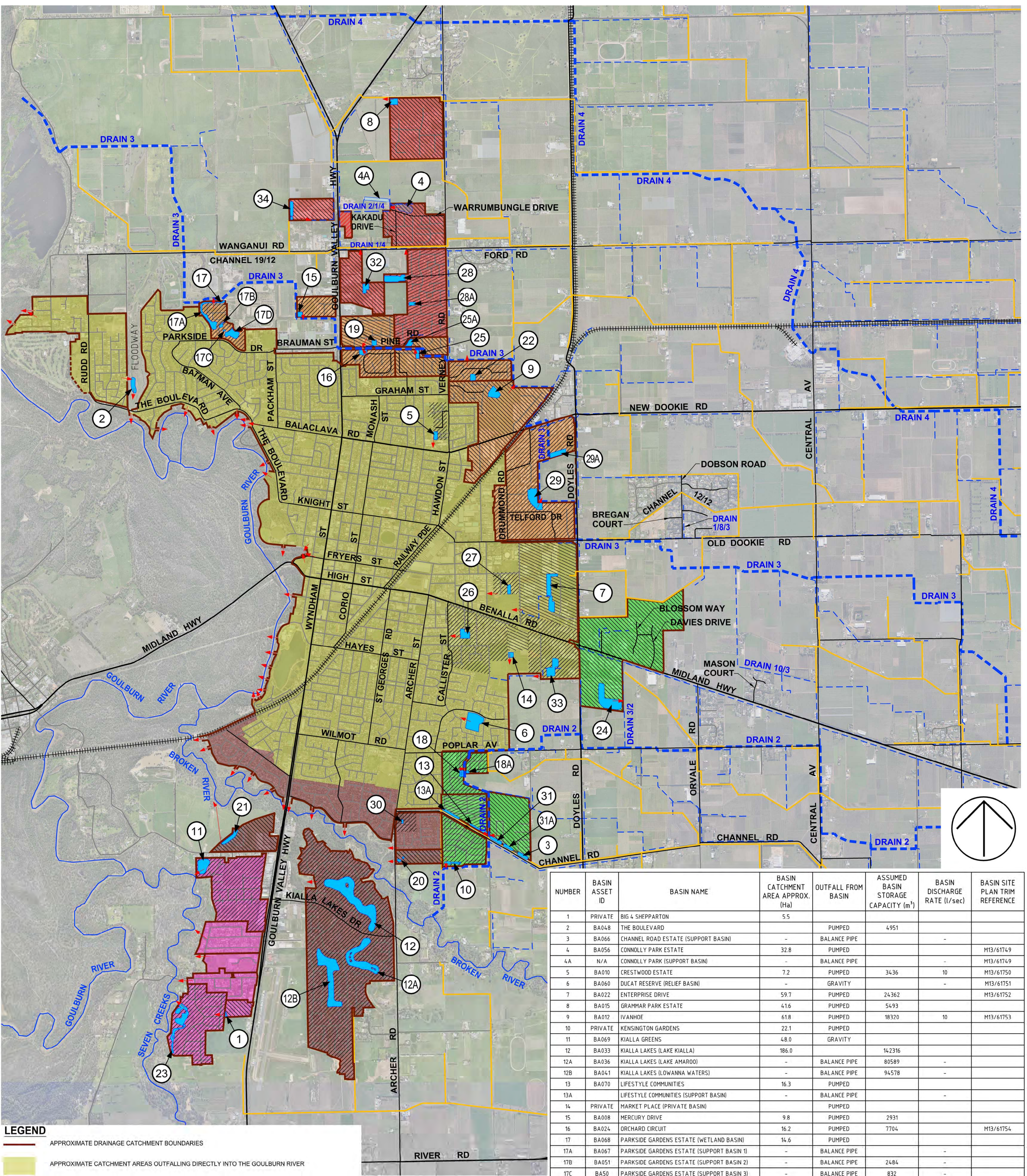


Appendix A Shepparton Retarding Basins – Locality Plan



LEGEND

APPROXIMATE DRAINAGE CATCHMENT BOUNDARIES

APPROXIMATE CATCHMENT AREAS OUTFALLING DIRECTLY INTO THE GOULBURN RIVER

APPROXIMATE CATCHMENT AREAS OUTFALLING DIRECTLY INTO THE BROKEN RIVER

APPROXIMATE CATCHMENT AREAS OUTFALLING DIRECTLY INTO THE SEVEN CREEKS

APPROXIMATE AREAS SERVED BY RETARDATION BASINS

APPROXIMATE CATCHMENT AREAS OUTFALLING INTO THE GOULBURN MURRAY WATER DRAIN 2 SYSTEM

APPROXIMATE CATCHMENT AREAS OUTFALLING INTO THE GOULBURN MURRAY WATER DRAIN 3 SYSTEM

APPROXIMATE CATCHMENT AREAS OUTFALLING INTO THE GOULBURN MURRAY WATER DRAIN 4 SYSTEM

APPROXIMATE CATCHMENT OUTFALL LOCATION

DRAINAGE RETARDATION BASIN

1

RETARDATION BASIN INDEX NUMBER

GOULBURN MURRAY WATER DRAIN

GOULBURN MURRAY WATER CHANNEL

RAILWAY LINE

RIVER

NUMBER	BASIN ASSET ID	BASIN NAME	BASIN CATCHMENT AREA APPROX. (Ha)	OUTFALL FROM BASIN	ASSUMED BASIN STORAGE CAPACITY (m³)	BASIN DISCHARGE RATE (l/sec)	BASIN SITE PLAN TRIM REFERENCE
1	PRIVATE	BIG 4 SHEPPARTON	5.5				
2	BA048	THE BOULEVARD		PUMPED	4951		
3	BA066	CHANNEL ROAD ESTATE (SUPPORT BASIN)	-	BALANCE PIPE		-	
4	BA056	CONNOLLY PARK ESTATE	32.8	PUMPED			M13/61749
4A	N/A	CONNOLLY PARK (SUPPORT BASIN)	-	BALANCE PIPE		-	M13/61749
5	BA010	CRESTWOOD ESTATE	7.2	PUMPED	3436	10	M13/61750
6	BA060	DUCAT RESERVE (RELIEF BASIN)	-	GRAVITY		-	M13/61751
7	BA022	ENTERPRISE DRIVE	59.7	PUMPED	24362		M13/61752
8	BA015	GRAMMAR PARK ESTATE	41.6	PUMPED	5493		
9	BA012	IVANHOE	61.8	PUMPED	18320	10	M13/61753
10	PRIVATE	KENSINGTON GARDENS	22.1	PUMPED			
11	BA069	KIALLA GREENS	48.0	GRAVITY			
12	BA033	KIALLA LAKES (LAKE KIALLA)	186.0		142316		
12A	BA036	KIALLA LAKES (LAKE AMAROO)	-	BALANCE PIPE	80589	-	
12B	BA041	KIALLA LAKES (LOWANNA WATERS)	-	BALANCE PIPE	94578	-	
13	BA070	LIFESTYLE COMMUNITIES	16.3	PUMPED			
13A		LIFESTYLE COMMUNITIES (SUPPORT BASIN)	-	BALANCE PIPE		-	
14	PRIVATE	MARKET PLACE (PRIVATE BASIN)		PUMPED			
15	BA008	MERCURY DRIVE	9.8	PUMPED	2931		
16	BA024	ORCHARD CIRCUIT	16.2	PUMPED	7704		M13/61754
17	BA068	PARKSIDE GARDENS ESTATE (WETLAND BASIN)	14.6	PUMPED			
17A	BA067	PARKSIDE GARDENS ESTATE (SUPPORT BASIN 1)	-	BALANCE PIPE		-	
17B	BA051	PARKSIDE GARDENS ESTATE (SUPPORT BASIN 2)	-	BALANCE PIPE	2484		
17C	BA050	PARKSIDE GARDENS ESTATE (SUPPORT BASIN 3)	-	BALANCE PIPE	832	-	
17D	BA049	PARKSIDE GARDENS ESTATE (SUPPORT BASIN 4)	-	BALANCE PIPE	16435	-	
18	BA023	PERRIVALE	18.6	PUMPED	3992		M13/61755
18A	BA062	PERRIVALE (SUPPORT BASIN)	-	BALANCE PIPE		-	M13/61755
19	BA021	PINE PARK ESTATE	21.7	PUMPED	5601		M13/61754
20	BA064	RIVER RISE ESTATE	8.3				
21	BA046	RIVERVIEW ESTATE	19.5	PUMPED	9052		
22	BA017	ROSS ALAN DRIVE	16.1	PUMPED	6575		M13/61753
23	BA013	SEVEN CREEKS ESTATE	39.9		26939		
24	BA059	SHEPPARTON EAST DRAINAGE SCHEME	93.8	PUMPED			M13/61756
25	BA058	SHERBOURNE ESTATE	22.5	PUMPED			M13/61757
25A	BA057	SHERBOURNE ESTATE (SUPPORT BASIN)	-	BALANCE PIPE		-	M13/61757
26	BA063	SMY THE STREET	42.9	GRAVITY			M13/61758
27	BA018	SOFRA DRIVE	7.2	PUMPED	8175		M13/61759
28	BA005	SOUTHDOWN ESTATE	51.7	PUMPED	16943		M13/61760
28A	BA006	SOUTHDOWN ESTATE (SUPPORT BASIN)	-	BALANCE PIPE	4239	-	M13/61760
29	BA016	TELFORD DRIVE	85.8	PUMPED	19904		M13/61761
29A	BA061	TELFORD DRIVE (SUPPORT BASIN)	-	BALANCE PIPE	UNKNOWN	-	M13/61761
30	PRIVATE	VISION AUSTRALIA (PRIVATE BASIN)	4.7				
31	BA047	WINSOR PARK ESTATE	28.0	PUMPED	3884		
31A	BA065	WINDSOR PARK ESTATE (SUPPORT BASIN 1)	-	BALANCE PIPE		-	
32	BA007	YAKKA ESTATE	22.1	PUMPED	5840		M13/61762
33	BA025	ZURCAS LANE	36.5	PUMPED	11104		M13/61763
34	PRIVATE	405 GOULBURN VALLEY HIGHWAY (PRIVATE BASIN)	12.2	PUMPED	8784	10.1	

Appendix B Time of Concentration Calculations

Time of Concentration Calculations



M8415 Shepparton East
Time of Concentration Calculation Sheet
MAIN DRAIN 2

Parameters

Gravity = 9.81 g
 K_s (m) = 0.0015 K_s
 Viscosity (m^2/s) = 1.13E-06 $v @ 15$ degrees Celsius

Overland Flow	Length (m)	Preliminary Tuflow Results	
		Velocity (m/s)	Time (mins)
Top of catchment	3122.0	0.8*	64.7
Drain_219	187.7	1.0	3.1
Drain_220	157.3	1.0	2.6
Drain_221	148.7	1.1	2.2
Drain_213	14.7	0.9	0.3
Drain_214	101.9	1.0	1.6
Drain_215	82.8	1.2	1.1
Drain_216	203.0	0.8	4.1
Drain_217	209.4	0.7	4.7
Drain_218	200.6	0.7	4.9
Drain_209	159.0	0.6	4.4
Drain_210	127.7	0.7	3.1
Drain_211	199.8	0.6	5.4
Drain_212	211.7	0.6	6.0
Drain_80	144.4	0.6	3.7
Drain_81	144.9	0.8	3.1
Drain_76	42.2	0.7	1.0
Drain_77	90.7	0.7	2.3
Drain_78	196.4	0.7	4.9
Drain_79	179.9	0.7	4.5
Drain_53	182.8	0.7	4.2
Drain_54	186.3	0.7	4.4
Drain_55	210.7	0.7	5.1
Drain_56	211.2	0.6	5.7
Drain_57	217.2	0.6	6.0
Drain_58	166.9	0.6	4.4
Drain_59	164.2	0.7	3.9
Drain_50	71.3	0.6	1.9
Drain_51	199.8	0.5	6.1
Drain_52	159.6	0.4	6.4
Drain_47	198.7	0.4	7.8
Drain_49	40.0	1.0	0.7
Drain_48	142.3	1.0	2.4
Drain_43	199.7	0.9	3.6
Drain_44	200.0	0.9	3.6

* average of other velocities

Time of Concentration Calculations

Drain_45	180.7	0.9	3.2
Drain_46	54.4	1.6	0.6
Drain_29	8.5	2.3	0.1
Drain_20	207.4	0.8	4.1
Drain_21	193.7	0.8	3.9
Drain_22	172.2	0.8	3.6
Drain_23	65.1	0.7	1.7
Drain_24	80.6	0.8	1.6
Drain_25	104.4	0.8	2.2
Drain_26	93.6	0.9	1.6
Drain_27	230.0	0.6	6.1
Drain_19	37.2	0.7	0.9
Drain_18	32.2	0.9	0.6
Drain_17	135.0	0.6	3.8
Drain_9	4.2	1.6	0.0
Drain_10	8.5	1.6	0.1
Drain_11	197.6	0.7	4.5
Drain_12	203.3	0.7	4.9
Drain_13	232.3	0.4	9.1
Drain_14	151.8	0.6	4.2
Drain_15	149.8	0.6	4.0
Drain_16	173.8	0.6	4.9
Drain_7	13.7	0.6	0.4
Drain_8	32.4	0.6	0.9
Drain_1	16.4	0.7	0.4
Drain_3	125.1	0.6	3.3
Drain_2	151.1	0.7	3.9
Drain_4	191.0	0.6	5.0
Drain_5	190.3	0.6	5.1
Drain_6	124.3	0.8	2.8
Drain_241	462.4	1.2	6.3
Total	12499		287

Time of Concentration Calculations



M8415 Shepparton East
Time of Concentration Calculation Sheet
MAIN DRAIN 3

Parameters

Gravity = 9.81 g
 K_s (m) = 0.0015 K_s
 Viscosity (m²/s) = 1.13E-06 ν @ 15 degrees Celsius

Overland Flow	Length (m)	Preliminary Tuflow Results	
		Velocity (m/s)	Time (mins)
Top of Catchment	5060.0	0.9*	94.5
Drain_169	634.1	0.8	13.9
Drain_167	33.9	1.9	0.3
Drain_166	365.6	1.2	5.1
Drain_165	445.9	1.0	7.7
Drain_163	69.5	1.1	1.1
Drain_164	8.2	1.5	0.1
Drain_162	65.2	1.0	1.1
Drain_160	302.1	0.7	7.1
Drain_159	203.3	0.6	5.9
Drain_158	116.7	0.5	3.8
Drain_157	76.0	0.6	2.2
Drain_156	136.6	0.5	4.7
Drain_154	66.9	0.5	2.4
Drain_155	37.3	0.5	1.3
Drain_153	102.7	0.6	3.1
Drain_152	45.0	0.6	1.2
Drain_151	35.5	0.7	0.9
Drain_150	15.1	0.7	0.4
Drain_149	79.0	0.6	2.1
Drain_144	178.5	0.8	3.8
Drain_143	38.5	0.9	0.7
Drain_142	209.9	0.8	4.6
Drain_141	292.0	0.9	5.1
Drain_132	8.2	1.7	0.1
Drain_206	6.6	1.6	0.1
Drain_130	407.2	0.6	11.0
Drain_129	439.9	0.6	12.8
Drain_125	195.5	0.6	5.7
Drain_126	204.8	0.6	5.9
Drain_124	124.5	0.6	3.4
Drain_127	196.7	0.6	5.1
Drain_128	204.2	0.7	4.6
Drain_123	143.1	0.9	2.8
Drain_121	74.2	0.7	1.8
Drain_119	4.0	0.6	0.1

* average of other velocities

Time of Concentration Calculations

Drain_118	56.4	0.8	1.3
Drain_207	233.0	0.7	5.4
Drain_208	250.0	0.7	6.2
Drain_101	80.5	0.9	1.4
Drain_100	366.0	0.7	8.6
Drain_99	308.7	0.7	7.1
Drain_98	243.5	0.8	5.3
Drain_97	227.5	0.8	4.8
Drain_96	243.9	0.8	5.2
Drain_95	55.9	0.8	1.1
Drain_94	190.6	0.7	4.3
Drain_91	71.6	0.7	1.7
Drain_92	72.6	0.8	1.5
Drain_93	61.4	1.0	1.1
Drain_88	2.1	2.1	0.0
Drain_87	2.6	1.9	0.0
Drain_90	266.2	0.8	5.5
Drain_89	249.6	0.8	5.1
Drain_82	7.9	0.9	0.2
Drain_83	6.1	1.2	0.1
Drain_84	6.3	1.5	0.1
Drain_85	254.8	1.0	4.4
Drain_86	29.3	2.0	0.2
Total	13913		296

IFD Table

Appendix C IFD Table

Duration		Design Rainfalls for Average Recurrence Intervals (Years)						
		1	2	5	10	20	50	100
(min)	(hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)
5	0.083	51.00	67.00	91.00	106.00	126.00	154.00	176.00
5.5	0.092	49.10	65.00	88.00	102.00	122.00	148.00	169.00
6	0.100	47.50	63.00	85.00	99.00	117.00	143.00	163.00
6.5	0.108	46.10	61.00	82.00	96.00	114.00	138.00	158.00
7	0.117	44.80	59.00	80.00	93.00	110.00	134.00	153.00
7.5	0.125	43.50	57.00	77.00	90.00	107.00	130.00	148.00
8	0.133	42.40	56.00	75.00	88.00	104.00	126.00	144.00
8.5	0.142	41.30	54.00	73.00	85.00	101.00	123.00	140.00
9	0.150	40.40	53.00	72.00	83.00	99.00	120.00	137.00
9.5	0.158	39.40	52.00	70.00	81.00	96.00	117.00	133.00
10	0.167	38.60	51.00	68.00	79.00	94.00	114.00	130.00
11	0.183	37.00	48.60	65.00	76.00	90.00	109.00	124.00
12	0.200	35.50	46.70	63.00	73.00	86.00	105.00	119.00
13	0.217	34.20	45.00	60.00	70.00	83.00	100.00	114.00
14	0.233	33.10	43.40	58.00	68.00	80.00	97.00	110.00
15	0.250	32.00	42.00	56.00	65.00	77.00	93.00	106.00
16	0.267	31.00	40.70	54.00	63.00	75.00	90.00	103.00
17	0.283	30.10	39.50	53.00	61.00	72.00	87.00	99.00
18	0.300	29.20	38.40	51.00	59.00	70.00	85.00	96.00
19	0.317	28.50	37.30	49.80	58.00	68.00	82.00	94.00
20	0.333	27.70	36.30	48.50	56.00	66.00	80.00	91.00
21	0.350	27.00	35.40	47.20	55.00	64.00	78.00	89.00
22	0.367	26.40	34.60	46.10	53.00	63.00	76.00	86.00
23	0.383	25.80	33.80	45.00	52.00	61.00	74.00	84.00
24	0.400	25.20	33.00	43.90	51.00	60.00	72.00	82.00
25	0.417	24.70	32.30	43.00	49.70	58.00	71.00	80.00
26	0.433	24.10	31.60	42.00	48.60	57.00	69.00	78.00
27	0.450	23.70	31.00	41.10	47.50	56.00	67.00	77.00
28	0.467	23.20	30.40	40.30	46.60	55.00	66.00	75.00
29	0.483	22.80	29.80	39.50	45.60	54.00	65.00	73.00
30	0.500	22.30	29.20	38.80	44.80	53.00	63.00	72.00
32	0.533	21.60	28.20	37.40	43.10	51.00	61.00	69.00
34	0.567	20.80	27.20	36.10	41.60	48.90	59.00	67.00
36	0.600	20.20	26.40	34.90	40.20	47.20	57.00	64.00
38	0.633	19.60	25.60	33.80	38.90	45.70	55.00	62.00
40	0.667	19.00	24.80	32.80	37.80	44.30	53.00	60.00
45	0.750	17.80	23.20	30.50	35.20	41.20	49.50	56.00
50	0.833	16.70	21.80	28.70	32.90	38.60	46.30	52.00
55	0.917	15.80	20.60	27.00	31.10	36.40	43.60	49.30
60	1.00	15.00	19.50	25.60	29.40	34.40	41.20	46.60
75	1.25	12.90	16.80	22.00	25.20	29.50	35.30	39.90
90	1.50	11.40	14.80	19.40	22.20	25.90	31.00	35.00
105	1.75	10.30	13.30	17.40	19.90	23.30	27.80	31.30
120	2.00	9.35	12.20	15.80	18.10	21.10	25.20	28.50

IFD Table

Duration		Design Rainfalls for Average Recurrence Intervals (Years)						
		1	2	5	10	20	50	100
(min)	(hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)
135	2.25	8.62	11.20	14.60	16.70	19.40	23.20	26.10
150	2.50	8.01	10.40	13.50	15.40	18.00	21.50	24.20
165	2.75	7.50	9.73	12.60	14.40	16.80	20.00	22.60
180	3.00	7.06	9.15	11.90	13.60	15.80	18.80	21.20
195	3.25	6.67	8.65	11.20	12.80	14.90	17.70	20.00
210	3.50	6.34	8.21	10.60	12.10	14.10	16.80	18.90
225	3.75	6.04	7.82	10.10	11.50	13.40	16.00	18.00
240	4.0	5.77	7.48	9.68	11.00	12.80	15.20	17.10
270	4.5	5.32	6.88	8.90	10.10	11.80	14.00	15.70
300	5	4.94	6.39	8.25	9.39	10.90	13.00	14.60
360	6	4.35	5.63	7.25	8.24	9.56	11.30	12.70
420	7	3.91	5.05	6.50	7.38	8.56	10.10	11.40
480	8	3.56	4.60	5.91	6.71	7.77	9.21	10.30
540	9	3.28	4.24	5.44	6.16	7.14	8.45	9.48
600	10	3.05	3.94	5.04	5.72	6.62	7.83	8.78
660	11	2.85	3.68	4.72	5.34	6.18	7.31	8.19
720	12	2.69	3.47	4.43	5.02	5.81	6.86	7.69
840	14	2.41	3.11	3.98	4.51	5.22	6.18	6.93
960	16	2.19	2.82	3.63	4.11	4.77	5.64	6.33
1080	18	2.01	2.60	3.34	3.79	4.39	5.21	5.84
1200	20	1.86	2.41	3.10	3.52	4.08	4.84	5.44
1320	22	1.74	2.25	2.90	3.29	3.82	4.54	5.09
1440	24	1.63	2.11	2.72	3.10	3.60	4.27	4.80
1800	30	1.38	1.79	2.32	2.64	3.07	3.65	4.11
2160	36	1.20	1.56	2.03	2.31	2.69	3.20	3.60
2520	42	1.07	1.39	1.80	2.06	2.40	2.86	3.22
2880	48	0.96	1.25	1.63	1.86	2.17	2.59	2.91
3240	54	0.87	1.14	1.48	1.69	1.98	2.36	2.66
3600	60	0.80	1.04	1.36	1.56	1.82	2.17	2.45
3960	66	0.74	0.96	1.26	1.44	1.68	2.01	2.27
4320	72	0.68	0.89	1.17	1.34	1.56	1.87	2.12

Appendix D PMF Summary Worksheet

GSDM WORKSHEET

LOCATION INFORMATION				
Catchment:	Shepparton East	Area:	49.333 km ²	
State:	VIC	Duration Limit:	3 hours	
Latitude:	36.38336° S	Longitude:	145.4° E	
Portion of Area Considered:				
Smooth, S =	1	Rough, R =	0	
ELEVATION ADJUSTMENT FACTOR (EAF)				
Mean Elevation: 114.622 mAHD				
Adjustment for Elevation (-0.05 per 300m above 1500m): 0.00				
EAF = 1.00				
GSDM MOISTURE ADJUSTMENT FACTOR (MAF)				
GSDM MAF = 0.59				
PMP VALUES (mm)				
Duration (hours)	Initial Depth - Smooth (D _s)	Initial Depth - Rough (D _R)	PMP Estimate = (D _s HS + D _R HR) H MAF H EAF	Rounded PMP Estimate (nearest 10 mm)
0.25	183	183	108	110
0.5	269	269	159	160
0.75	341	341	201	200
1	408	408	241	240
1.5	466	525	275	280
2	525	607	310	310
2.5	560	680	330	330
3	590	736	348	350
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0

Prepared by: TC
Checked by: TC

Date: 20/11/2012
Date: 20/11/2012

GSAM WORKSHEET

LOCATION INFORMATION				
Catchment:	Shepparton East			State: VIC
GSAM zone:	Inland	Area:	49.333	km ²
CATCHMENTS FACTOR				
Topographical Adjustment Factor		TAF =	1.183	(1.0 - 2.0)
Season	EPW _{seasonal catchment average}	EPW _{seasonal standard}	MAF	
Summer (Annual)	62.155	80.80	0.77 (0.60 - 1.05)	
Autumn	50.331	71.00	0.71 (0.56 - 0.91)	
PMP values (mm)	Summer		Autumn	
Duration (hours)	Initial Depth (D _{summer})	PMP Estimate (D _s × TAF × MAF _s)	Initial Depth (D _{autumn})	PMP Estimate (D _a × TAF × MAF _a)
24	463	421	658	552
36	494	450	756	634
48	514	468	810	679
72	557	507	857	718
96	582	530	872	731
FINAL PMP VALUES (mm)				
Duration (hours)	<u>Maximum</u> of the Seasonal Depths		Rounded PMP Estimate (nearest 10 mm)	Final PMP Estimate (from envelope)
24	552		550	550
36	634		630	630
48	679		680	680
72	718		720	720
96	N/A		N/A	N/A

Prepared by: TC
Checked by: TC

Date: 21/11/2012
Date: 21/11/2012