5 DESIGN FLOOD MODELLING

The process of establishing development controls in potentially flood liable lands relies on the assessment of 'flood planning levels'. These are based on the definition of flood levels for a range of 'design' flood events, such as the 100 year flood. A very important output from a flood study such as this is therefore the calculation of the design flood levels. This chapter describes how these levels have been calculated.

The various parameter values used in the DRAINS and TUFLOW models were consistent with values used in a number of similar flood studies. As it was not possible to calibrate the models to the 1984 and 1990 flood events and the simulation of these events produced broad agreement with the observed behaviour, there was no basis to adjust the model parameters from the adopted values.

Several specific changes were made to the 'historic' DRAINS and TUFLOW models to reflect 'present day' conditions. The most significant change was made to the University Creek TUFLOW model. This was the inclusion of Council's design information for the mid 1990s works which saw the retrofitting of a detention basin at Dunbar Park.

5.1 ASSESSMENT OF DESIGN STORM DURATIONS

Council's 100 year design rainfall information for a range of storm durations up to twelve hours were imported into DRAINS to generate the series of corresponding runoff hydrographs. Those storm durations which generated flows close to peak flow values were then imported into TUFLOW and the flood surfaces compared in order to determine which duration produced the highest flood levels. This exercise found that the two hour storm was overwhelmingly the critical duration for the Mars, Shrimptons, Industrial, Porters and Lane Cove catchments while the critical storm duration for the river at and downstream of Fullers Bridge was nine hours.

Hence the flood map presented in this report is a combination of the two hour storm flood levels along the local catchments draining to the river and the nine hour storm levels for the river itself.

5.2 DOWNSTREAM BOUNDARY CONDITION

As reported in **Section 3.2.2**, the TUFLOW model of the Lane Cove River was extended to the Epping Road bridge to ensure the downstream boundary regime did not unduly influence the derivation of study area flood levels (i.e. adjacent to River Avenue).

The design downstream boundary condition in the river is the same rating curve which had been used to generate the November 1984 flood profile (and which achieved a satisfactory fit with the reported flood depths along River Avenue).

The sensitivity of the adopted rating curve was also tested by halving the flood slope used to generate the rating curve values. Re-running the 100 year TUFLOW model showed that while the flood level at the downstream boundary would increase by about 0.7m there was no more than 0.2 metre difference in flood levels along the river frontage of River Avenue. This finding confirmed that the hydraulic model's downstream boundary location was sufficiently

downstream of the formal study area to essentially have no impact on flood levels within the study area.

5.3 BLOCKAGE

As resolved by the Management Committee, the culvert (and culvert fence) blockage policy adopted for the neighbouring Terrys Creek floodplain risk management study (**Reference 9**) was also utilised for this study.

Hence the following culvert blockage conditions were tested in TUFLOW:

- a blockage factor of 25% was applied to culverts/bridges whose diagonal dimension exceeds six metres;
- a blockage factor of 35% was applied to culverts/bridges whose diagonal dimension is between two metres and six metres; and
- a blockage factor of 50% was applied to culverts whose diagonal dimension is less than two metres.

Table 10 lists the various study area culvert and bridge sizes and their corresponding blockage factors.

As for Terrys Creek, a blockage factor of 35% was applied to culvert mesh type fences that are perpendicular to the flow direction; that is, at Libya Place (northern Mars Creek), Talavera Road (Mars Creek and Shrimptons Creek), private property culvert upstream of M2 Motorway (University Creek), Waterloo Road (Shrimptons Creek) and Epping Road bridge (Shrimptons Creek).

The TUFLOW models were edited to incorporate the design blockage factors as presented in **Table 10** and (where appropriate) the associated fence blockage factors. The two hour storm runs were then re-run and the results of the 'blocked' and 'unblocked' models were compared. This comparison found that while flood levels rose (but typically only marginally) at and upslope of 'blocked' culverts, elsewhere the flood levels did not change.

5.4 DESIGN FLOOD MAPS AND FLOWS

Figures 7 and **8** which present the results of the 20 year and 100 year ARI flood modelling are the product of enveloping the worst two hour duration flood levels for the Ryde study area catchments and the nine hour duration flood levels for the Lane Cover River floodplain.

Section 4.3.4 documents how the Marsfield November 1984 rainfall intensities were found to be very similar to Council's 100 year event design intensities. Not surprisingly, review of the Mars Creek and Shrimptons Creek 1984 mapping presented in **Figure 4** with the 100 year mapping presented in **Figure 8** found the two sets of results were very similar.

Figure 9 presents the results of the PMF modelling

Tables 11 to **15** list the corresponding peak flows at the series of representative locations shown in **Figure 10**.

It is recommended that the 100 year extent of inundation maps shown in **Figure 8** form the basis for mapping both flood risk precincts and overland flow precincts during the next study phase, in a manner similar to the approach which was adopted for the 2009 Eastwood & Terrys Creek Floodplain Risk Management Study (**Reference 9**).

Table 10: Watercourse Structures (and associated design blockage factors)

Culvert Location	TUFLOW Model ID	Structure Type	Dimensions			Percentage Blockage
			Number	Width/Diameter (m)	Height (m)	
Creek West of Mars Ck						
Marsfield Park pipe crossing	MC_03C	RCP	1	0.90	-	50
M2 Motorway	pM0100100	RCBC	2	2.40	1.80	35
Mars Ck						
University internal road, D/S Epping Rd	pM0502100	RCBC	1	1.50	1.00	50
University - Pond1 Outlet	pM0501700	RCP	1	1.80	-	50
University - Pond2 Outlet	pM0501300	RCP	1	1.80	-	50
University - Pond3 Outlet	pM0501100	RCP	1	1.80	-	50
Lake Weir - low flow structure	MR_36C	RCBC	3	1.30	0.60	50
Talavera Rd	pM0500300	RCP	1	1.80	-	50
M2 Motorway	pM0500100	RCBC	3	2.40	1.80	35
University Creek						
pipe U/S of Dunbar Park	pM3810100	RCP	1	0.30	-	50
Macquarie University Headwall	pM0901300	RCP	1	0.90	-	50
Macquarie University Weir Slot	MC_55R	RCBC	1	6.21	0.31	35
Macquarie University Headwall	pM0901200	RCBC	1	1.85	0.90	50
Macquarie University Headwall	MC_61B	Bridge	1	4.80	1.50	50
Macquarie University Headwall	pM0901000	RCP	1	1.20	-	50
Macquarie University Headwall	pM0901000C	RCP	3	0.90	-	50
Macquarie University Headwall	pM0900700	RCBC	3	3.80	1.50	35
Talavera Rd	pM0900500	RCP	1	0.90	-	50
M2 Motorway	pM0900100	RCBC	3	2.40	1.80	35
Shrimptons Ck						
M2 Motorway	pS7050010	RCBC	1	7.00	5.50	25
Waterloo Rd	pS0120720	RCBC	3	2.60	2.70	35
Epping Rd	Shp_42B	Bridge	1	18.30	variable	25
EIS Hall Park	Shp_36R	RCBC	2	3.30	1.05	35
EIS Hall Park	GW_07B	Bridge	2	~ 9.00	~ 1.50	25
Kent Rd	Shp_29R	RCBC	1	4.00	2.00	35
Lucinda Rd	Shp_26B	Bridge	1	~ 10.00	~ 3.00	25
Water Main Pipe Bridge	Shp_23B	Bridge	1	~ 8.00	~ 1.50	25
Footbridge, 150m D/S Bridge Rd	Shp_22B	Bridge	1	~ 10.00	~ 3.50	25
Bridge Rd	Shp_16B	Bridge	2	2.80	2.50	35
Golf Course outlet (Lane Cove Road)	pS2331460	RCBC	1	1.80	0.75	50
Paul Street North	pS1200600	RCP	1	0.90	-	50
private bridge D/S Talavera Rd	Shp_55B	Bridge	2	10.00	6.00	25
Industrial Creek						
D/S M2 Motorway	pI0100100	RCBC	1	2.10	1.05	35
Porters Creek (North)						
U/S M2 Motorway	pP0400018	RCBC	1	2.40	1.80	35
Talavera Rd (private access road)	pP0400050	RCBC	1	2.40	1.20	35
Porters Creek						
U/S M2 Motorway (Near Wicks Rd)	pP0100700	RCBC	1	3.60	2.40	35
D/S M2 Motorway (Near Wicks Rd)	pP0100300	RCBC	2	3.60	2.40	35
D/S of Wicks Rd & Waterloo Rd	pP0100820A	RCP	1	0.38	-	50
Lane Cove Catchment						
U/S Pittwater Road	pL0200015	RCP	1	1.05	-	50

Notes:
U/S = Upstream
D/S = Downstream
RCP = pipe conduit
RCBC = box culvert conduit

TABLE 11: Mars Creek Catchment Flows (m3/s)

Location	ID in Figure 10	5 Year 2-hr Unblocked			5 Year 2-hr blocked			5 Year Unblocked 9-hr		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Waterloo Rd (Western Mars Ck)	M1	0.0	1.4	1.4	0.0	1.4	1.4	0.2	2.2	2.4
M2 Motorway (Western Mars Ck)	M2	0.0	6.3	6.3	0.0	6.3	6.3	0.0	5.1	5.1
Busaco Rd Underpass	M3	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Mac Uni D/S Epping Rd (Mars Ck)	M4	6.5	0.0	6.5	6.5	0.0	6.5	3.0	0.0	3.0
Mac Uni U/S Waterloo Rd (Mars Ck)	M5	7.6	0.0	7.6	6.4	0.0	6.4	5.4	0.0	5.4
M2 Motorway (Mars Ck)	M5	0.0	15.5	15.5	0.0	15.3	15.3	0.0	10.4	10.4
Mac Uni D/S Epping Rd (Uni Ck)	M7	1.5	4.7	6.1	1.4	4.7	6.1	0.5	3.8	4.3
M2 Motorway (Uni Ck)	M8	0.0	9.1	9.1	0.0	10.0	10.0	0.0	7.4	7.4

Location	ID in Figure 10	20 Year 2-hr Unblocked			20 Year 2-hr blocked			20 Year blocked 9-hr		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Waterloo Rd (Western Mars Ck)	M1	0.6	2.7	3.4	0.6	2.7	3.3	0.5	2.6	3.1
M2 Motorway (Western Mars Ck)	M2	0.0	9.9	9.9	0.0	9.9	9.9	0.0	6.8	6.8
Busaco Rd Underpass	M3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1
Mac Uni D/S Epping Rd (Mars Ck)	M4	8.7	0.0	8.7	8.9	0.0	8.9	3.7	0.0	3.7
Mac Uni U/S Waterloo Rd (Mars Ck)	M5	10.9	0.0	10.9	8.3	0.0	8.3	6.8	0.0	6.8
M2 Motorway (Mars Ck)	M5	0.0	20.1	20.1	0.0	19.3	19.3	0.0	12.7	12.7
Mac Uni D/S Epping Rd (Uni Ck)	M7	4.6	5.0	9.6	4.6	5.0	9.6	0.6	4.4	5.0
M2 Motorway (Uni Ck)	M8	0.0	14.9	14.9	0.0	15.8	15.8	0.0	9.9	9.9

Location	ID in Figure 10	50 Year 2-hr Unblocked			50 Year 2-hr blocked			50 Year blocked 9-hr		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Waterloo Rd (Western Mars Ck)	M1	1.6	3.5	5.1	1.6	3.5	5.1	0.9	3.0	3.9
M2 Motorway (Western Mars Ck)	M2	0.0	11.5	11.5	0.0	11.5	11.5	0.0	8.0	8.0
Busaco Rd Underpass	M3	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Mac Uni D/S Epping Rd (Mars Ck)	M4	9.7	0.0	9.7	9.7	0.0	9.7	4.6	0.0	4.6
Mac Uni U/S Waterloo Rd (Mars Ck)	M5	12.3	0.0	12.3	11.3	0.0	11.3	7.8	0.0	7.8
M2 Motorway (Mars Ck)	M5	0.0	22.2	22.2	0.0	21.3	21.3	0.0	14.9	14.9
Mac Uni D/S Epping Rd (Uni Ck)	M7	6.3	5.0	11.3	6.3	5.0	11.3	1.7	4.7	6.4
M2 Motorway (Uni Ck)	M8	0.0	18.5	18.5	0.0	19.2	19.2	0.0	12.0	12.0

Location	ID in Figure 10	100 Year 2-hr Unblocked			100 Year 2-hr blocked			100 Year blocked 9-hr		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Waterloo Rd (Western Mars Ck)	M1	3.3	3.5	6.7	3.2	3.5	6.7	1.2	3.4	4.5
M2 Motorway (Western Mars Ck)	M2	0.0	13.3	13.3	0.0	13.3	13.3	0.0	9.3	9.3
Busaco Rd Underpass	M3	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1
Mac Uni D/S Epping Rd (Mars Ck)	M4	11.0	0.0	11.0	11.0	0.0	11.0	4.9	0.0	4.9
Mac Uni U/S Waterloo Rd (Mars Ck)	M5	13.0	0.0	13.0	14.4	0.0	14.4	10.5	0.0	10.5
M2 Motorway (Mars Ck)	M5	0.0	24.5	24.5	0.0	23.5	23.5	0.0	16.2	16.2
Mac Uni D/S Epping Rd (Uni Ck)	M7	7.9	5.1	13.0	7.9	5.1	13.0	2.7	4.8	7.5
M2 Motorway (Uni Ck)	M8	0.0	21.7	21.7	0.0	22.6	22.6	0.0	14.0	14.0

Location	ID in Figure 10	PMF15-min Unblocked			PMF 3-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Waterloo Rd (Western Mars Ck)	M1	26.4	3.6	29.7	7.8	3.5	11.2
M2 Motorway (Western Mars Ck)	M2	0.0	45.3	45.3	0.0	25.4	25.4
Busaco Rd Underpass	M3	7.9	0.0	7.9	0.1	0.0	0.1
Mac Uni D/S Epping Rd (Mars Ck)	M4	39.8	0.0	39.8	12.2	0.0	12.2
Mac Uni U/S Waterloo Rd (Mars Ck)	M5	86.9	0.0	86.9	38.6	0.0	38.6
M2 Motorway (Mars Ck)	M5	0.0	71.9	71.9	0.0	42.3	42.3
Mac Uni D/S Epping Rd (Uni Ck)	M7	48.5	5.2	53.5	16.7	5.2	21.9
M2 Motorway (Uni Ck)	M8	16.5	57.7	71.1	0.0	40.8	40.8

TABLE 12: Shrimptons Creek Catchment Flows (m3/s)

Location	ID in Figure 10	5 Year 2-hr Unblocked			5 Year 2-hr Blocked			5 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Richmond St	S1	1.2	1.3	2.5	1.2	1.3	2.5	0.1	1.2	1.3
Quarry Rd (D/S of Midway shops)	S2	2.4	2.9	5.3	2.5	2.9	5.4	0.7	2.1	2.8
North Rd	S3	2.7	1.0	3.7	2.7	1.0	3.7	0.7	0.9	1.5
Quarry Rd (U/S Santa Rosa Park)	S4	3.6	1.8	5.4	3.6	1.8	5.4	1.5	1.7	3.2
Santa Rosa Park North	S5	19.6	0.0	19.6	19.6	0.0	19.6	12.8	0.0	12.8
Bridge Rd	S6	0.7	24.3	24.4	0.5	24.3	24.4	0.2	16.5	16.6
Julie St	S7	25.3	0.0	25.3	25.3	0.0	25.3	17.7	0.0	17.7
Lucinda Rd (D/S of Footbridge)	S8	25.8	0.0	25.8	25.7	0.0	25.7	18.3	0.0	18.3
Kent Rd (Main Shrimpton Creek)	S9	26.8	0.0	26.8	26.8	0.0	26.8	19.4	0.0	19.4
Patricia St	S10	2.0	0.8	2.8	2.1	0.8	2.9	0.4	0.7	1.2
Abuklea Rd	S11	3.8	4.4	8.1	3.8	4.4	8.1	0.8	3.2	4.0
Kent Rd (West tributary near Kent Road PS)	S12	5.1	8.5	13.6	5.2	8.5	13.6	1.0	7.7	8.7
Lane Cove Golf Club (Immediate D/S of Twin Rd)	S13	1.8	0.0	1.8	1.9	0.0	1.9	0.7	0.0	0.7
Lane Cove Golf Club (Immediate U/S Lane Cove Rd)	S14	1.6	0.0	1.6	1.6	0.0	1.6	0.7	0.0	0.7
Eastview Ave	S15	3.4	6.1	9.5	3.5	6.1	9.5	0.5	5.4	5.9
Kent Rd (Near Gibb St interestion)	S16	1.5	1.4	3.0	1.5	1.4	3.0	0.5	1.1	1.6
Kent Rd (East tributary near Ada St intersection)	S17	12.1	0.0	12.1	12.1	0.0	12.1	8.2	0.0	8.2
Kent Rd (East Tributary)	S18	13.1	0.0	13.1	13.2	0.0	13.2	9.1	0.0	9.1
Epping Rd U/S	S19	57.5	0.0	57.5	57.8	0.0	57.8	42.5	0.0	42.5
Epping Rd D/S	S20	57.2	0.0	57.2	57.4	0.0	57.4	41.7	0.0	41.7
Waterloo Rd U/S	S21	61.8	0.0	61.8	59.8	0.0	59.8	48.3	0.0	48.3
Waterloo Rd D/S	S22	0.8	63.9	64.1	2.3	61.0	63.3	0.3	50.0	50.2
Talavera Rd D/S	S23	65.4	0.0	65.4	63.8	0.0	63.8	51.5	0.0	51.5
M2 Motorway (Shrimptons Ck)	S24	0.0	65.8	65.8	0.0	63.8	63.8	0.0	52.0	52.0

Location	ID in Figure 10	20 Year 2-hr Unblocked			20 Year 2-hr Blocked			20 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Richmond St	S1	2.1	1.3	3.4	2.2	1.3	3.6	0.5	1.2	1.7
Quarry Rd (D/S of Midway shops)	S2	4.5	3.2	7.6	4.6	3.2	7.8	1.4	2.4	3.8
North Rd	S3	4.9	1.1	6.0	4.9	1.1	6.0	2.2	1.0	3.2
Quarry Rd (U/S Santa Rosa Park)	S4	6.6	1.8	8.4	6.6	1.8	8.4	3.5	1.7	5.2
Santa Rosa Park North	S5	31.9	0.0	31.9	32.0	0.0	32.0	18.8	0.0	18.8
Bridge Rd	S6	0.8	34.7	34.8	0.9	34.7	34.8	0.2	23.5	23.6
Julie St	S7	35.7	0.0	35.7	35.7	0.0	35.7	25.0	0.0	25.0
Lucinda Rd (D/S of Footbridge)	S8	36.3	0.0	36.3	36.3	0.0	36.3	25.8	0.0	25.8
Kent Rd (Main Shrimpton Creek)	S9	38.3	0.0	38.3	38.2	0.0	38.2	27.6	0.0	27.6
Patricia St	S10	3.0	0.8	3.8	3.0	0.8	3.8	0.8	0.8	1.6
Abuklea Rd	S11	6.9	4.7	11.4	6.8	4.7	11.4	1.6	3.8	5.5
Kent Rd (West tributary near Kent Road PS)	S12	9.5	8.6	18.1	9.5	8.6	18.0	3.2	8.4	11.5
Lane Cove Golf Club (Immediate D/S of Twin Rd)	S13	2.4	0.0	2.4	2.4	0.0	2.4	1.0	0.0	1.0
Lane Cove Golf Club (Immediate U/S Lane Cove Rd)	S14	2.3	0.0	2.3	2.3	0.0	2.3	1.0	0.0	1.0
Eastview Ave	S15	8.2	6.3	14.5	8.2	6.3	14.4	2.3	5.9	8.3
Kent Rd (Near Gibb St interestion)	S16	2.9	1.4	4.3	2.9	1.4	4.3	0.9	1.3	2.1
Kent Rd (East tributary near Ada St intersection)	S17	19.0	0.0	19.0	19.1	0.0	19.1	11.7	0.0	11.7
Kent Rd (East Tributary)	S18	20.1	0.0	20.1	20.0	0.0	20.0	12.8	0.0	12.8
Epping Rd U/S	S19	81.8	0.0	81.8	81.6	0.0	81.6	58.4	0.0	58.4
Epping Rd D/S	S20	82.7	0.0	82.7	82.1	0.0	82.1	58.4	0.0	58.4
Waterloo Rd U/S	S21	85.8	0.0	85.8	85.5	0.0	85.5	65.3	0.0	65.3
Waterloo Rd D/S	S22	4.2	86.6	90.8	24.9	65.9	90.7	0.5	68.3	68.6
Talavera Rd D/S	S23	92.9	0.0	92.9	94.8	0.0	94.8	70.4	0.0	70.4
M2 Motorway (Shrimptons Ck)	S24	0.0	92.2	92.2	0.0	92.5	92.5	0.0	71.0	71.0

TABLE 12: Shrimptons Creek Catchment Flows (m3/s) - Cont'd

Location	ID in Figure 10	50 Year 2-hr Unblocked			50 Year 2-hr Blocked			50 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Richmond St	S1	2.8	1.4	4.2	2.8	1.4	4.2	0.7	1.3	2.0
Quarry Rd (D/S of Midway shops)	S2	6.3	3.2	9.4	6.3	3.2	9.4	1.8	2.6	4.3
North Rd	S3	5.8	1.1	6.9	5.9	1.1	6.9	2.1	1.0	3.1
Quarry Rd (U/S Santa Rosa Park)	S4	8.1	1.8	9.9	8.1	1.8	9.9	3.6	1.8	5.4
Santa Rosa Park North	S5	39.7	0.0	39.7	39.6	0.0	39.6	20.9	0.0	20.9
Bridge Rd	S6	1.2	40.8	40.9	1.2	40.8	40.9	0.2	26.0	26.1
Julie St	S7	41.9	0.0	41.9	41.9	0.0	41.9	27.7	0.0	27.7
Lucinda Rd (D/S of Footbridge)	S8	42.6	0.0	42.6	42.6	0.0	42.6	28.6	0.0	28.6
Kent Rd (Main Shrimpton Creek)	S9	45.3	0.0	45.3	45.1	0.0	45.1	30.9	0.0	30.9
Patricia St	S10	3.5	0.8	4.3	3.5	0.8	4.2	1.0	0.8	1.8
Abuklea Rd	S11	8.5	4.7	13.0	8.4	4.7	13.0	2.1	4.0	6.1
Kent Rd (West tributary near Kent Road PS)	S12	12.8	8.8	21.6	12.8	8.8	21.5	4.4	8.4	12.8
Lane Cove Golf Club (Immediate D/S of Twin Rd)	S13	2.6	0.0	2.6	2.6	0.0	2.6	1.3	0.0	1.3
Lane Cove Golf Club (Immediate U/S Lane Cove Rd)	S14	2.6	0.0	2.6	2.6	0.0	2.6	1.1	0.0	1.1
Eastview Ave	S15	10.1	6.3	16.5	10.6	6.3	16.9	3.3	6.0	9.4
Kent Rd (Near Gibb St interestion)	S16	3.5	1.4	4.9	3.5	1.4	5.0	1.0	1.4	2.4
Kent Rd (East tributary near Ada St intersection)	S17	22.8	0.0	22.8	22.8	0.0	22.8	13.5	0.0	13.5
Kent Rd (East Tributary)	S18	23.2	0.0	23.2	23.3	0.0	23.3	14.6	0.0	14.6
Epping Rd U/S	S19	95.8	0.0	95.8	95.6	0.0	95.6	65.8	0.0	65.8
Epping Rd D/S	S20	99.4	0.0	99.4	99.2	0.0	99.2	66.7	0.0	66.7
Waterloo Rd U/S	S21	101.6	0.0	101.6	101.1	0.0	101.1	73.1	0.0	73.1
Waterloo Rd D/S	S22	17.8	90.1	107.9	40.1	67.8	107.8	0.5	76.9	77.2
Talavera Rd D/S	S23	112.0	0.0	112.0	111.9	0.0	111.9	79.4	0.0	79.4
M2 Motorway (Shrimptons Ck)	S24	0.0	111.2	111.2	0.0	109.3	109.3	0.0	80.0	80.0

Location	ID in Figure 10	100 Year 2-hr Unblocked			100 Year 2-hr Blocked			100 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Richmond St	S1	3.4	1.4	4.8	3.1	1.4	4.5	1.0	1.3	2.3
Quarry Rd (D/S of Midway shops)	S2	7.2	3.2	10.4	7.3	3.2	10.4	2.5	2.8	5.2
North Rd	S3	6.3	1.1	7.4	6.3	1.1	7.4	2.6	1.0	3.6
Quarry Rd (U/S Santa Rosa Park)	S4	9.1	1.8	10.9	9.2	1.8	10.9	4.5	1.8	6.2
Santa Rosa Park North	S5	46.4	0.0	46.4	46.3	0.0	46.3	24.5	0.0	24.5
Bridge Rd	S6	1.3	46.2	46.4	1.1	46.2	46.3	0.3	29.8	29.9
Julie St	S7	47.7	0.0	47.7	46.9	0.0	46.9	31.5	0.0	31.5
Lucinda Rd (D/S of Footbridge)	S8	48.4	0.0	48.4	48.3	0.0	48.3	32.5	0.0	32.5
Kent Rd (Main Shrimpton Creek)	S9	51.4	0.0	51.4	51.3	0.0	51.3	35.1	0.0	35.1
Patricia St	S10	3.7	0.8	4.4	3.6	0.8	4.3	1.3	0.8	2.0
Abuklea Rd	S11	8.9	4.7	13.5	9.1	4.7	13.7	2.8	4.2	6.9
Kent Rd (West tributary near Kent Road PS)	S12	15.1	8.8	23.9	15.2	8.8	24.0	6.3	8.5	14.8
Lane Cove Golf Club (Immediate D/S of Twin Rd)	S13	2.8	0.0	2.8	2.8	0.0	2.8	1.2	0.0	1.2
Lane Cove Golf Club (Immediate U/S Lane Cove Rd)	S14	2.7	0.0	2.7	2.7	0.0	2.7	1.3	0.0	1.3
Eastview Ave	S15	7.7	6.3	13.9	7.8	6.2	14.0	4.5	6.1	10.5
Kent Rd (Near Gibb St interestion)	S16	3.7	1.4	5.2	3.8	1.4	5.2	1.3	1.4	2.7
Kent Rd (East tributary near Ada St intersection)	S17	20.6	0.0	20.6	20.6	0.0	20.6	15.5	0.0	15.5
Kent Rd (East Tributary)	S18	21.9	0.0	21.9	21.9	0.0	21.9	16.6	0.0	16.6
Epping Rd U/S	S19	104.2	0.0	104.2	103.8	0.0	103.8	74.4	0.0	74.4
Epping Rd D/S	S20	109.1	0.0	109.1	108.7	0.0	108.7	76.7	0.0	76.7
Waterloo Rd U/S	S21	111.9	0.0	111.9	111.3	0.0	111.3	81.9	0.0	81.9
Waterloo Rd D/S	S22	27.5	91.8	119.3	50.2	68.8	119.0	2.0	85.5	87.6
Talavera Rd D/S	S23	123.7	0.0	123.7	123.6	0.0	123.6	90.5	0.0	90.5
M2 Motorway (Shrimptons Ck)	S24	0.0	128.1	128.1	0.0	120.4	120.4	0.0	91.4	91.4

TABLE 12: Shrimptons Creek Catchment Flows (m3/s) - Cont'd

Location	ID in Figure 10	PMF 15-min Unblocked			PMF 3-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Richmond St	S1	18.7	1.7	20.3	4.5	1.4	5.9
Quarry Rd (D/S of Midway shops)	S2	50.6	3.2	53.6	15.2	3.2	18.3
North Rd	S3	32.0	1.3	33.3	9.1	1.1	10.2
Quarry Rd (U/S Santa Rosa Park)	S4	42.5	1.8	44.2	14.3	1.8	16.0
Santa Rosa Park North	S5	191.5	0.0	191.5	88.9	0.0	88.9
Bridge Rd	S6	117.5	76.7	173.4	7.9	79.1	82.8
Julie St	S7	171.3	0.0	171.3	87.6	0.0	87.6
Kent Rd (Main Shrimpton Creek)	S9	175.5	0.0	175.5	102.4	0.0	102.4
Patricia St	S10	18.4	0.8	19.2	4.7	0.8	5.5
Abuklea Rd	S11	52.7	5.3	57.6	13.2	4.7	17.9
Kent Rd (West tributary near Kent Road PS)	S12	92.1	9.0	101.1	30.5	8.9	39.4
Lane Cove Golf Club (Immediate D/S of Twin Rd)	S13	12.1	0.0	12.1	3.3	0.0	3.3
Lane Cove Golf Club (Immediate U/S Lane Cove Rd)	S14	11.6	0.0	11.6	3.2	0.0	3.2
Eastview Ave	S15	61.4	6.2	67.3	20.3	5.7	26.0
Kent Rd (Near Gibb St interestion)	S16	20.9	1.5	22.3	5.4	1.4	6.8
Kent Rd (East tributary near Ada St intersection)	S17	94.7	0.0	94.7	40.8	0.0	40.8
Kent Rd (East Tributary)	S18	82.9	0.0	82.9	37.5	0.0	37.5
Epping Rd U/S	S19	319.8	0.0	319.8	203.5	0.0	203.5
Epping Rd D/S	S20	343.4	0.0	343.4	223.8	0.0	223.8
Waterloo Rd U/S	S21	309.2	0.0	309.2	230.9	0.0	230.9
Waterloo Rd D/S	S22	230.1	95.4	325.5	159.9	90.6	250.6
Talavera Rd D/S	S23	327.3	0.0	327.3	262.1	0.0	262.1
M2 Motorway (Shrimptons Ck)	S24	0.0	311.5	311.5	0.0	255.8	255.8

TABLE 13: Industrial Creek Catchment Flows (m3/s)

Location	ID in Figure 10	5 Year 2-hr Unblocked			5 Year 2-hr Blocked			5 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Epping Rd (Industrial Ck)	I1	0.3	1.7	1.9	0.3	1.7	1.9	0.1	1.4	1.5
Waterloo Rd (Industrial Ck)	I2	2.7	3.8	5.9	2.7	3.8	5.9	0.5	3.3	3.8
M2 Motorway (Industrial Ck)	I3	4.2	7.0	11.2	4.5	7.0	11.4	0.8	6.4	7.2
Industrial Ck near Durham Close	I4	10.4	0.0	10.4	9.9	0.0	9.9	7.8	0.0	7.8
Flowpath near Fontenoy St	I5	5.8	0.0	5.8	5.5	0.0	5.5	2.8	0.0	2.8

Location	ID in Figure 10	20 Year 2-hr Unblocked			20 Year 2-hr Blocked			20 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Epping Rd (Industrial Ck)	I1	0.5	1.8	2.2	0.5	1.8	2.2	0.1	1.6	1.7
Waterloo Rd (Industrial Ck)	I2	4.5	3.8	7.3	4.5	3.8	7.3	1.2	3.6	4.6
M2 Motorway (Industrial Ck)	I3	7.6	7.0	14.6	7.6	7.0	14.6	2.7	6.8	9.5
Industrial Ck near Durham Close	I4	13.2	0.0	13.2	14.7	0.0	14.7	10.0	0.0	10.0
Flowpath near Fontenoy St	I5	7.8	0.0	7.8	7.1	0.0	7.1	4.4	0.0	4.4

Location	ID in Figure 10	50 Year 2-hr Unblocked			50 Year 2-hr Blocked			50 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Epping Rd (Industrial Ck)	I1	0.6	1.9	2.3	0.6	1.9	2.3	0.1	1.7	1.8
Waterloo Rd (Industrial Ck)	I2	5.4	3.9	7.9	5.4	3.9	7.9	1.8	3.7	5.0
M2 Motorway (Industrial Ck)	I3	8.7	7.0	15.8	8.9	7.0	15.9	3.4	6.9	10.3
Industrial Ck near Durham Close	I4	15.1	0.0	15.1	17.2	0.0	17.2	12.7	0.0	12.7
Flowpath near Fontenoy St	I5	6.4	0.0	6.4	6.3	0.0	6.3	2.8	0.0	2.8

Location	ID in Figure 10	100 Year 2-hr Unblocked			100 Year 2-hr Blocked			100 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Epping Rd (Industrial Ck)	I1	0.6	1.9	2.4	0.6	1.9	2.4	0.2	1.8	1.9
Waterloo Rd (Industrial Ck)	I2	6.6	3.9	9.0	6.6	3.9	9.1	2.5	3.8	5.5
M2 Motorway (Industrial Ck)	I3	10.5	7.1	17.5	10.5	7.1	17.5	4.2	7.0	11.2
Industrial Ck near Durham Close	I4	17.9	0.0	17.9	19.5	0.0	19.5	14.2	0.0	14.2
Flowpath near Fontenoy St	I5	7.0	0.0	7.0	7.0	0.0	7.0	3.2	0.0	3.2

Location	ID in Figure 10	PMF 15-min Unblocked			PMF 3-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Epping Rd (Industrial Ck)	I1	3.0	2.4	5.0	3.6	2.3	5.8
Waterloo Rd (Industrial Ck)	I2	26.2	3.3	27.8	11.1	4.1	13.1
M2 Motorway (Industrial Ck)	I3	49.2	7.2	56.4	21.0	7.1	28.0
Industrial Ck near Durham Close	I4	61.4	0.0	61.4	31.5	0.0	31.5
Flowpath near Fontenoy St	I5	27.4	0.0	27.4	8.0	0.0	8.0

TABLE 14: Porters Creek Catchment Flows (m3/s)

Location	ID In Figure 10	5 Year 2-hr Unblocked			5 Year 2-hr Blocked			5 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Avon Rd & Wick Rd (Porters Ck)	P1	1.9	2.4	4.3	1.9	2.4	4.3	0.5	1.6	2.1
Hendry Pde (Porters Ck)	P2	1.2	1.0	2.3	1.2	1.0	2.3	0.5	1.0	1.5
Epping Rd (Porters Ck)	P3	8.7	4.8	13.5	8.7	4.8	13.5	4.0	4.6	8.6
M2 Motorway (Porters Ck)	P4	0.1	29.6	29.7	0.1	30.3	30.3	0.0	19.0	19.0

Location	ID In Figure 10	20 Year 2-hr Unblocked			20 Year 2-hr Blocked			20 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Avon Rd & Wick Rd (Porters Ck)	P1	3.5	2.6	6.1	3.6	2.6	6.1	1.0	1.9	2.9
Hendry Pde (Porters Ck)	P2	3.0	1.0	4.0	2.9	1.0	4.0	1.1	1.0	2.1
Epping Rd (Porters Ck)	P3	14.5	5.0	19.5	14.4	5.0	19.4	7.1	4.7	11.8
M2 Motorway (Porters Ck)	P4	0.1	36.3	36.4	0.1	35.8	35.9	0.0	23.6	23.6

Location	ID In Figure 10	50 Year 2-hr Unblocked			50 Year 2-hr Blocked			50 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Avon Rd & Wick Rd (Porters Ck)	P1	4.4	2.6	7.1	4.3	2.6	7.0	1.2	2.1	3.3
Hendry Pde (Porters Ck)	P2	3.6	1.0	4.6	3.6	1.0	4.6	1.3	1.0	2.4
Epping Rd (Porters Ck)	P3	17.5	5.0	22.4	17.4	5.0	22.4	8.7	4.8	13.5
M2 Motorway (Porters Ck)	P4	0.2	38.7	38.9	0.2	37.7	37.8	0.0	26.8	26.8

Location	ID In Figure 10	100 Year 2-hr Unblocked			100 Year 2-hr Blocked			100 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Avon Rd & Wick Rd (Porters Ck)	P1	5.1	2.7	7.8	5.4	2.7	8.1	1.5	2.2	3.7
Hendry Pde (Porters Ck)	P2	4.2	1.0	5.2	4.2	1.0	5.2	1.6	1.0	2.7
Epping Rd (Porters Ck)	P3	20.6	5.0	25.7	20.6	5.0	25.6	10.7	4.9	15.5
M2 Motorway (Porters Ck)	P4	0.2	41.3	41.3	0.2	40.0	40.0	0.0	31.2	31.2

Location	ID In Figure 10	PMF 15-min Unblocked			PMF 3-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Avon Rd & Wick Rd (Porters Ck)	P1	29.9	3.2	33.1	7.1	2.8	9.9
Hendry Pde (Porters Ck)	P2	18.6	1.0	19.6	5.8	1.0	6.8
Epping Rd (Porters Ck)	P3	89.0	5.2	93.2	35.4	5.3	40.4

TABLE 15: Lane Cove Catchment Flows (m3/s)

Location	ID in Figure 10	5 Year 2-hr Unblocked			5 Year 2-hr Blocked			5 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Plassey Rd	L1	3.6	0.0	3.6	3.6	0.0	3.6	1.6	0.0	1.6
Gilda St	L2	4.8	0.0	4.8	3.7	0.0	3.7	3.1	0.0	3.1
LCR1	L3	7.5	0.0	7.5	7.5	0.0	7.5	1.4	0.0	1.4

Location	ID in Figure 10	20 Year 2-hr Unblocked			20 Year 2-hr Blocked			20 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Plassey Rd	L1	4.6	0.0	4.6	4.6	0.0	4.6	2.3	0.0	2.3
Gilda St	L2	7.2	0.0	7.2	5.6	0.0	5.6	4.1	0.0	4.1
LCR1	L3	4.3	0.0	4.3	4.3	0.0	4.3	1.8	0.0	1.8

Location	ID in Figure 10	50 Year 2-hr Unblocked			50 Year 2-hr Blocked			50 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Plassey Rd	L1	5.4	0.0	5.4	5.4	0.0	5.4	2.6	0.0	2.6
Gilda St	L2	8.1	0.0	8.1	6.6	0.0	6.6	4.9	0.0	4.9
LCR1	L3	5.0	0.0	5.0	5.0	0.0	5.0	2.5	0.0	2.5

Location	ID in Figure 10	100 Year 2-hr Unblocked			100 Year 2-hr Blocked			100 Year 9-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Plassey Rd	L1	6.2	0.0	6.2	6.2	0.0	6.2	2.9	0.0	2.9
Gilda St	L2	9.2	0.0	9.2	7.5	0.0	7.5	5.8	0.0	5.8
LCR1	L3	5.7	0.0	5.7	5.7	0.0	5.7	2.4	0.0	2.4

Location	ID in Figure 10	PMF 15-min Unblocked			PMF 3-hr Unblocked		
		Creek + Overland Flow	Conduit Flow	Total Flow	Creek + Overland Flow	Conduit Flow	Total Flow
Plassey Rd	L1	23.9	0.0	23.9	7.1	0.0	7.1
Gilda St	L2	38.0	0.0	38.0	14.6	0.0	14.6
LCR1	L3	18.7	0.0	18.7	6.3	0.0	6.3