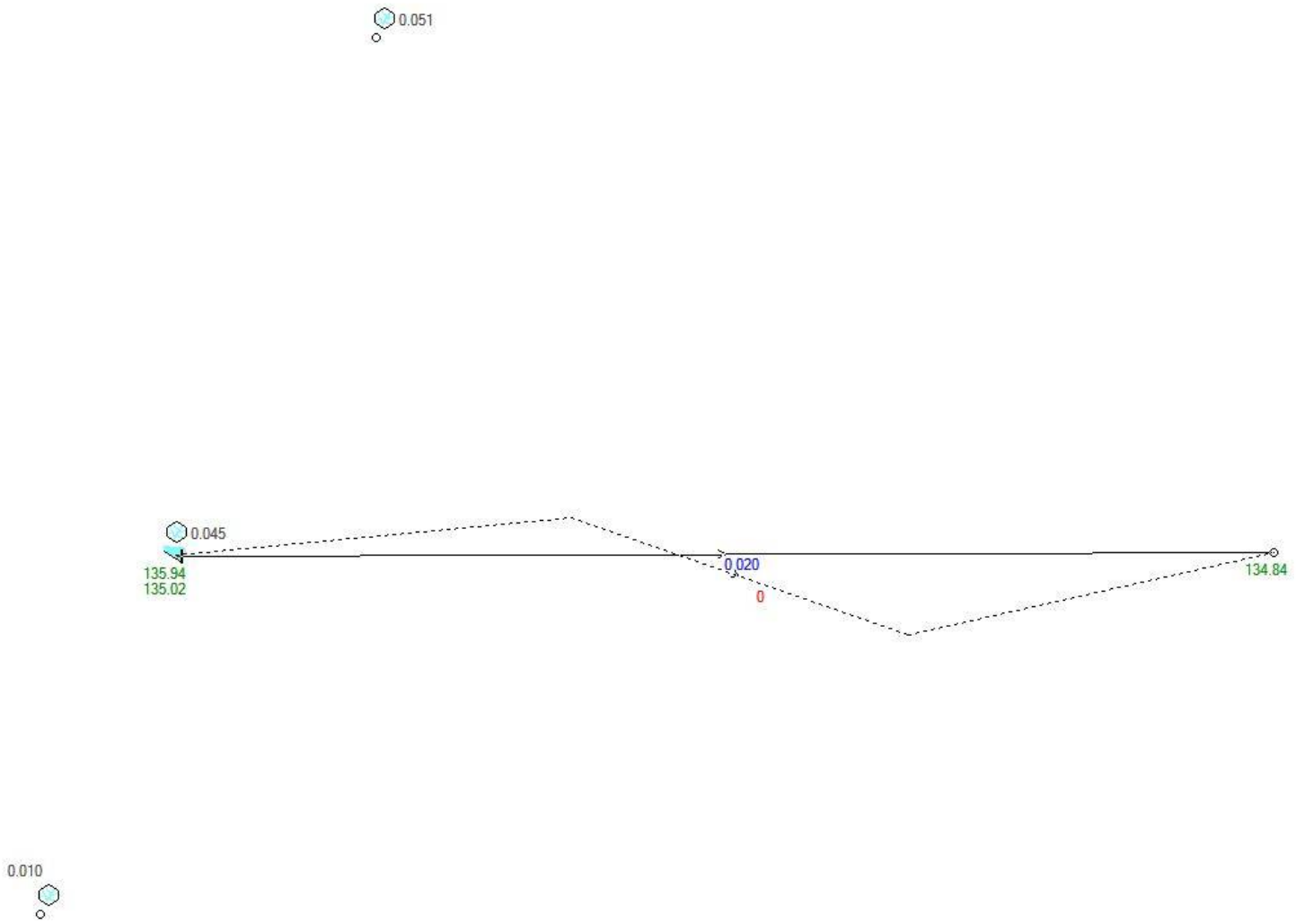
3. Drains Analysis for 5% AEP (20 years ARI)



- Max WL in OSD 1 = 135.64m (Approximate)
- Max Vol in OSD 1 = 12m^3 (Approximate)

Red = overland flow rate
Blue = Pipe flow rate
Green = Water Surface level
Grey = Catchment flow rate

4. Drains Analysis for 1% AEP (100 years ARI)



- Max WL in OSD 1 = 135.94m (Approximate)
- Max Vol in OSD 1 = 18m^3 (Approximate)

Red = overland flow rate
Blue = Pipe flow rate
Green = Water Surface level
Grey = Catchment flow rate

5. Polynomial Coefficients Table (Used in DRAINS)

Polynomial Coefficients Table

Location: 33.750S 151.250E NEAR.. 242 Warringah Rd, Beacon Hill Issued: 13/11/2019

List of coefficients to equations of the form

$$\log_e(I) = A + B \times (\log_e(T)) + C \times (\log_e(T))^2 + D \times (\log_e(T))^3 + E \times (\log_e(T))^4 + F \times (\log_e(T))^5 + G \times (\log_e(T))^6$$

T = Time in hours and I = Intensity in millimetres per hour

YEARS	A	B	C	D	E	F	G
1	3.4311842918	-5.7247239E-1	-2.3460330E-2	8.3310707E-3	-5.1924380E-4	-3.3570634E-4	3.1091931E-5
2	3.6944651604	-5.6954420E-1	-2.6648406E-2	8.1955921E-3	-1.7680760E-4	-3.2418862E-4	2.0589163E-5
5	3.9750316143	-5.6176317E-1	-3.5641983E-2	7.8389226E-3	7.9532240E-4	-3.0519778E-4	-7.7077470E-6
10	4.1114835739	-5.5879104E-1	-4.0339816E-2	8.1696054E-3	1.2433784E-3	-3.4692822E-4	-1.2993975E-5
20	4.2639741898	-5.5497438E-1	-4.4066220E-2	7.8301737E-3	1.6663328E-3	-3.2107162E-4	-2.7852146E-5
50	4.4360761642	-5.5150050E-1	-4.8542403E-2	7.8145405E-3	2.1427779E-3	-3.2863396E-4	-3.9198108E-5
100	4.5507254601	-5.4881412E-1	-5.1506445E-2	7.6600029E-3	2.4736752E-3	-3.2159215E-4	-4.8891437E-5

(Raw data: 40.32, 9.12, 2.76, 85.38, 18.67, 6.1, skew=0.00, F2=4.3, F50=15.87)

6. Intensity – Frequency – Duration Table

Intensity-Frequency-Duration Table

Location: 33.750S 151.250E NEAR.. 242 Warringah Rd, Beacon Hill Issued: 13/11/2019

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

	Average Recurrence Interval						
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	99.5	128	162	182	208	242	268
6Mins	93.2	120	152	171	196	228	252
10Mins	76.4	98.2	126	142	163	191	212
20Mins	55.7	72.1	93.7	107	123	145	162
30Mins	45.3	58.8	77.1	88.0	102	121	135
1Hr	30.9	40.2	53.3	61.0	71.1	84.4	94.7
2Hrs	20.6	26.8	35.6	40.8	47.5	56.5	63.3
3Hrs	16.2	21.0	27.8	31.8	37.1	44.0	49.3
6Hrs	10.7	13.9	18.2	20.8	24.1	28.6	31.9
12Hrs	7.01	9.10	11.9	13.6	15.8	18.7	20.9
24Hrs	4.54	5.91	7.81	8.95	10.4	12.4	13.9
48Hrs	2.84	3.72	4.99	5.76	6.76	8.09	9.12
72Hrs	2.10	2.76	3.73	4.32	5.08	6.10	6.88

(Raw data: 40.32, 9.12, 2.76, 85.38, 18.67, 6.1, skew=0.00, F2=4.3, F50=15.87)

PIT / NODE DETAILS Version 12

Name	Type	Pressure Change Coeff. Ku	Surface Elev (m)	x	y	id
Ex.Dischar	Node			807.607	-457.169	1
Kerb Outle	Node		134.9	901.244	-511.021	13
N1659	Node			772.643	-548.798	93975

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Outlet Typ	Dia(mm)	Centre RL	x	y	id
OSD	134.93	0	Orifice	100	134.93	786.806	-511.343	9
	135.01	1						
	135.07	20						
	136.08	20						

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Paved Time (min)	Grass Time (min)	Rainfall Multiplier
Pre	Ex.Dischar	0.0877	23	77	5	8	1
Roof	OSD	0.0685	70	30	5	8	1
By-Pass	N1659	0.0193	0	100	5	8	1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	No. Pipes	Chg From
P2	OSD	Kerb Outle	12	134.93	134.75	1.5	uPVC, not	150	154	0.03	1	OSD

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	SafeDepth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	id
O2	OSD	Kerb Outle	0.1	136.08	1	1	4 m wide p	0.3	0.15	0.4	1	19

DRAINS results prepared from Version 2016.02

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Kerb Outle	134.82		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre	0.029	0.009	0.02	5	8	5	AR&R 5 year, 25 minutes storm, average 84.3 mm/h, Zone 1
Roof	0.028	0.022	0.006	5	8	5	AR&R 5 year, 25 minutes storm, average 84.3 mm/h, Zone 1
By-Pass	0.006	0	0.006	5	8	5	AR&R 5 year, 25 minutes storm, average 84.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.07 impervious + 0.11 pervious = 0.18 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 5 ye	23.7	11.25 (47.5	8.52 (92.69	2.73 (18.9%)
AR&R 5 ye	36.83	21.18 (57.5	13.62 (95.2	7.57 (33.6%)
AR&R 5 ye	46.76	28.63 (61.2	17.47 (96.2	11.16 (39.0%)
AR&R 5 ye	54.83	34.62 (63.1	20.60 (96.8	14.02 (41.8%)
AR&R 5 ye	61.68	38.93 (63.1	23.26 (97.2	15.68 (41.5%)
AR&R 5 ye	67.64	42.49 (62.8	25.57 (97.4	16.92 (40.9%)
AR&R 5 ye	82.13	52.23 (63.6	31.20 (97.9	21.04 (41.9%)
AR&R 5 ye	93.45	59.38 (63.5	35.59 (98.1	23.79 (41.6%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P2	0.014	1.59	135.002	134.822	AR&R 5 year, 25 minutes storm, average 84.3 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	135.41	7.4	0.014	0.014	0

CONTINUITY CHECK for AR&R 5 year, 25 minutes storm, average 84.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Ex.Dischar	16.74	16.74	0	0
OSD	19.37	19.39	0	-0.1
Kerb Outle	19.39	19.39	0	0
N1659	2.82	2.82	0	0

Run Log for OSD 19.11.21 run at 16:59:41 on 22/11/2019
Flows were safe in all overflow routes.

DRAINS results prepared from Version 2016.02

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Kerb Outle	134.83		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre	0.041	0.012	0.029	5	8	5	AR&R 20 year, 25 minutes storm, average 111 mm/h, Zone 1
Roof	0.038	0.029	0.009	5	8	5	AR&R 20 year, 25 minutes storm, average 111 mm/h, Zone 1
By-Pass	0.008	0	0.008	5	8	5	AR&R 20 year, 25 minutes storm, average 111 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.07 impervious + 0.11 pervious = 0.18 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 20 y	30.44	17.82 (58.5	11.13 (94.2	6.69 (35.9%)
AR&R 20 y	47.69	31.83 (66.7	17.83 (96.3	14.00 (48.0%)
AR&R 20 y	61.04	42.57 (69.7	23.01 (97.1	19.56 (52.4%)
AR&R 20 y	72.01	51.46 (71.5	27.27 (97.6	24.19 (54.9%)
AR&R 20 y	81.36	58.19 (71.5	30.90 (97.8	27.29 (54.8%)
AR&R 20 y	89.53	64.05 (71.5	34.07 (98.0	29.98 (54.7%)
AR&R 20 y	109.35	78.82 (72.1	41.76 (98.4	37.06 (55.4%)
AR&R 20 y	124.77	90.01 (72.1	47.75 (98.6	42.26 (55.4%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P2	0.017	1.68	135.012	134.832	AR&R 20 year, 1 hour storm, average 71.1 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	135.64	12	0.017	0.017	0

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 111 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Ex.Dischar	26.31	26.31	0	0
OSD	26.97	26.99	0	-0.1
Kerb Outle	26.99	26.99	0	0
N1659	4.9	4.9	0	0

Run Log for OSD 19.11.21 run at 16:58:14 on 22/11/2019
Flows were safe in all overflow routes.

DRAINS results prepared from Version 2016.02

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Kerb Outle	134.84		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre	0.051	0.014	0.036	5	8	5	AR&R 100 year, 25 minutes storm, average 147 mm/h, Zone 1
Roof	0.045	0.034	0.011	5	8	5	AR&R 100 year, 25 minutes storm, average 147 mm/h, Zone 1
By-Pass	0.01	0	0.01	5	8	5	AR&R 100 year, 20 minutes storm, average 162 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.07 impervious + 0.11 pervious = 0.18 total ha)

Storm	Total Rainf cu.m	Total Runo cu.m (Runc	Impervious cu.m (Runc	Pervious Runoff cu.m (Runoff %)
AR&R 100	39.24	26.49 (67.5	14.55 (95.5	11.94 (49.7%)
AR&R 100	61.88	45.83 (74.1	23.34 (97.2	22.49 (59.4%)
AR&R 100	79.74	60.94 (76.4	30.27 (97.8	30.67 (62.9%)
AR&R 100	94.56	73.38 (77.6	36.02 (98.1	37.36 (64.6%)
AR&R 100	107.25	83.43 (77.8	40.95 (98.4	42.49 (64.7%)
AR&R 100	118.36	92.37 (78.0	45.26 (98.5	47.11 (65.1%)
AR&R 100	145.32	114.01 (78	55.73 (98.8	58.28 (65.5%)
AR&R 100	166.2	130.65 (78	63.83 (98.9	66.82 (65.7%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P2	0.02	1.76	135.022	134.842	AR&R 100 year, 1 hour storm, average 94.7 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
O2	0	0	0	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	135.94	18	0.02	0.02	0

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 147 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Ch (cu.m)	Difference %
Ex.Dischar	38.84	38.84	0	0
OSD	36.95	36.97	0	0
Kerb Outle	36.97	36.97	0	0
N1659	7.64	7.64	0	0

Run Log for OSD 19.11.21 run at 16:57:31 on 22/11/2019
Flows were safe in all overflow routes.