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The Influence of Particle Size on the Nature and Transport of Sediments and Associated Pollutants in Urban Stormwater Drainage

Volume II of II
Figures, Tables and Program Code

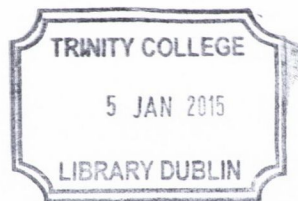
Presented in fulfilment of
the requirements for the degree of
Doctor of Philosophy

By

David Thomas Morgan

October 2014

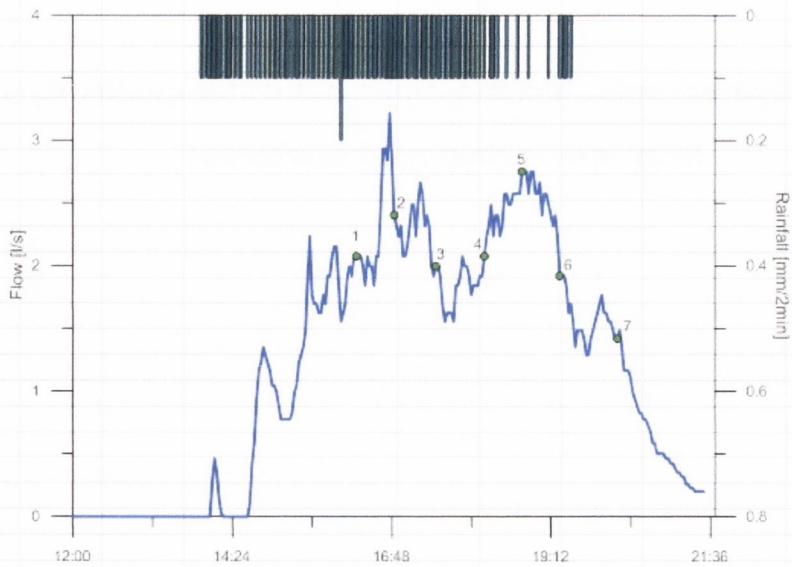
Department of Civil, Structural and Environmental Engineering,
University of Dublin,
Trinity College



Thesis 10841.2

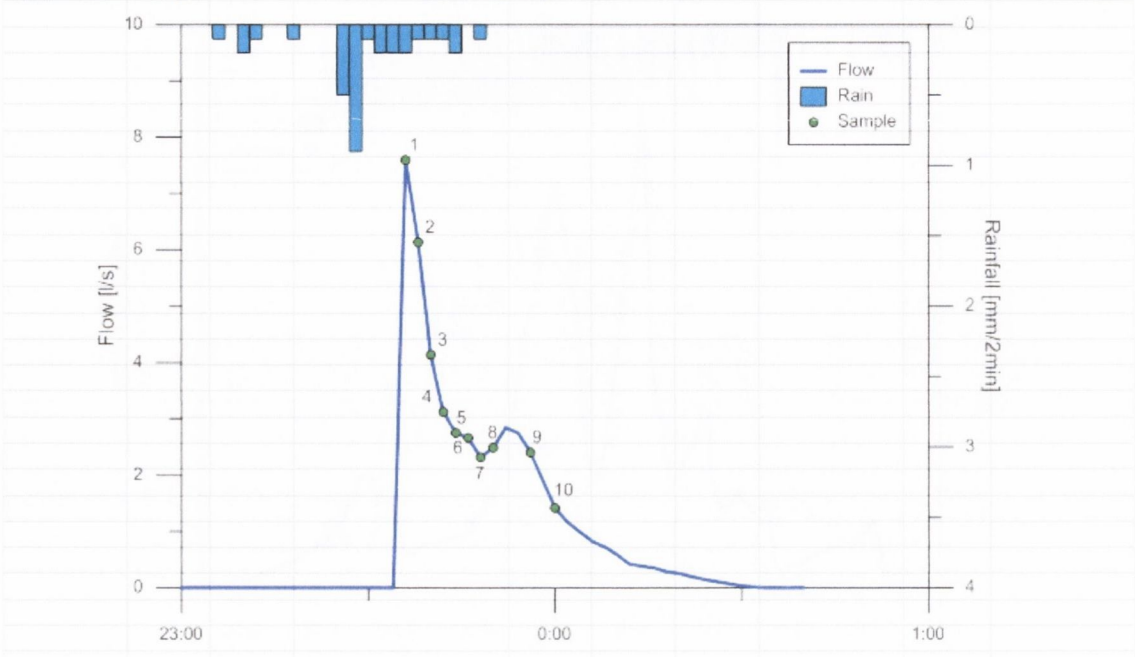
Appendices		Page
Appendix A	Hydrographs, pollutographs and water quality data for the Bray inter-urban road catchment.....	3
Appendix B	Hydrographs, pollutographs and water quality data for the Kimmage residential catchment.....	9
Appendix C	Matlab code for SWMM runoff auto-calibration tool.....	85
Appendix D	SWMM input file for Kimmage runoff model.....	97
Appendix E	Matlab code for build-up and washoff model.....	113

**Appendix A: Hydrographs, pollutographs and water quality data for the
Bray inter-urban road catchment**



Rainfall	9.8 mm	Rainfall duration	334 minutes	Analysis			
Runoff	41 m3	Av rain intensity	1.8 mm/hr	Event mean SSC and heavy metals			
DCIA	3000 m2	Peak 10min rain intensity	3.6 mm/hr				
Runoff Coeff	1.4	Flow duration	446 minutes	Prev rain	21/02/2010 12:18	Flow start	23/02/2010 14:04
ADP	2.1 days	Average flow	1.2 l/s	Rain start	23/02/2010 13:56	Flow end	23/02/2010 21:30
		Peak flow	3.2 l/s	Rain end	23/02/2010 19:30		

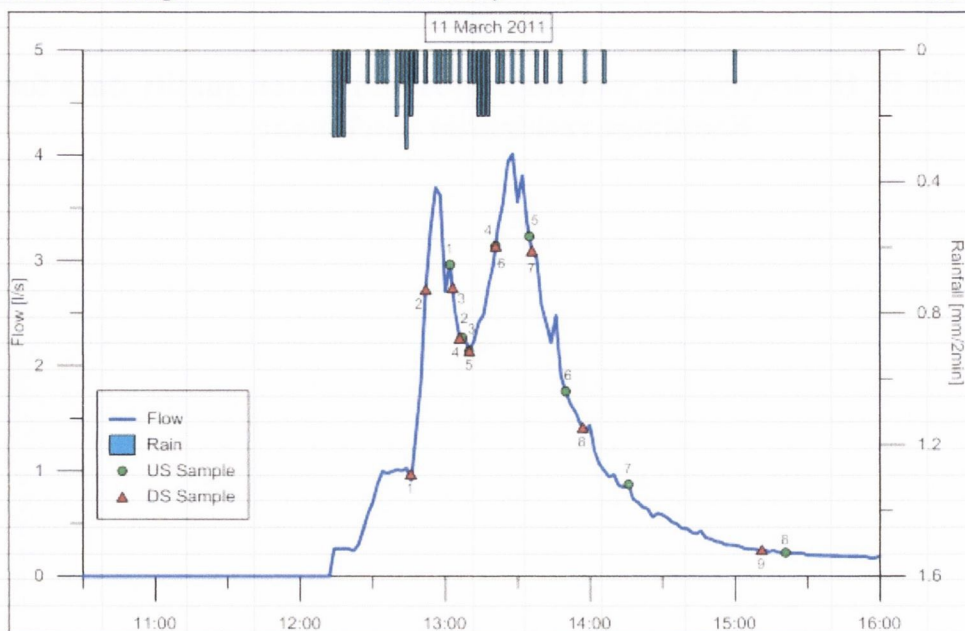
23 February 2010	Bray	Storm Summary						2 of 2
	SSC	Cd	Cr	Cu	Ni	Pb	Zn	
	[mg/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	
Detection limit		2	2	5	5	5	5	
EMCs								
US F	nd		8	7	8	5	33	
US NF	558	nd	55	80	34	41	202	
DS F	nd		7	15	6	4	11	
DS NF	542	nd	55	72	35	41	195	



Rainfall	3.2 mm	Rainfall duration	42 minutes	Analysis			
Runoff	5.9 m3	Av rain intensity	4.6 mm/hr	Event mean SSC and heavy metals			
DCIA	3000 m2	Peak 10min rain intensity	11.4 mm/hr				
Runoff Coeff	0.61	Flow duration	58 minutes	Prev rain	15/06/2010 11:10	Flow start	28/06/2010 23:36
ADP	13.5 days	Average flow	1.6 l/s	Rain start	28/06/2010 23:06	Flow end	29/06/2010 00:34
		Peak flow	7.6 l/s	Rain end	28/06/2010 23:48		

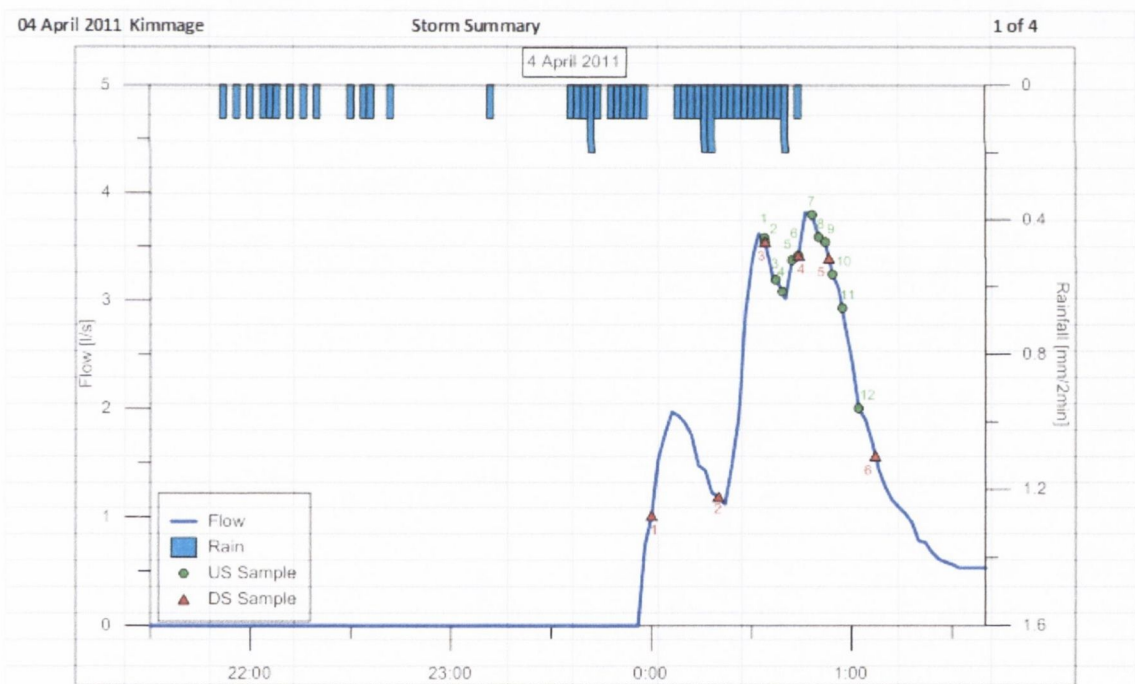
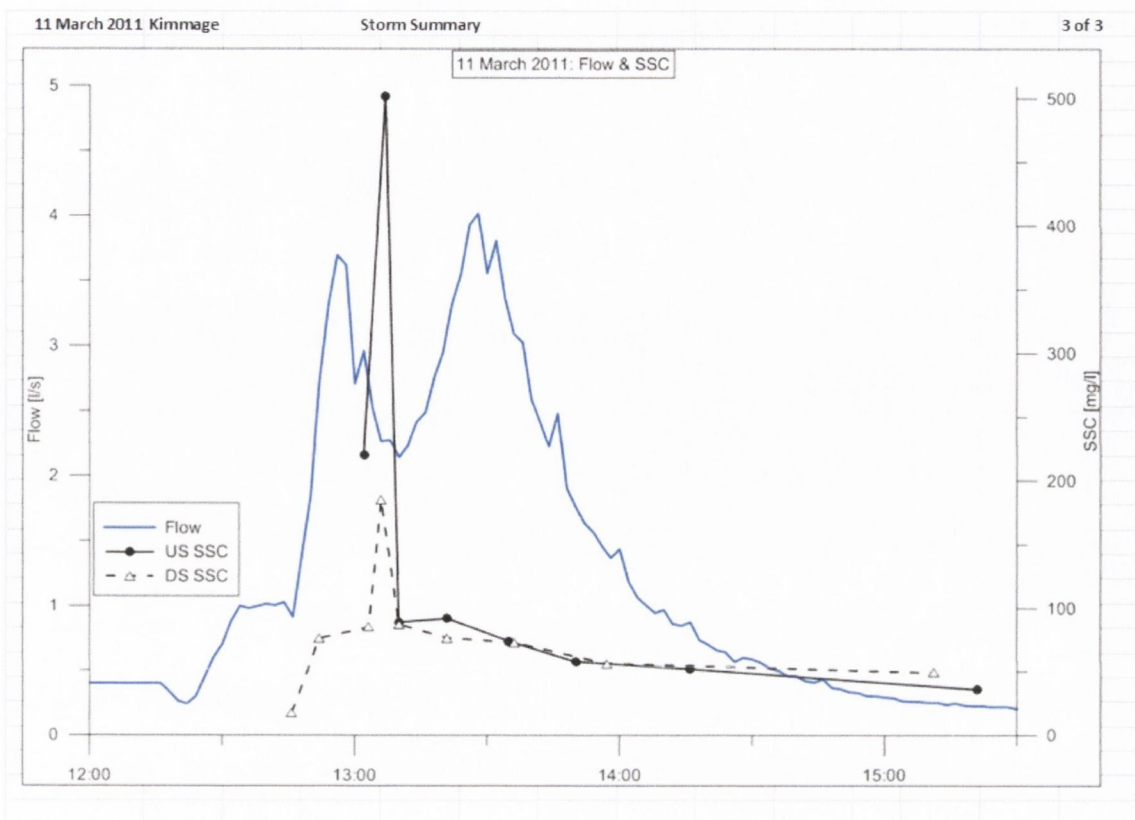
28 June 2010	Bray	Storm Summary										2 of 2				
	SSC	Cd	Cr	Cu	Ni	Pb	Zn	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90	
	[mg/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]	
Detection limit		2	2	5	5	5	5									
EMCs																
US F		nd	nd	26	nd	5	5									
US NF	418	nd	43	70	28	33	198	9.3	21.0	38.2	19.3	12.1	10	30	106	
DS F		nd	nd	35	nd	nd	8									
DS NF	532	nd	41	90	28	40	220	10.3	22.0	36.2	19.9	11.6	10	30	100	

**Appendix B: Hydrographs, pollutographs and water quality data for the
Kimmage residential catchment**



Rainfall	5.2 mm	Av rain intensity	1.2 mm/hr	Analysis			
Runoff	15.7 m ³	Peak hourly intensity	3 mm/hr	Single bottle SSC			
DCIA	14200 m ²	Peak 10min rain intensity	5.4 mm/hr				
Runoff Coeff	0.21	Flow duration	220 minutes	Prev Rain	10/03/2011 00:56	Flow start	11/03/2011 12:20
ADP	1.4 days	Average flow	1.2 l/s	Rain Start	11/03/2011 10:48	Flow end	11/03/2011 16:00
Rainfall duration	252 minutes	Peak flow	4 l/s	Rain end	11/03/2011 15:00		

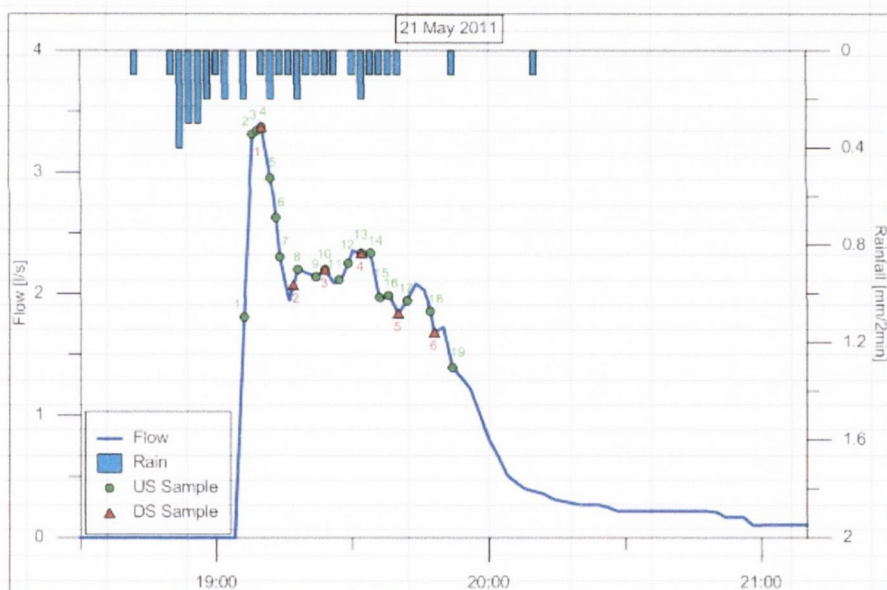
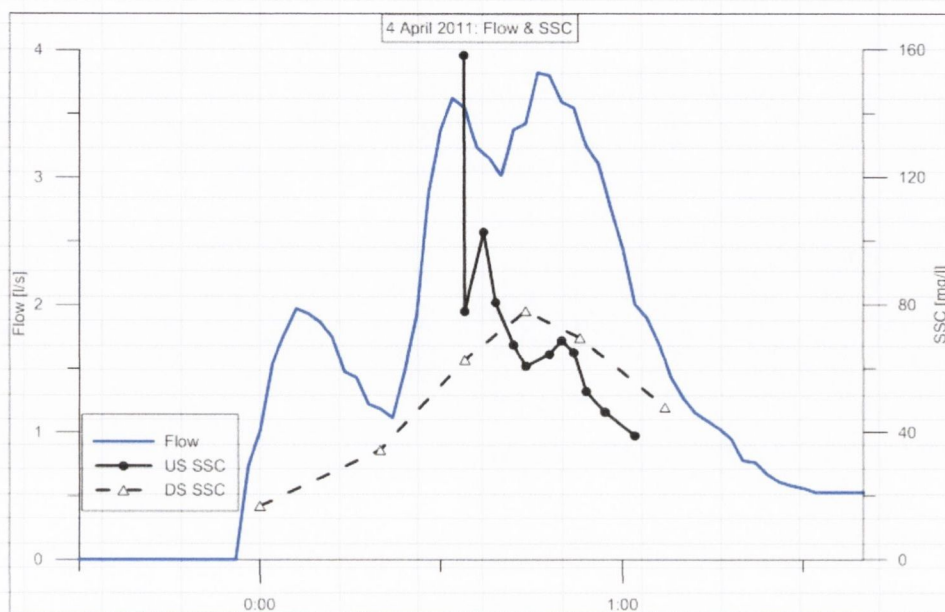
	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	pH	MSS [g]
Sample						
DS 1	1455	0.09	18	2	8.0	26
DS 2	1363	0.09	76	7	7.9	104
US 1	1333	0.08	220	19	8.0	294
US 2	552	0.04	502	18	7.9	277
US 3	1067	0.07	89	6	8.0	95
US 4	2448	0.16	92	14	8.0	224
US 5	2550	0.16	74	12	7.9	189
US 6	1989	0.13	58	7	7.8	115
US 7	1701	0.11	52	6	8.3	89
US 8	1246	0.08	36	3	9.1	44
Min			18			
Max			502			
Me d			75			
EMC			93			
Total Mass						1456
DS 1	1455	0.093	18	2	8.4	26
DS 2	1362.54	0.087	76	7	8.6	104
DS 3	1340.22	0.085	85	7	8.1	114
DS 4	476.52	0.03	185	6	7.9	88
DS 5	1135.26	0.072	87	6	7.9	99
DS 6	2488.68	0.158	77	12	7.9	191
DS 7	2922.57	0.186	73	14	7.9	214
DS 8	2613.75	0.166	57	9	7.9	148
DS 9	1909.02	0.122	49	6	7.9	94
Min			18			
Max			185			
Me d			76			
EMC			69			
Total Mass						1077



Rainfall	4.7 mm	Av rain intensity	1.6 mm/hr	Analysis			
Runoff	11.7 m ³	Peak hourly intensity	2.9 mm/hr	Single bottle SSC, PSD			
DCIA	14200 m ²	Peak 10min rain intensity	4.2 mm/hr				
Runoff Coeff	0.18	Flow duration	94 minutes	Prev Rain	02/04/2011 20:12	Flow start	04/04/2011 23:58
ADP	2.1 days	Average flow	2.1 l/s	Rain Start	04/04/2011 21:52	Flow end	05/04/2011 01:32
Rainfall dur	172 minutes	Peak flow	3.8 l/s	Rain end	05/04/2011 00:44		

04-Apr-11 Kimmage		Storm Summary										2 of 4		
	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90	
Sample	[l]		[mg/l]		[g]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]	
DS1	1176	0.10	17	2	20									
DS2	1830	0.16	34	5	62	42.9	28.5	18.5	5.1	5.0	3	12	45	
US1	1076	0.09	158	15	170	26.7	21.0	21.5	13.4	17.1	4	22	173	
US2	504	0.04	78	3	39									
US3	475	0.04	103	4	49	28.2	29.8	28.5	9.3	4.2	4	17	54	
US4	463	0.04	81	3	37									
US5	509	0.04	67	3	34									
US6	664	0.06	61	3	40	32.9	26.0	22.1	12.6	6.4	3	17	72	
US7	671	0.06	64	4	43									
US8	428	0.04	69	3	29									
US9	407	0.03	65	2	26									
US10	474	0.04	53	2	25									
US11	644	0.06	46	3	30									
US12	2369	0.20	39	8	92	34.9	27.8	22.9	9.2	5.2	3	15	61	
Min			17											
Max			158											
Med			65								3	17	61	
EMC			60								2	18	90	
Total mass					699									

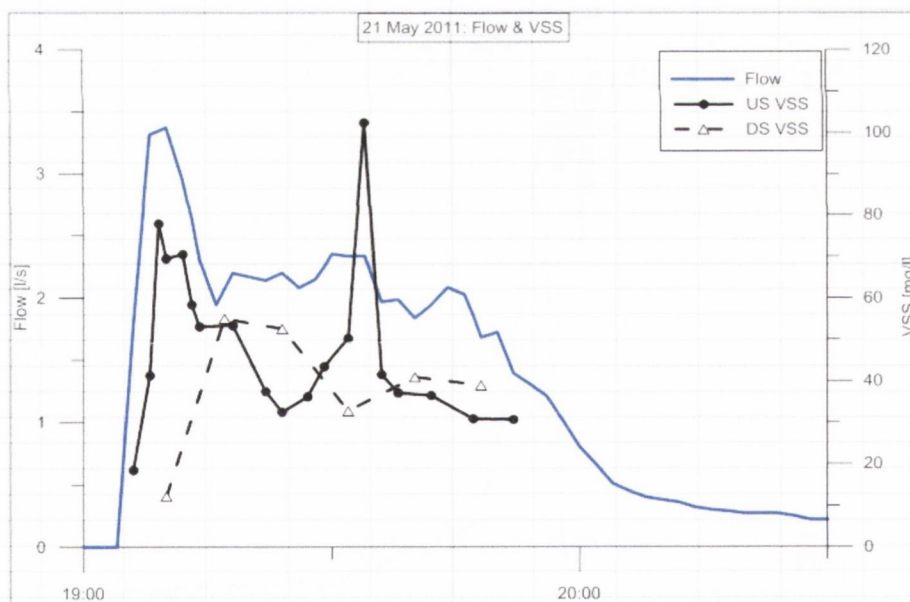
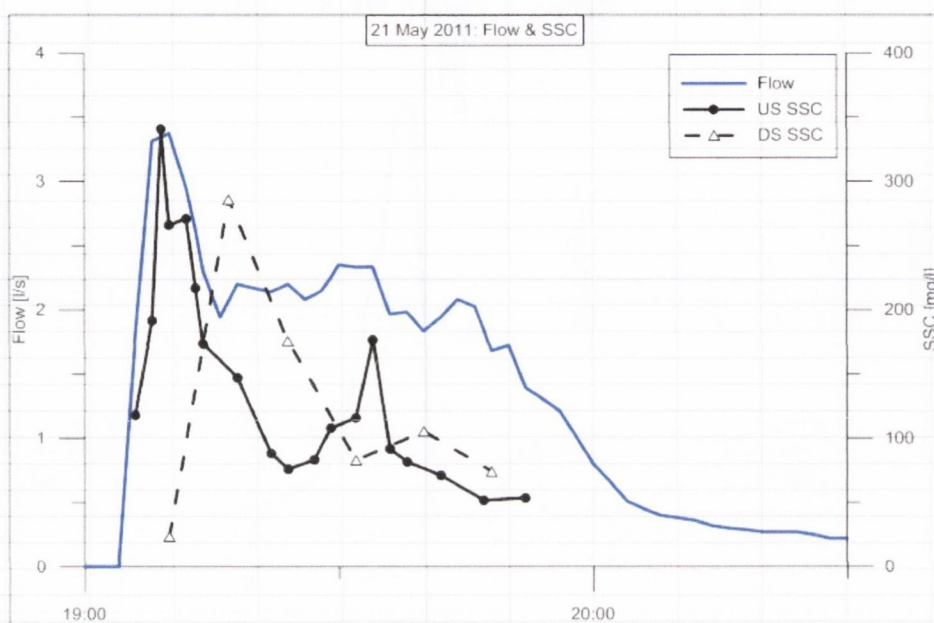
04 April 2011	Kimmage /// Storm Summary													3 of 4
	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	<10 µm	10-20µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90	
Sample	[l]		[mg/l]		[g]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]	
DS1	1297	0.111	17	2	22									
DS2	1561	0.134	34	5	54	42.9	28.5	18.5	5.1	5.0	3	12	45	
DS3	2384	0.204	63	13	149									
DS4	2019	0.173	78	13	157	33.0	27.4	23.9	10.2	5.6	3	16	63	
DS5	2135	0.183	70	13	149									
DS6	2295	0.196	48	9	110	35.8	30.3	23.7	7.8	2.4	3	15	45	
Min			17											
Max			78											
Med			55								3	15	45	
EMC			55											
Total mass					641									

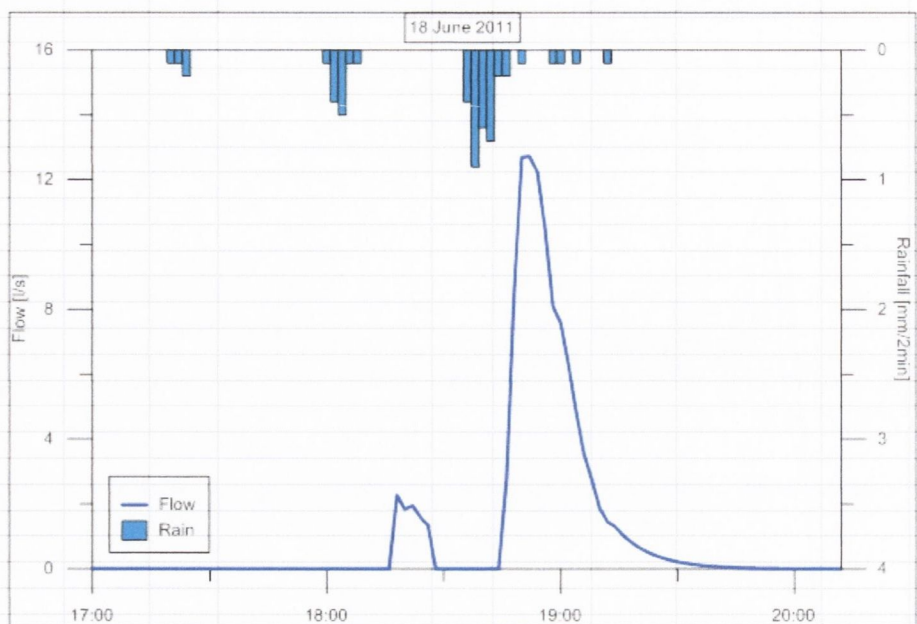


Rainfall	3.9 mm	Av rain intensity	2.7 mm/hr	Analysis			
Runoff	7.8 m ³	Peak hourly intensity	3.7 mm/hr	Single bottle SSC, VSS			
DCIA	14200 m ²	Peak 10min rain intensity	7.8 mm/hr				
Runoff Coeff	0.14	Flow duration	124 minutes	Prev Rain	21/05/2011 16:46	Flow start	21/05/2011 19:06
ADP	0.1 days	Average flow	1 l/s	Rain Start	21/05/2011 18:42	Flow end	21/05/2011 21:10
Rainfall duration	88 minutes	Peak flow	3.4 l/s	Rain end	21/05/2011 20:10		

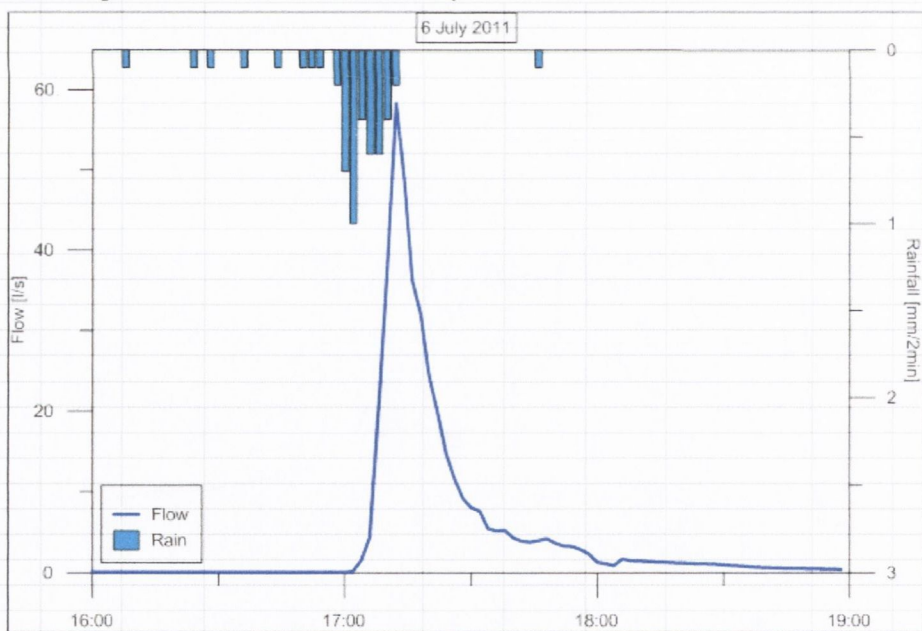
21 May 2011 Kimmage		Storm Summary								2 of 5
	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	
Sample	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]	
US1	416	0.05	118	6	49	19	1	8	16	
US2	300	0.04	192	7	58	41	2	12	22	
US3	202	0.03	341	9	69	78	2	16	23	
US4	278	0.04	266	9	74	69	2	19	26	
US5	246	0.03	271	9	67	70	2	17	26	
US6	138	0.02	217	4	30	58	1	8	27	
US7	302	0.04	174	7	52	53	2	16	31	
US8	524	0.07	147	10	77	53	4	28	36	
US9	389	0.05	88	4	34	37	2	15	42	
US10	319	0.04	76	3	24	33	1	10	43	
US11	321	0.04	84	3	27	36	1	12	43	
US12	352	0.05	108	5	38	43	2	15	40	
US13	350	0.04	116	5	41	50	2	18	43	
US14	258	0.03	177	6	46	102	3	26	58	
US15	237	0.03	92	3	22	42	1	10	45	
US16	340	0.04	82	4	28	37	2	13	45	
US17	544	0.07	71	5	39	36	3	20	51	
US18	539	0.07	52	4	28	31	2	17	60	
US19	1766	0.23	54	12	95	31	7	54	57	
Min			52			19				
Max			341			102				
Med			116			42				
EMC			115			43			37	
Total Mass					897			334		

21 May 2011 Kimmage		Storm Summary								3 of 5
	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	
Sample	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]	
DS1	1581	0.20	24	5	37	12	2	19	52	
DS2	891	0.11	286	33	255	55	6	49	19	
DS3	965	0.12	176	22	170	53	6	51	30	
DS4	1078	0.14	83	11	90	33	5	35	39	
DS5	942	0.12	106	13	99	41	5	39	39	
DS6	2366	0.30	74	22	176	39	12	92	52	
Min			24			12				
Max			286			55				
Med			94			40				
EMC			106			36			34	
Total Mass					827			285		

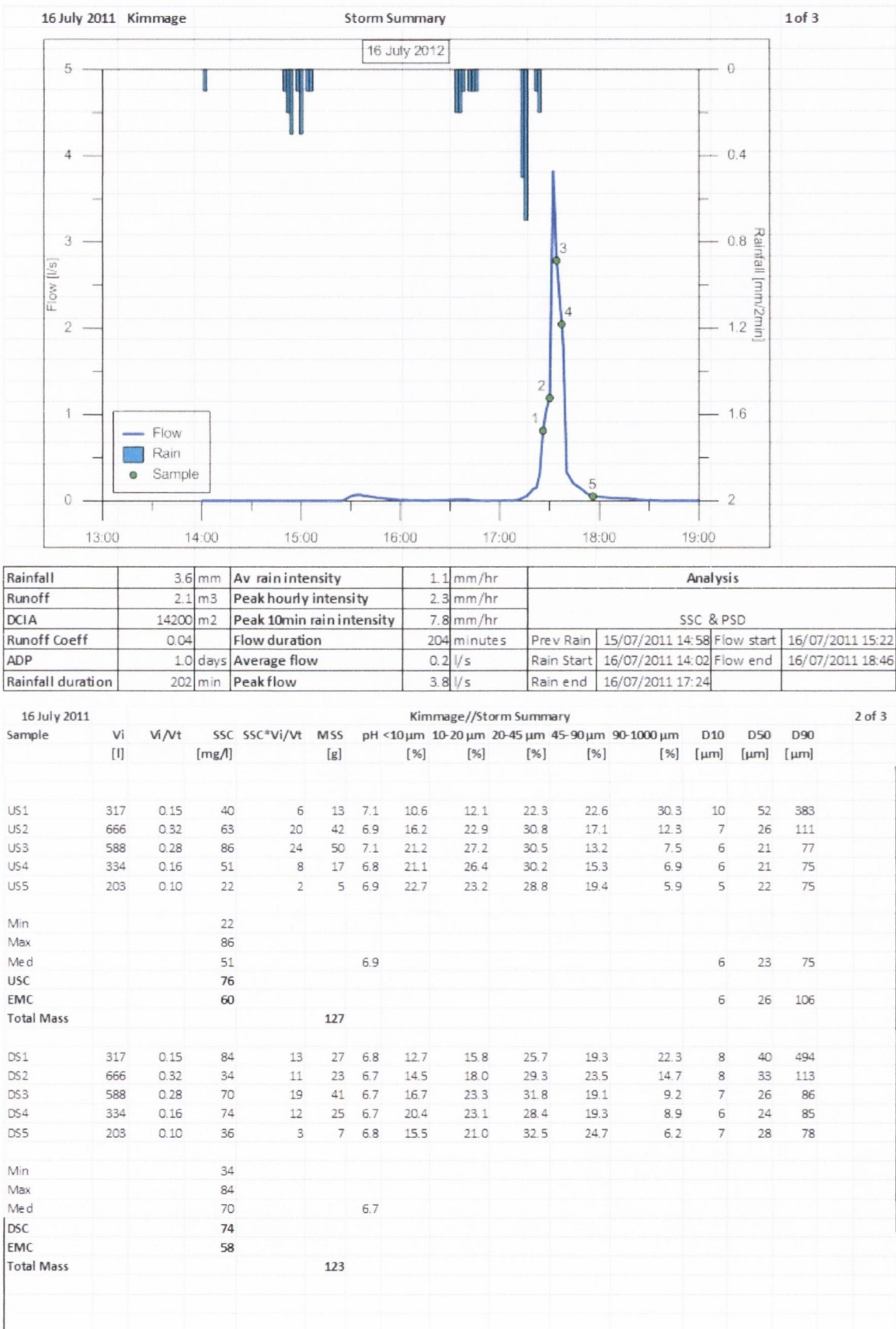


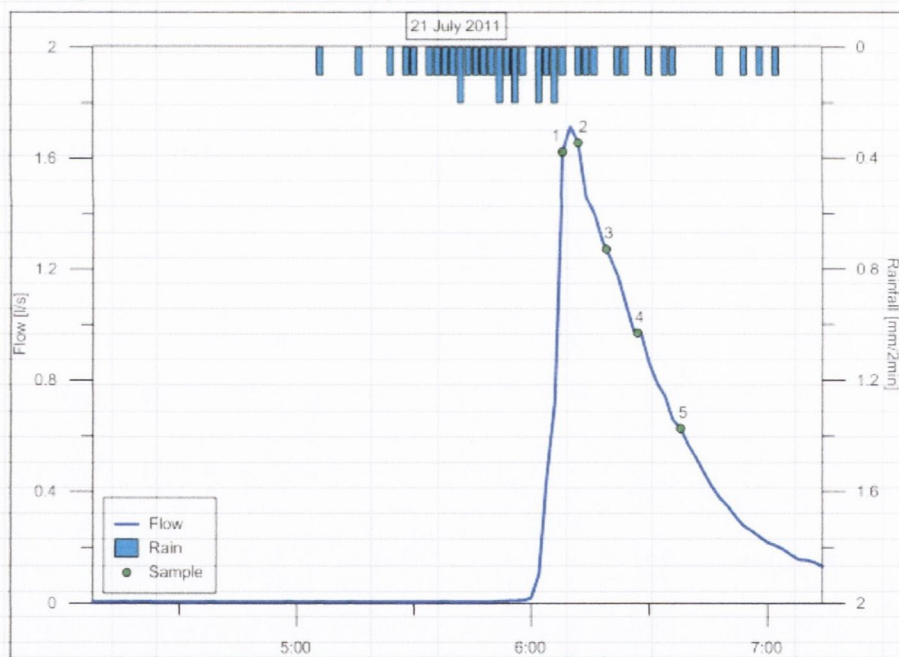
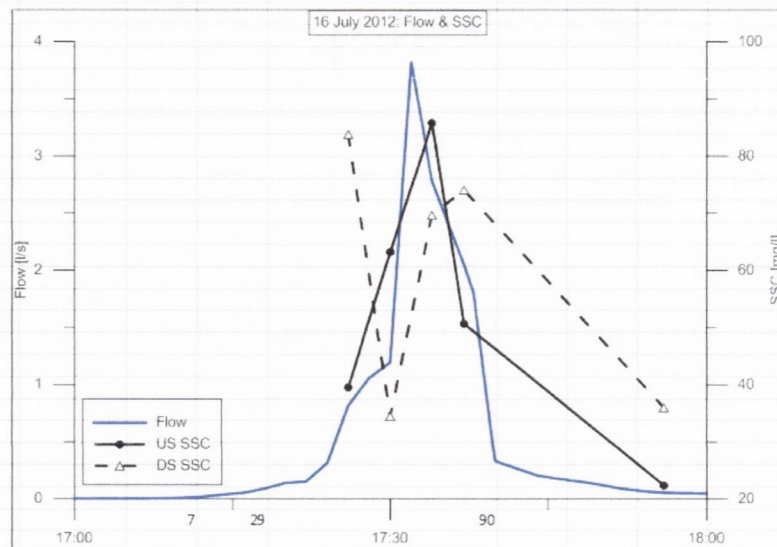


Rainfall	5.1 mm	Av rain intensity	2.7 mm/hr	Analysis			
Runoff	13.4 m3	Peak hourly intensity	4.4 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	16.8 mm/hr				
Runoff Coeff	0.19	Flow duration	114 minutes	Prev Rain	17/06/2011 16:58	Flow start	18/06/2011 18:18
ADP	1.0 days	Average flow	2 l/s	Rain Start	18/06/2011 17:20	Flow end	18/06/2011 20:12
Rainfall duration	112 min	Peak flow	12.7 l/s	Rain end	18/06/2011 19:12		



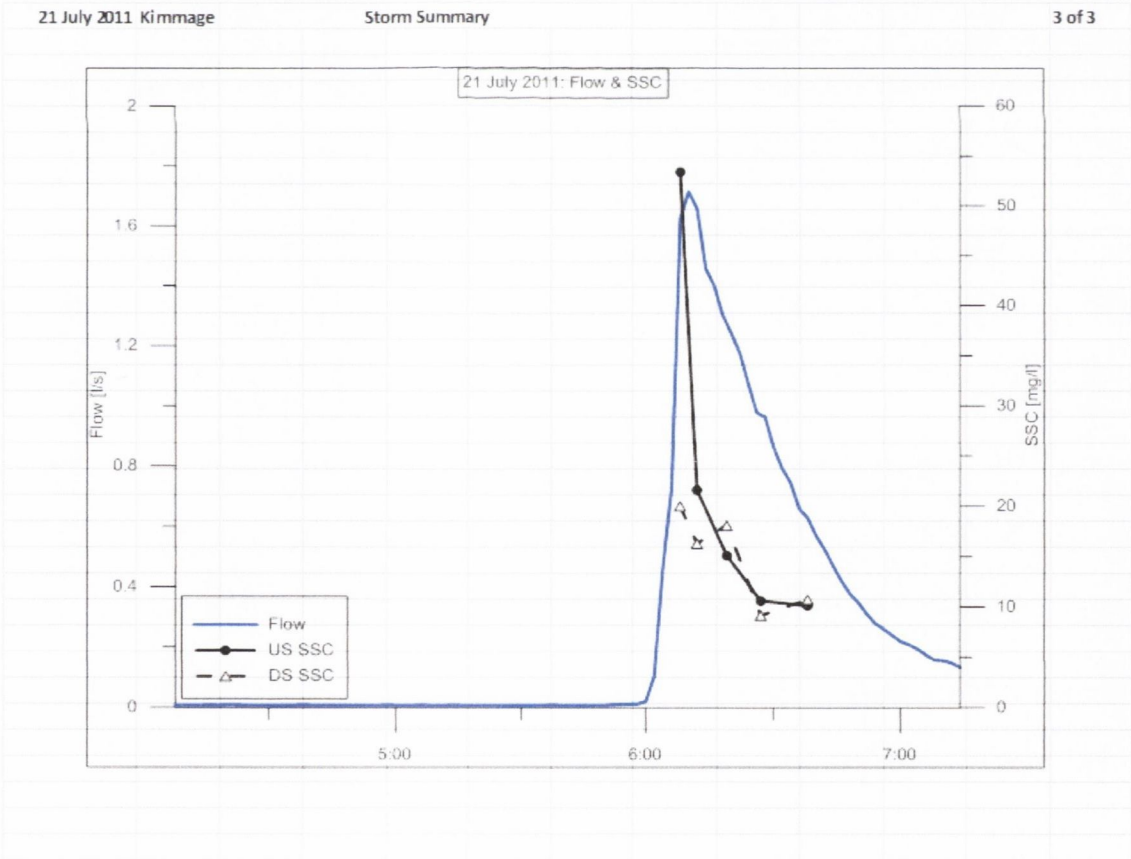
Rainfall	5 mm	Av rain intensity	3.1 mm/hr	Analysis			
Runoff	49.5 m3	Peak hourly intensity	4.8 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	19.8 mm/hr				
Runoff Coeff	0.69	Flow duration	104 minutes	Prev Rain	06/07/2011 05:02	Flow start	06/07/2011 17:02
ADP	0.5 days	Average flow	7.9 l/s	Rain Start	06/07/2011 16:08	Flow end	06/07/2011 18:46
Rainfall dur	98 minutes	Peak flow	58 l/s	Rain end	06/07/2011 17:46		

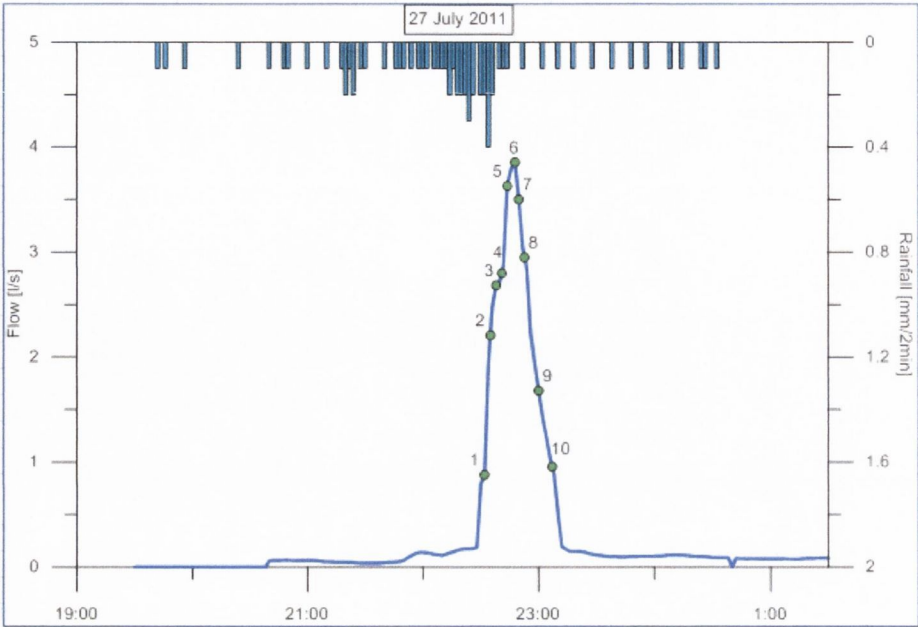




Rainfall	3.9 mm	Av rain intensity	2 mm/hr	Analysis			
Runoff	3 m3	Peak hourly intensity	2.9 mm/hr	Single bottle SSC			
DCIA	14200 m2	Peak 10min rain intensity	4.2 mm/hr				
Runoff Coeff	0.05	Flow duration	72 minutes	Prev Rain	17/07/2011 00:06	Flow start	21/07/2011 06:02
ADP	4.2 days	Average flow	0.7 l/s	Rain Start	21/07/2011 05:06	Flow end	21/07/2011 07:14
Rainfall dur	116 min	Peak flow	1.7 l/s	Rain end	21/07/2011 07:02		

21 July 2011 Kimmage			Storm Summary			2 of 3		
	Vi	Vi/Vt	SSC	SSC* Vi/Vt	M SS			
	[l]		[mg/l]		[g]			
Sample								
US1	551	0.19	53	10	29			
US2	489	0.16	22	4	11			
US3	547	0.18	15	3	8			
US4	510	0.17	11	2	5			
US5	871	0.29	10	3	9			
Min			10					
Max			53					
Med			15					
EMC			21					
Total Mass					62			
DS1	551	0.19	20	4	11			
DS2	489	0.16	16	3	8			
DS3	547	0.18	18	3	10			
DS4	510	0.17	9	2	5			
DS5	871	0.29	11	3	9			
Min			9					
Max			20					
Med			16					
EMC			14					
Total Mass					43			

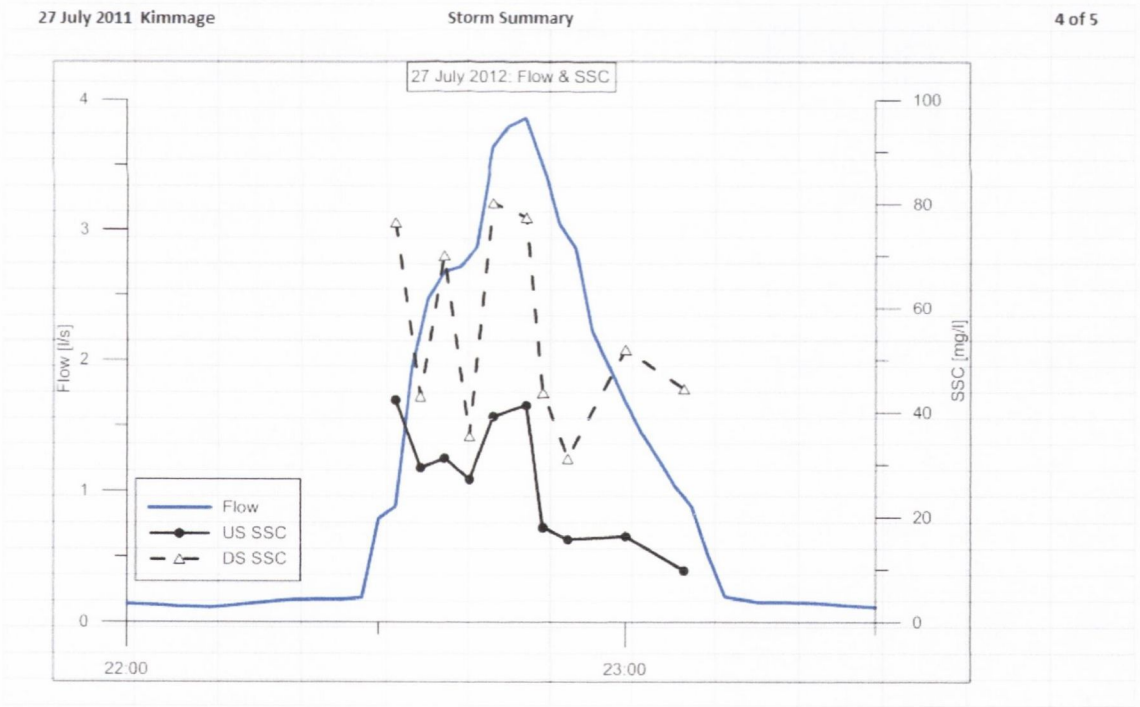


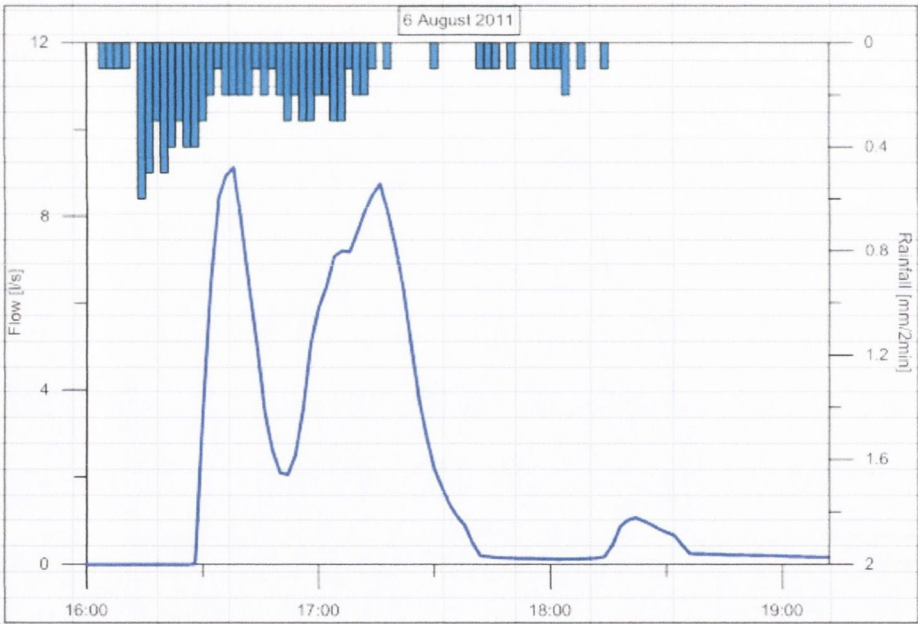
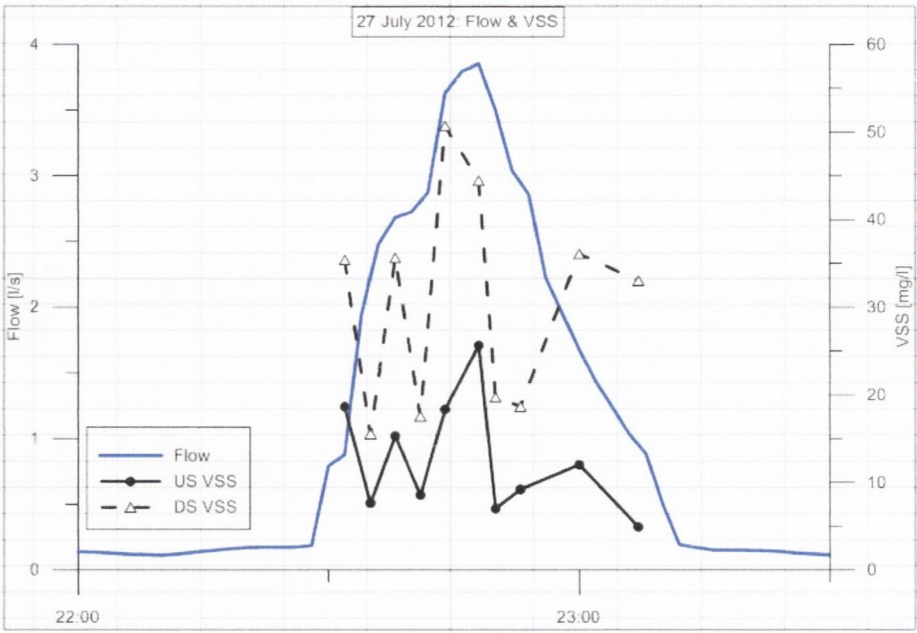


Rainfall	6.9 mm	Av rain intensity	1.4 mm/hr	Analysis			
Runoff	6.9 m3	Peak hourly intensity	3.6 mm/hr	Single-bottle SSC & VSS			
DCIA	14200 m2	Peak 10min rain intensity	6.6 mm/hr				
Runoff Coeff	0.07	Flow duration	292 minutes	Prev rain	21/07/2011 15:56	Flow start	27/07/2011 20:40
ADP	6.2 days	Average flow	0.4 l/s	Rain start	27/07/2011 19:42	Flow end	28/07/2011 01:32
Rainfall duration	290 min	Peak flow	3.9 l/s	Rain end	28/07/2011 00:32		

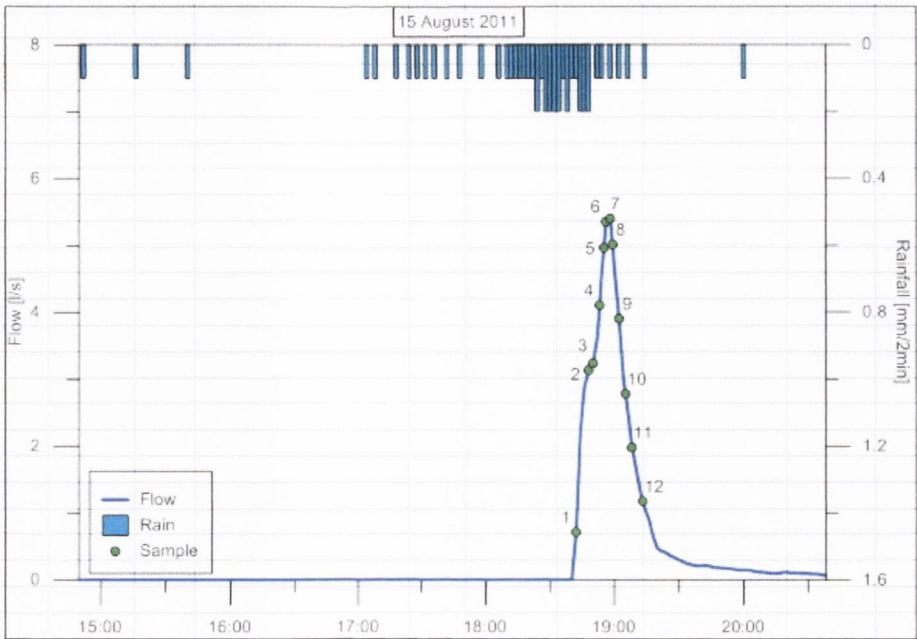
27 July 2011 Kimmage		Storm Summary										2 of 5					
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	MSS [g]	VSS [mg/l]	VSS*Vi/Vt	MVSS [mg/l]	OC [%]	<10 µm [%]	10-20 µm [%]	20-45 µm [%]	45-90 µm [%]	90-1000 µm [%]	D10 [µm]	D50 [µm]	D90 [µm]
US1	936	0.14	42	5.7	40	19	2.5	17	44	7.7	5.1	16.9	46.0	24.3	13	63	116
US2	426	0.06	29	1.8	13	8	0.5	3	26								
US3	485	0.07	31	2.2	15	15	1.1	7	49	12.0	9.2	26.4	38.9	13.5	8	47	98
US4	553	0.08	27	2.2	15	9	0.7	5	31								
US5	763	0.11	39	4.3	30	18	2.0	14	47	14.4	14.2	28.7	31.8	10.9	7	38	92
US6	669	0.10	41	4.0	28	26	2.5	17	62								
US7	478	0.07	18	1.2	9	7	0.5	3	39								
US8	706	0.10	16	1.6	11	9	0.9	7	58								
US9	686	0.10	16	1.6	11	12	1.2	8	74								
US10	1213	0.18	10	1.7	12	5	0.9	6	50	25.7	23.2	29.4	18.1	3.6	4	21	67
USC			23			8			36								
Min			10			5											
Max			42			26											
Med			28			11									7	43	96
EMC			26			13			48						7	38	96
Total					183			88									

27 July 2011 Kimmage			Storm Summary						3 of 5
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	M SSC [g]	VSS [mg/l]	VSS*Vi/Vt	M VSS [mg/l]	% Organic
DS1	936	0.14	76	10.4	72	35	4.8	33	46
DS2	426	0.06	43	2.7	18	16	1.0	7	36
DS3	485	0.07	70	4.9	34	36	2.5	17	51
DS4	553	0.08	36	2.8	20	18	1.4	10	49
DS5	763	0.11	80	8.9	61	51	5.6	39	63
DS6	669	0.10	78	7.5	52	44	4.3	30	57
DS7	478	0.07	44	3.0	21	20	1.4	9	45
DS8	706	0.10	31	3.2	22	19	1.9	13	60
DS9	686	0.10	52	5.2	36	36	3.6	25	69
DS10	1213	0.18	45	7.8	54	33	5.8	40	74
DSC			34			13			39
Min			31			16			
Max			80			51			
Med			48			34			
EMC			56			32			57
Total Mass					390			223	





Rainfall	9.9 mm	Av rain intensity	4.6 mm/hr	Analysis			
Runoff	23.9 m3	Peak hourly intensity	8 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	13.8 mm/hr				
Runoff Coeff	0.17	Flow duration	162 minutes	Prev rain	28/07/2011 07:36	Flow start	06/08/2011 16:30
ADP	9.4 days	Average flow	2.5 l/s	Rain start	06/08/2011 16:04	Flow end	06/08/2011 19:12
Rainfall dur	130 minutes	Peak flow	9.1 l/s	Rain end	06/08/2011 18:14		



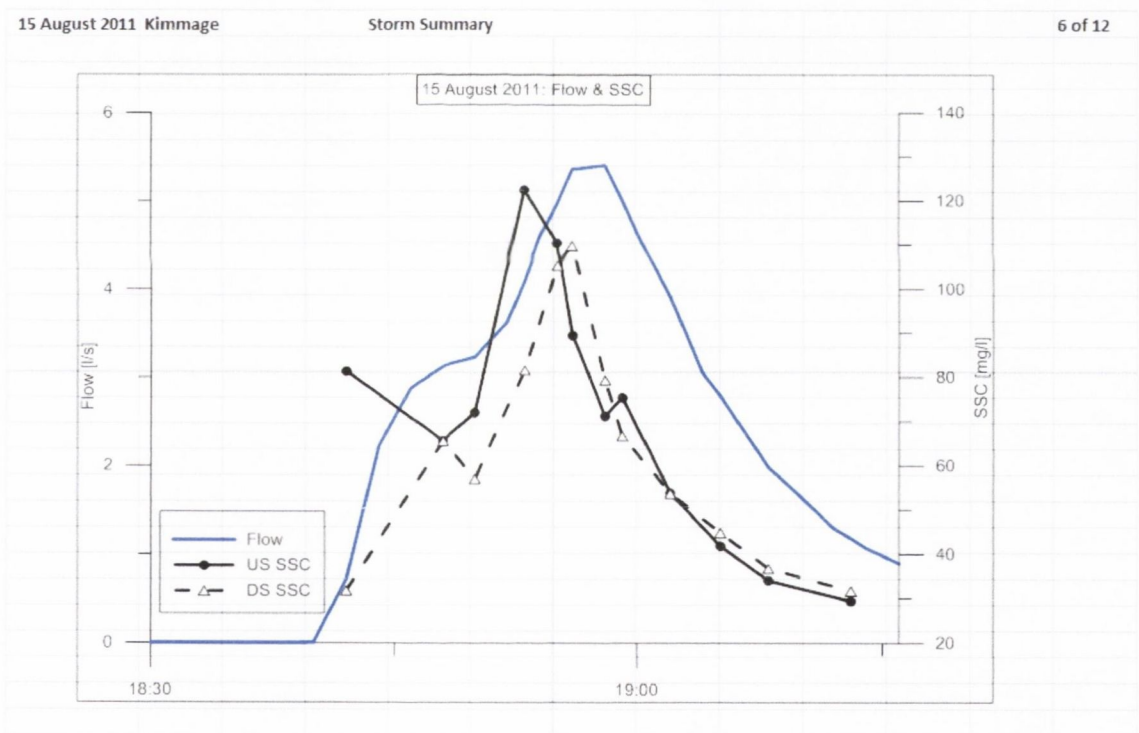
Rainfall	5 mm	Av rain intensity	1 mm/hr	Analysis			
Runoff	7.2 m3	Peak hourly intensity	3.4 mm/hr	Single bottle SSC, VSS, metals & P			
DCIA	14200 m2	Peak 10min rain intensity	5.4 mm/hr				
Runoff Coeff	0.1	Flow duration	78 minutes	Prev Rain	12/08/2011 20:58	Flow start	15/08/2011 18:42
ADP	2.8 days	Average flow	1.5 l/s	Rain Start	15/08/2011 14:52	Flow end	15/08/2011 20:00
Rainfall duration	308 min	Peak flow	5.4 l/s	Rain end	15/08/2011 20:00		

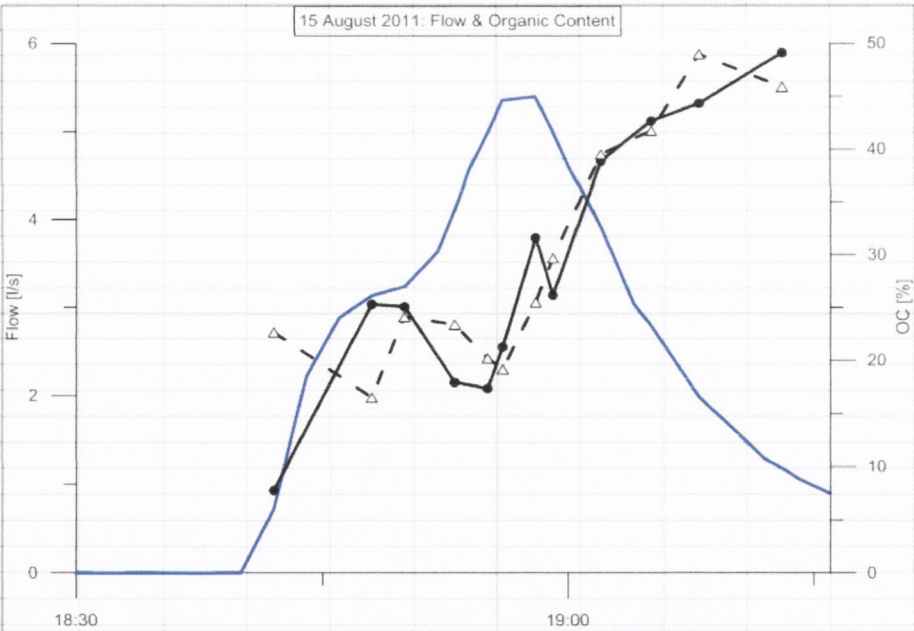
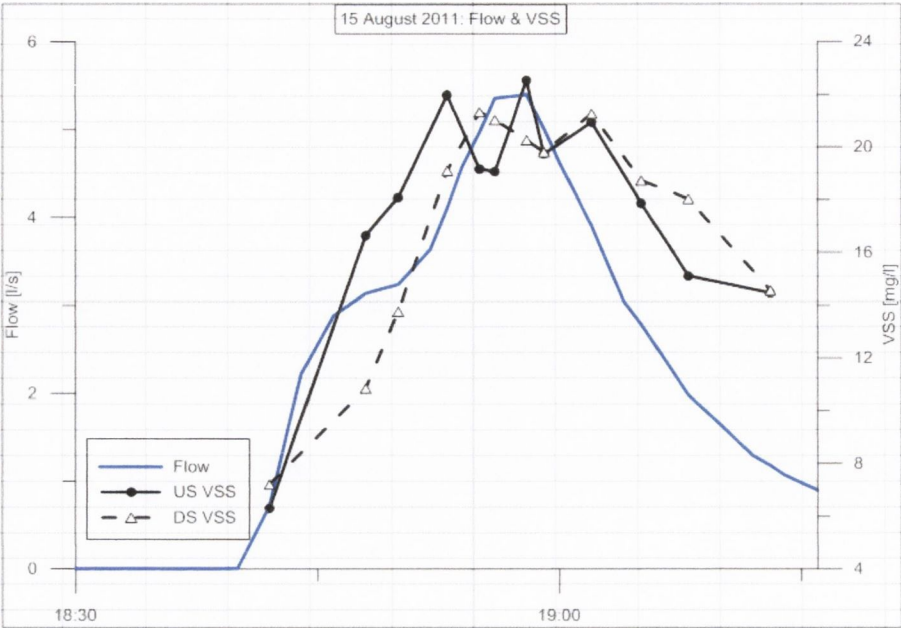
15 August 2011 Kimmage				Storm Summary				2 of 12	
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	M SS [g]	VSS [mg/l]	VSS*Vi/Vt	M VSS [g]	OC [%]
US1	581	0.08	81	7	47	6	1	4	8
US2	689	0.10	66	6	45	17	2	11	25
US3	550	0.08	72	6	40	18	1	10	25
US4	654	0.09	122	11	80	22	2	14	18
US5	459	0.06	110	7	51	19	1	9	17
US6	485	0.07	90	6	43	19	1	9	21
US7	463	0.06	71	5	33	23	1	10	32
US8	512	0.07	75	5	39	20	1	10	26
US9	632	0.09	54	5	34	21	2	13	39
US10	453	0.06	42	3	19	18	1	8	43
US11	403	0.06	34	2	14	15	1	6	44
US12	1316	0.18	29	5	39	14	3	19	49
Min			29			6			
Max			122			23			
Med			72			19			
EMC			67			17			26
Total Mass					483			124	

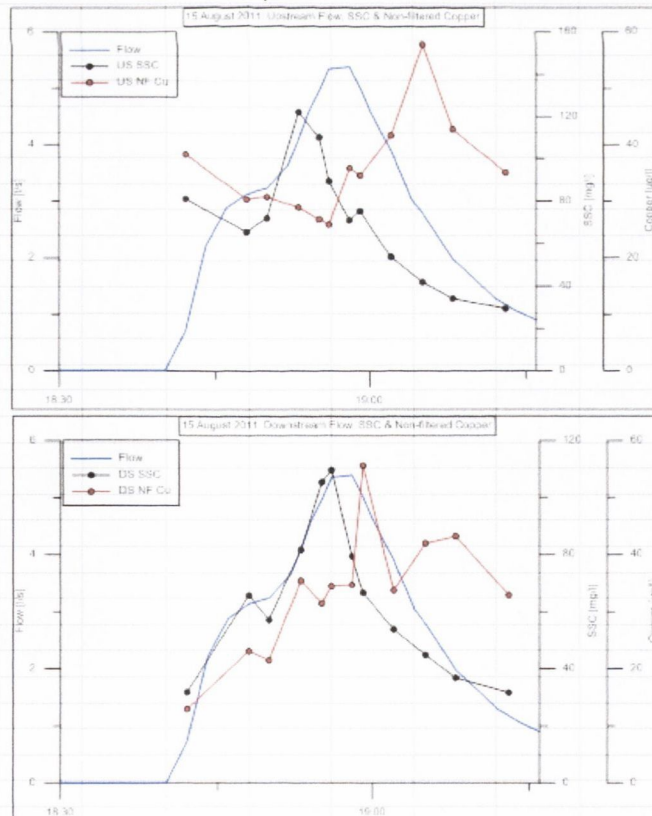
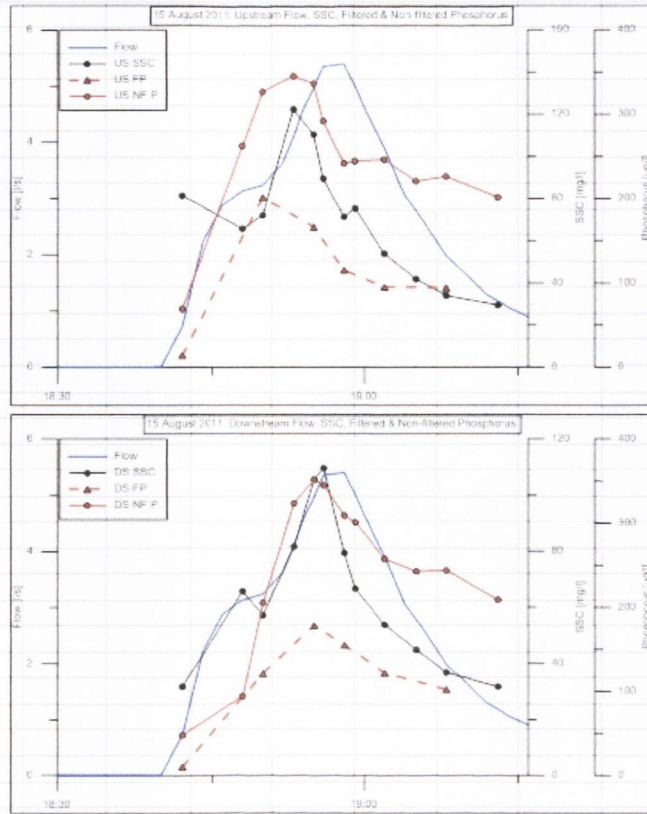
15 August 2011	Kimmage	Storm Summary								3 of 12
	Vi	Vi/Vt	SSC	SSC*Vi/Vt	M SS	VSS	VSS*Vi/Vt	M VSS	OC	
Sample	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]	
DS1	581	0.08	32	3	18	7	1	4	23	
DS2	689	0.10	66	6	45	11	1	7	17	
DS3	550	0.08	57	4	31	14	1	8	24	
DS4	654	0.09	82	7	53	19	2	12	23	
DS5	459	0.06	105	7	48	21	1	10	20	
DS6	485	0.07	110	7	53	21	1	10	19	
DS7	463	0.06	79	5	37	20	1	9	26	
DS8	512	0.07	67	5	34	20	1	10	30	
DS9	632	0.09	54	5	34	21	2	13	40	
DS10	453	0.06	45	3	20	19	1	8	42	
DS11	403	0.06	37	2	15	18	1	7	49	
DS12	1316	0.18	32	6	42	15	3	19	46	
Min			32			7				
Max			110			21				
Med			61			19				
EMC			60			17			28	
Total Mass					432			120		

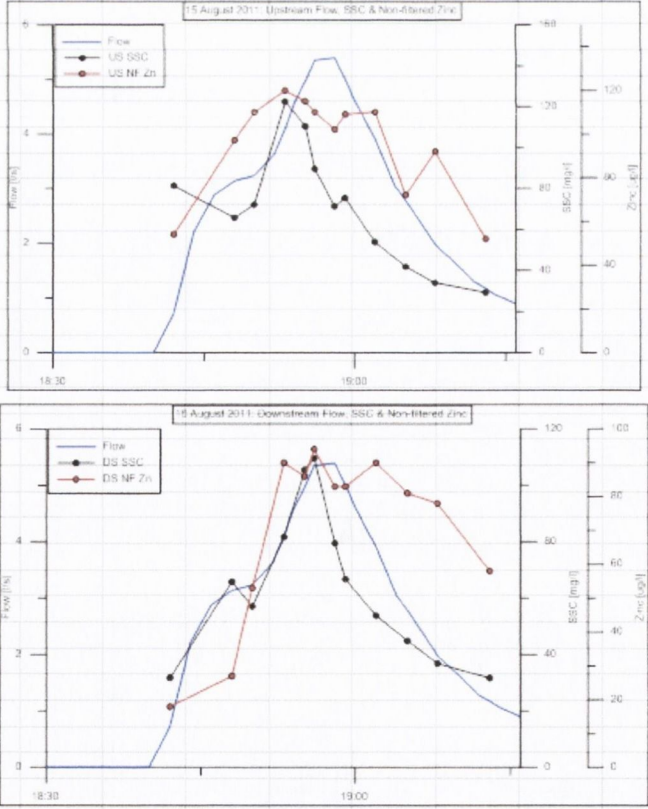
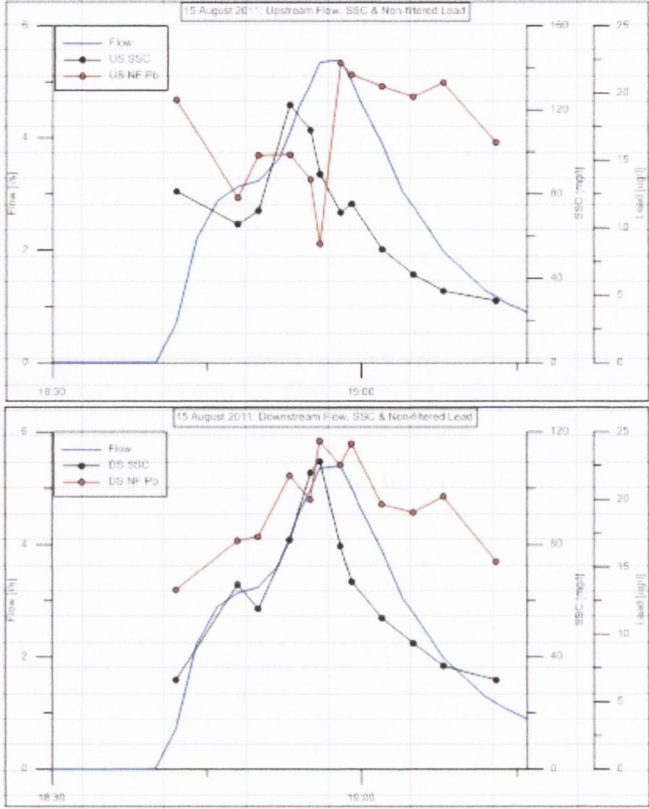
15 August 2011	Kimmage	Storm Summary												4 of 12
	F P	NF P	F Cd	NF Cd	F Cr	NF Cr	F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]
Detection Limit	5	5	2	2	2	2	5	5	5	5	5	5	5	5
US1	14	69	ND	ND	ND	ND	10	38	ND	ND	6	20	10	54
US2		263		ND		ND		30		ND		12		97
US3	201	327	ND	ND	ND	ND	11	31	ND	ND	4	15	5	110
US4		346		ND		ND		29		ND		15		120
US5	166	336	ND	ND	ND	ND	11	27	ND	ND	5	14	12	115
US6		292		ND		ND		26		ND		9		110
US7	115	242	ND	ND	ND	ND	13	36	ND	ND	6	22	27	102
US8		244		ND		ND		35		ND		21		109
US9	95	246	ND	ND	ND	ND	13	42	ND	ND	4	21	17	110
US10		221		ND		ND		58		ND		20		72
US11	94	226	ND	ND	ND	ND	12	43	ND	ND	3	21	25	92
US12		201		ND		ND		35		ND		16		52
Min	14	69					10	26			3	9	ND	52
Max	201	346					13	58			6	22	27	120
Med	105	245					11	35			5	18	15	106
EMC	118	248					12	36			5	17	16	91
Filtration blank	ND		ND		ND		10		ND		5		ND	
Digestion blank		ND		ND		ND		30		ND		5		ND

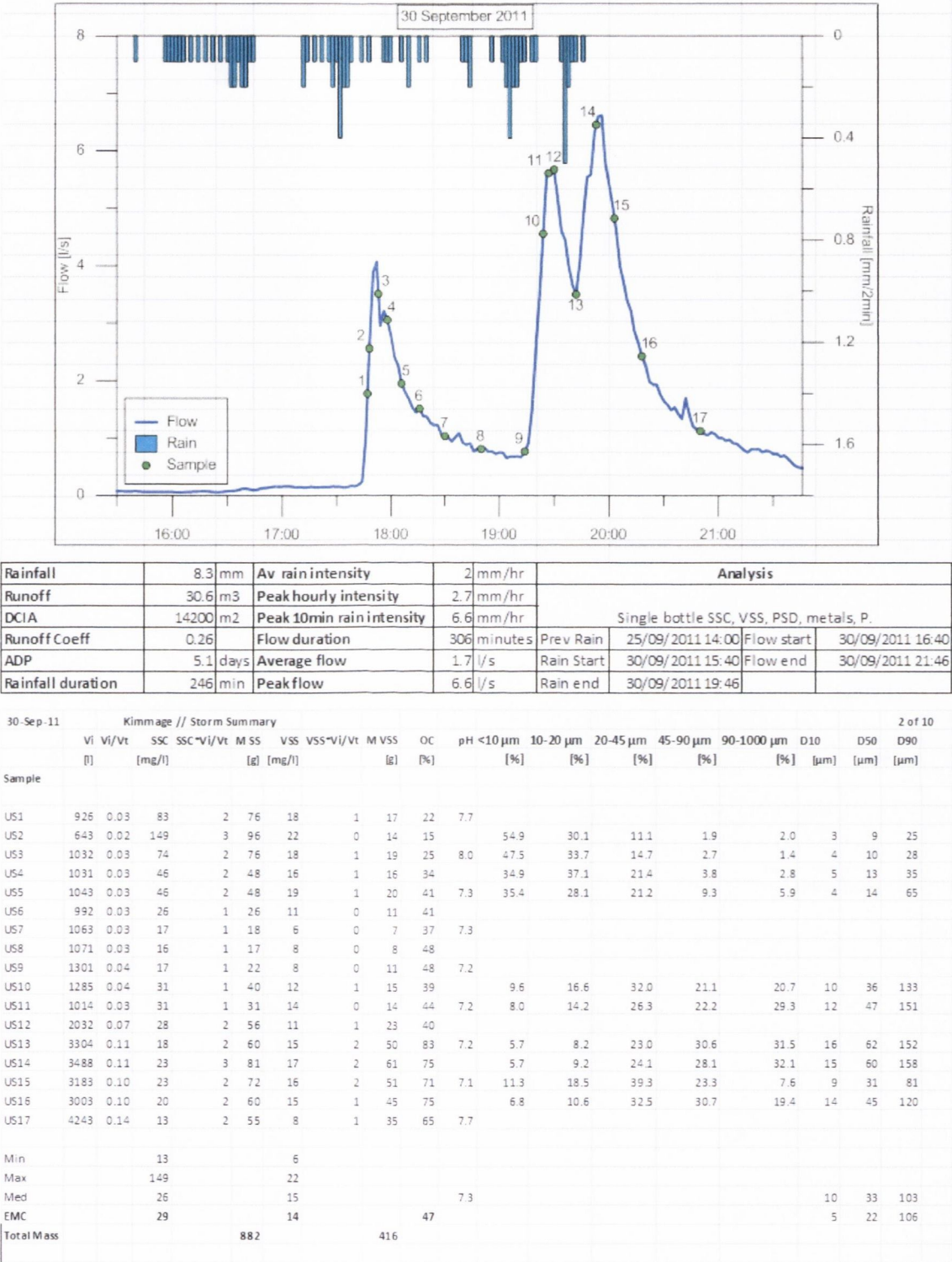
15 August 2011	Kimmage		Storm Summary											5 of 12	
	F P	NF P	F Cd	NF Cd	F Cr	NF Cr	F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn	
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	
Detection Limit	5	5	2	2	2	2	5	5	5	5	5	5	5	5	
DS1	10	48	ND	ND	ND	ND	12	13	ND	ND	6	13	ND	18	
DS2		94		ND		ND		23		ND		17		27	
DS3	121	205	ND	ND	ND	ND	13	21	ND	ND	4	17	ND	53	
DS4		324		ND		ND		35		ND		22		90	
DS5	179	352	ND	ND	ND	ND	14	31	ND	ND	4	20	ND	86	
DS6		345		ND		ND		35		ND		24		94	
DS7	155	309	ND	ND	ND	ND	12	35	ND	ND	5	23	ND	83	
DS8		301		ND		ND		56		ND		24		83	
DS9	122	257	ND	ND	ND	ND	13	34	ND	ND	5	20	ND	90	
DS10		243		ND		ND		42		ND		19		81	
DS11	102	241	ND	ND	ND	ND	15	43	ND	ND	5	20	ND	78	
DS12		209		ND		ND		33		ND		15		58	
Min	10	48					12	13			4	13	ND	18	
Max	179	352					15	56			6	24	ND	94	
Med	122	250					13	34			5	20		82	
EMC	119	236						33				19		68	
DS11NF REP1		238						48				19		84	
DS11NF REP2		244						39				21		73	
RPD		3						20				9		14	







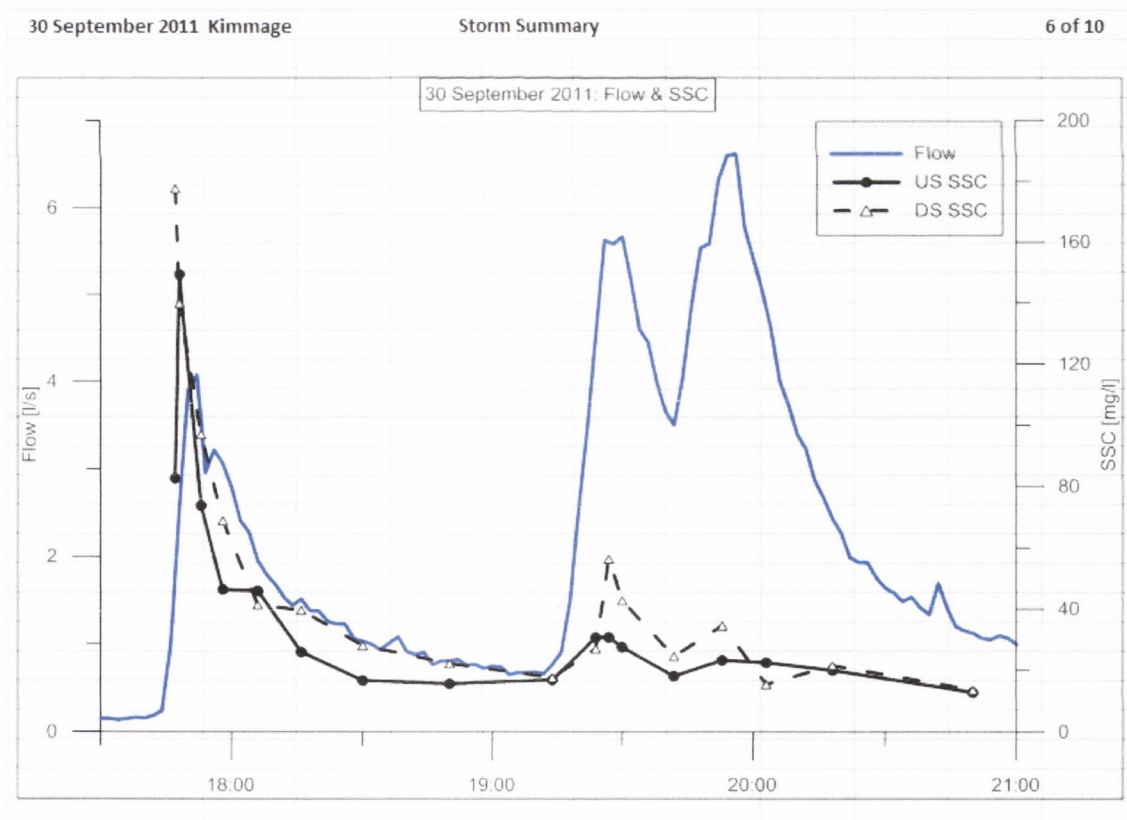


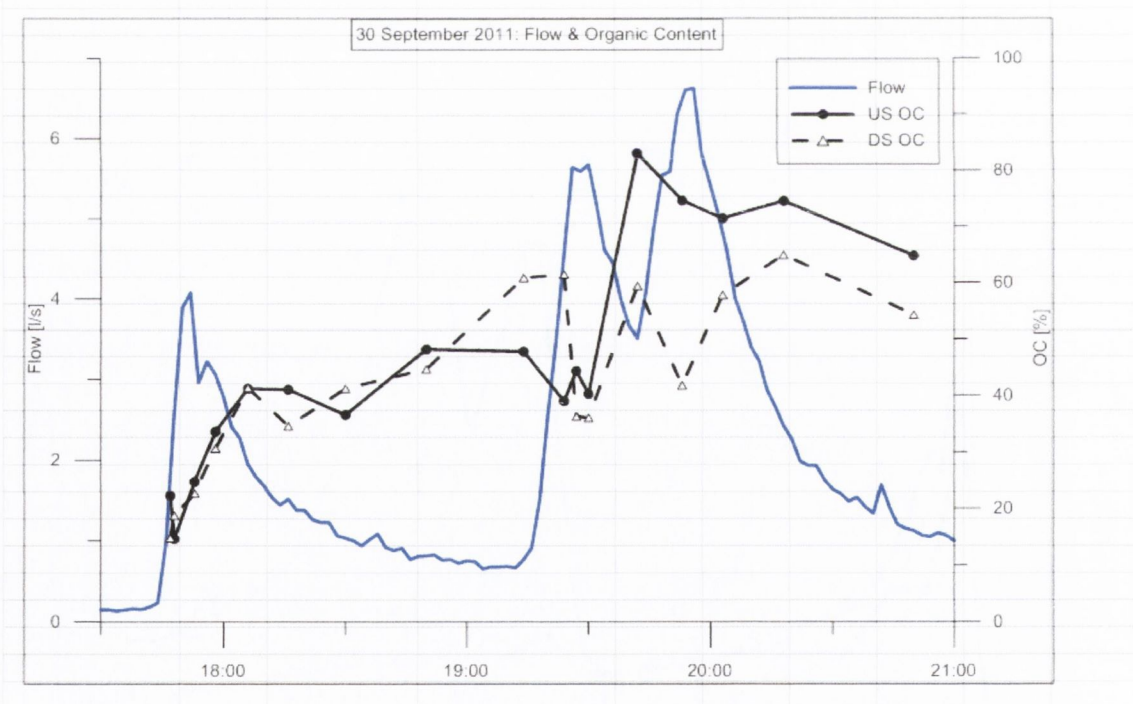
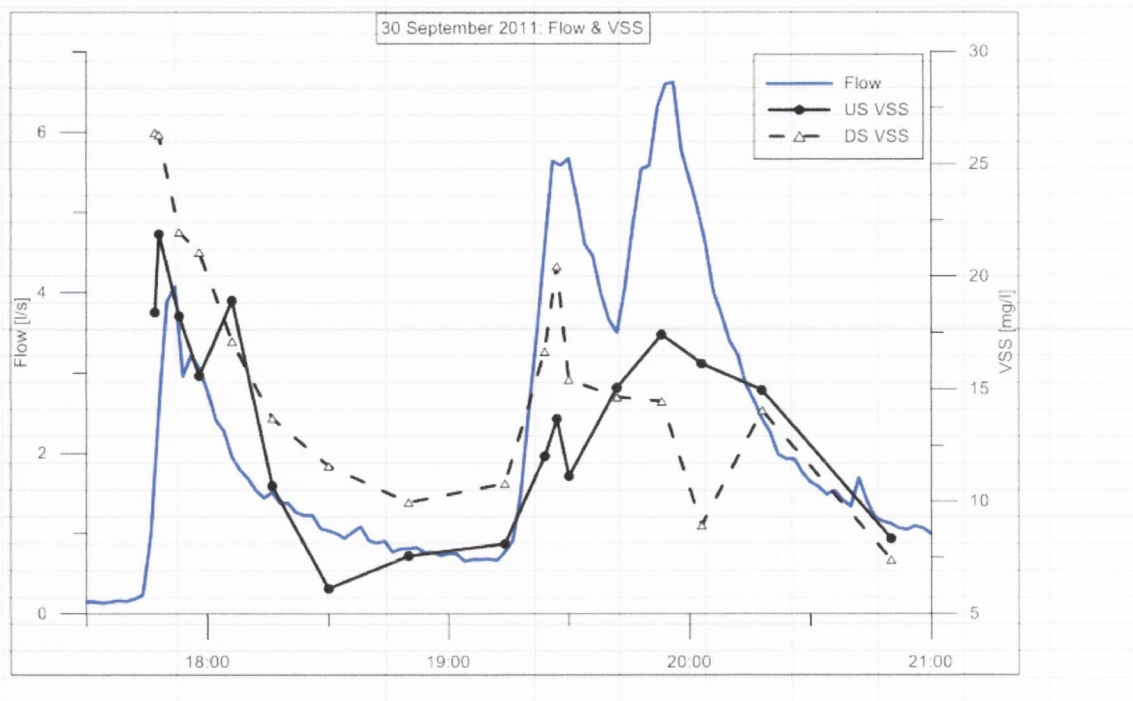


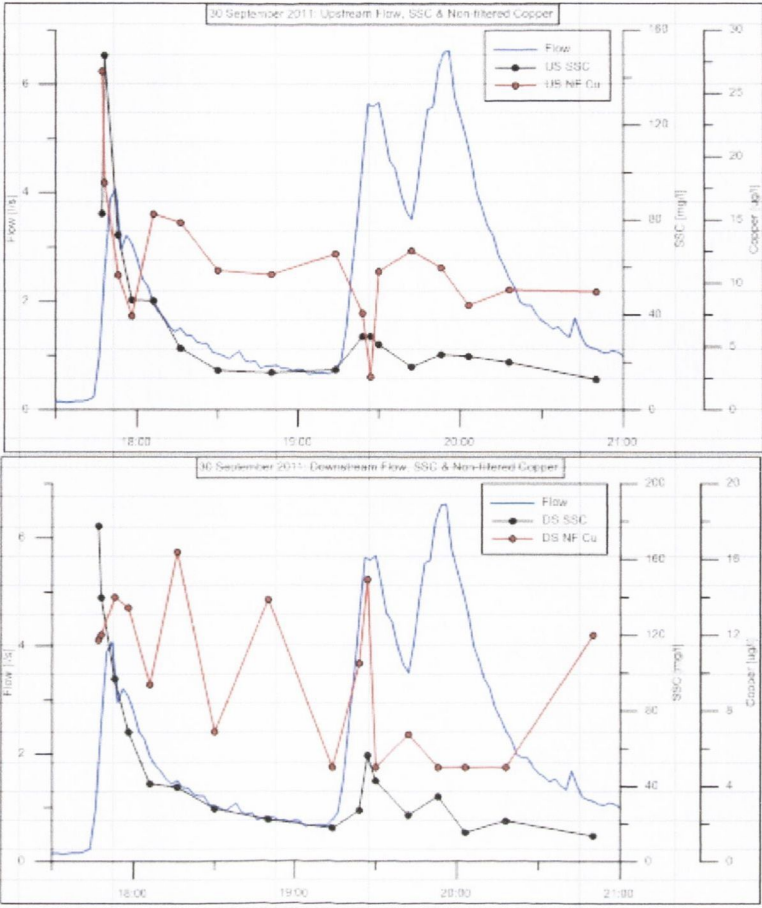
30-Sep-11			Kimmage // Storm Summary														3 of 10		
	Vi Vi/Vt		SSC Vi/Vt	M SS	VSS	VSS*Vi/Vt	M VSS	OC	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90			
	[l]		[mg/l]	[g]	[mg/l]		[g]	[%]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]			
Sample																			
DS1	926 0.03		178	5	164	26	0.80	24	15										
DS2	643 0.02		140	3	90	26	0.55	17	19	39.7	29.7	17.9	6.0	6.7	3	13	60		
DS3	1032 0.03		97	3	100	22	0.74	23	23	40.4	29.1	17.3	6.5	6.6	3	12	62		
DS4	1031 0.03		69	2	71	21	0.71	22	31	31.9	29.9	18.9	9.4	10.0	5	15	90		
DS5	1043 0.03		41	1	43	17	0.58	18	41	25.7	26.3	19.2	13.2	15.6	5	19	114		
DS6	992 0.03		40	1	39	14	0.44	14	35										
DS7	1063 0.03		28	1	30	12	0.40	12	41										
DS8	1071 0.03		22	1	24	10	0.35	11	45										
DS9	1301 0.04		18	1	23	11	0.46	14	61										
DS10	1285 0.04		27	1	35	17	0.70	21	61	8.1	11.8	24.0	25.0	31.2	12	55	151		
DS11	1014 0.03		56	2	57	20	0.68	21	36	7.9	15.6	32.0	22.2	22.3	12	39	138		
DS12	2032 0.07		43	3	87	15	1.02	31	36										
DS13	3304 0.11		25	3	82	15	1.58	48	59	4.7	8.5	23.4	29.7	33.7	17	63	153		
DS14	3488 0.11		35	4	121	14	1.64	50	42	5.6	9.4	27.7	30.4	26.8	15	53	140		
DS15	3183 0.10		15	2	49	9	0.93	28	58	5.8	9.5	28.8	30.0	25.5	15	52	141		
DS16	3003 0.10		22	2	65	14	1.38	42	65	5.4	7.8	26.8	32.2	27.9	17	56	141		
DS17	4243 0.14		14	2	58	7	1.03	31	54										
Min			14			7													
Max			178			26													
Med			35			15													
EMC			37			14		38											
Total Mass					1138			429											

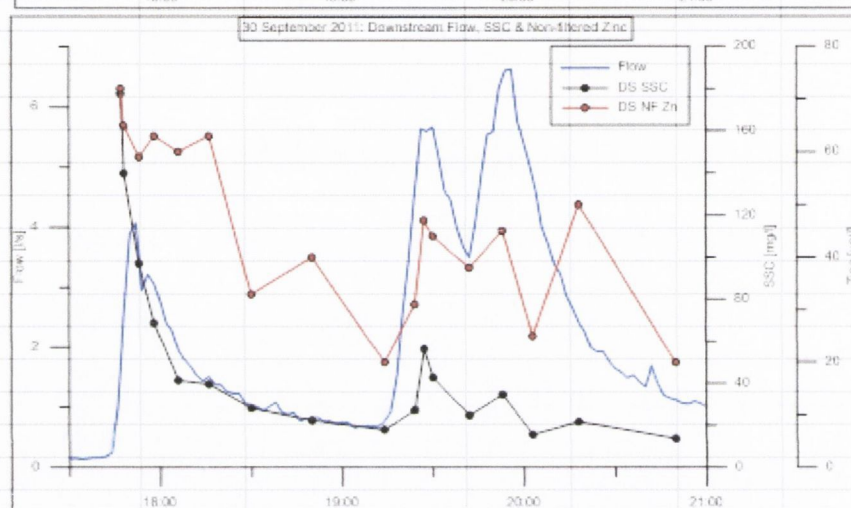
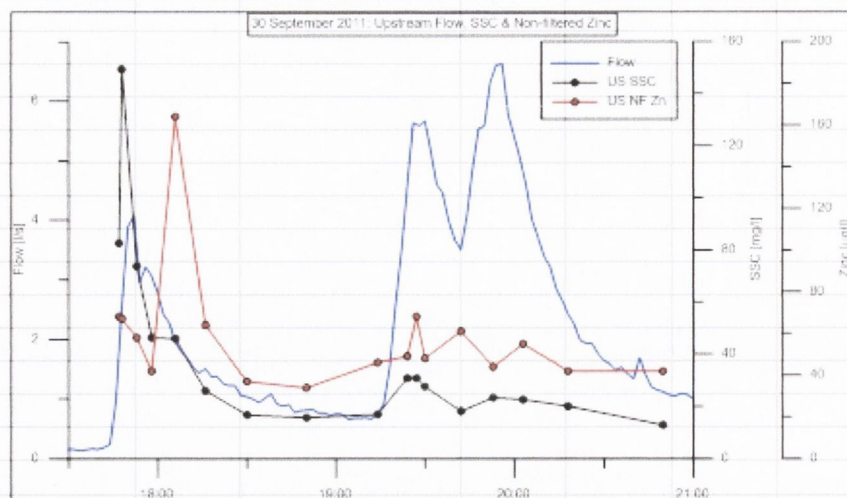
30 September 2011		Kimmage				Storm Summary		4 of 10	
	F Cu [µg/l]	NF Cu [µg/l]	F Pb [µg/l]	NF Pb [µg/l]	F Zn [µg/l]	NF Zn [µg/l]			
Detection Limit	5	5	6	6	5	5			
US1	ND	27	ND	12	16	68			
US2	ND	18	ND	14	18	67			
US3	ND	11	ND	9	17	58			
US4	ND	7	ND	ND	22	42			
US5	ND	15	ND	ND	29	164			
US6	ND	15	ND	ND	24	64			
US7	ND	11	ND	ND	22	37			
US8	ND	11	ND	ND	18	34			
US9	ND	12	ND	ND	23	46			
US10	ND	8	ND	ND	19	49			
US11	ND	5	ND	ND	24	68			
US12	ND	11	ND	ND	18	48			
US13	ND	13	ND	ND	39	61			
US14	ND	11	ND	ND	32	44			
US15	ND	8	ND	ND	35	55			
US16	ND	9	ND	ND	38	42			
US17	ND	9	ND	ND	42	42			
Min	ND	5	ND	ND	16	34			
Max	ND	27	ND	14	42	164			
Med		11			23	49			
EMC		11			30	53			
Digestion Blank		ND		ND		ND			
Filtration Blank	ND		ND		ND				

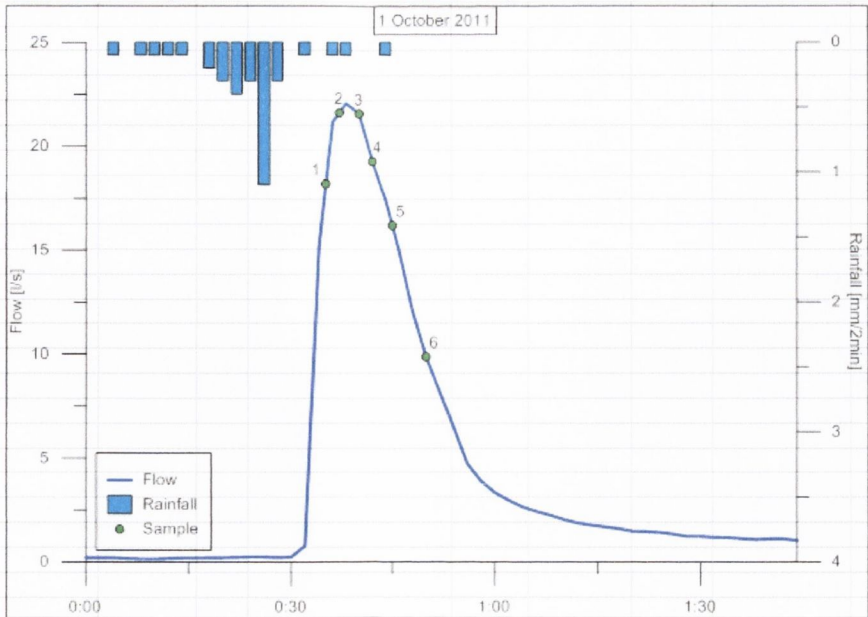
30 September 2011	Kimmage		Storm Summary				5 of 10
	F Cu [µg/l]	NF Cu [µg/l]	F Pb [µg/l]	NF Pb [µg/l]	F Zn [µg/l]	NF Zn [µg/l]	
Detection Limit	5	5	6	6	5	5	
DS1	ND	12	ND	14	48	72	
DS2	ND	12	ND	12	45	65	
DS3	ND	14	ND	8	48	59	
DS4	ND	13	ND	8	55	63	
DS5	ND	9	ND	ND	65	60	
DS6	ND	16	ND	ND	62	63	
DS7	ND	7	ND	ND	54	33	
DS8	ND	14	ND	ND	50	40	
DS9	ND	ND	ND	ND	54	20	
DS10	ND	10	ND	ND	51	31	
DS11	ND	15	ND	ND	51	47	
DS12	ND	ND	ND	ND	44	44	
DS13	ND	7	ND	ND	72	38	
DS14	ND	ND	ND	ND	65	45	
DS15	ND	ND	ND	ND	59	25	
DS16	ND	ND	ND	ND	63	50	
DS17	ND	12	ND	ND	74	20	
Min	ND	7	ND	ND	44	20	
Max	ND	16	ND	14	74	72	
Med		10			54	45	
EMC		9				40	







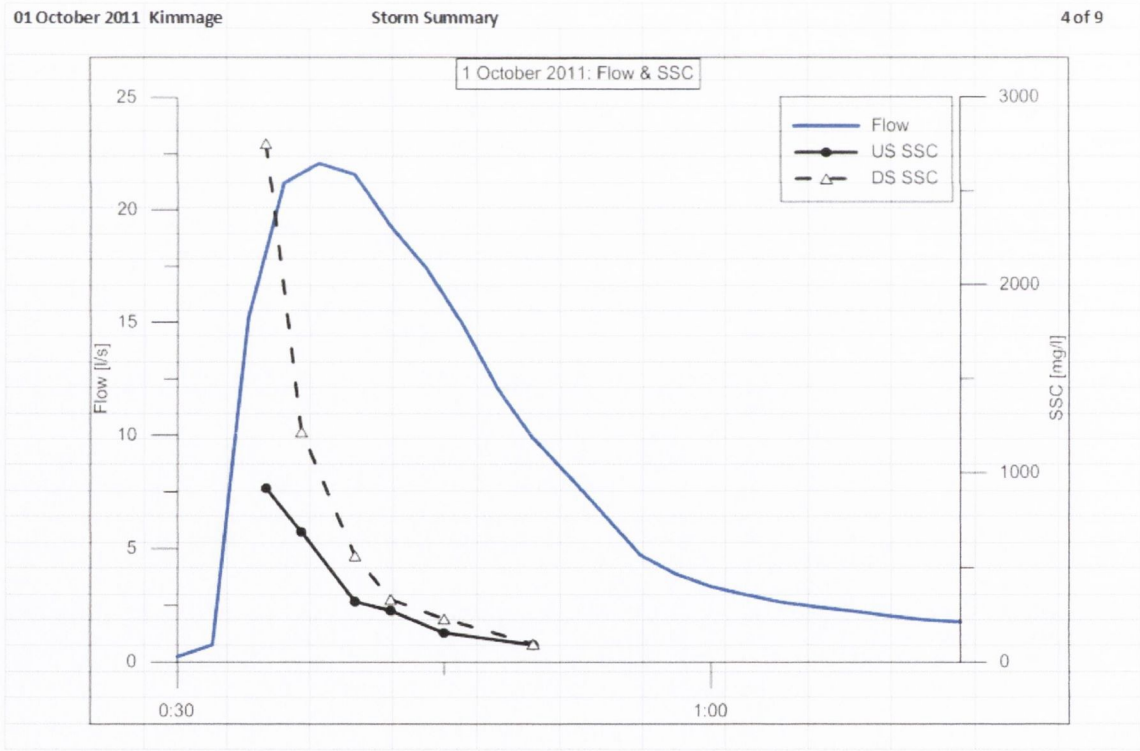


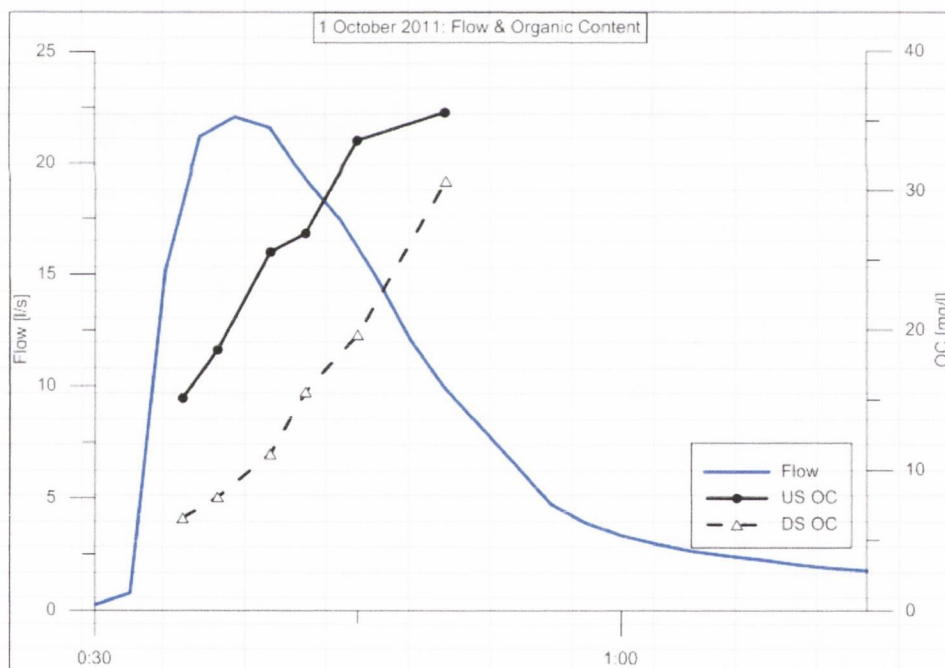
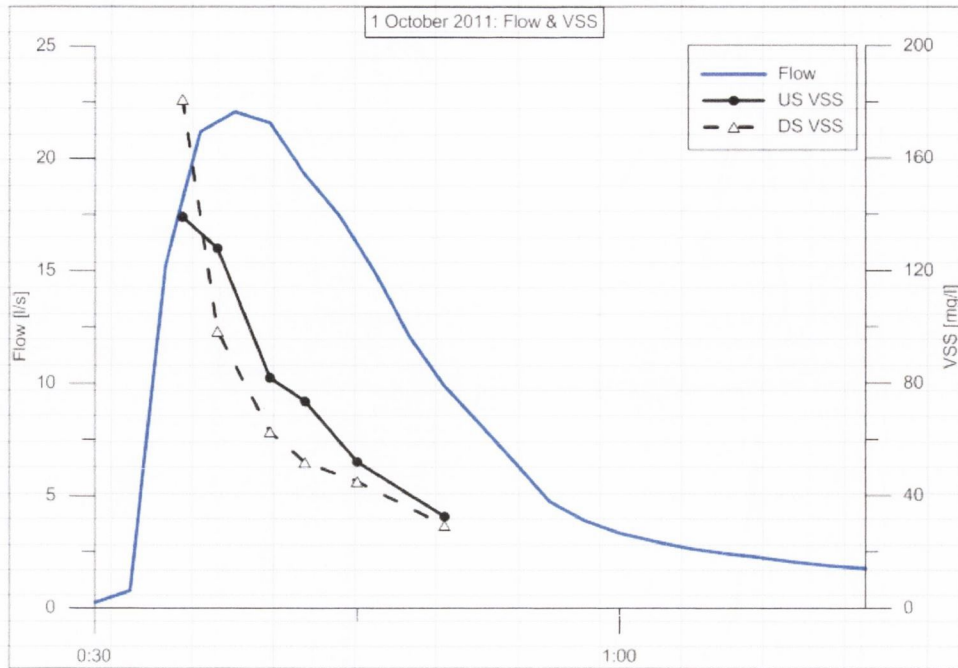


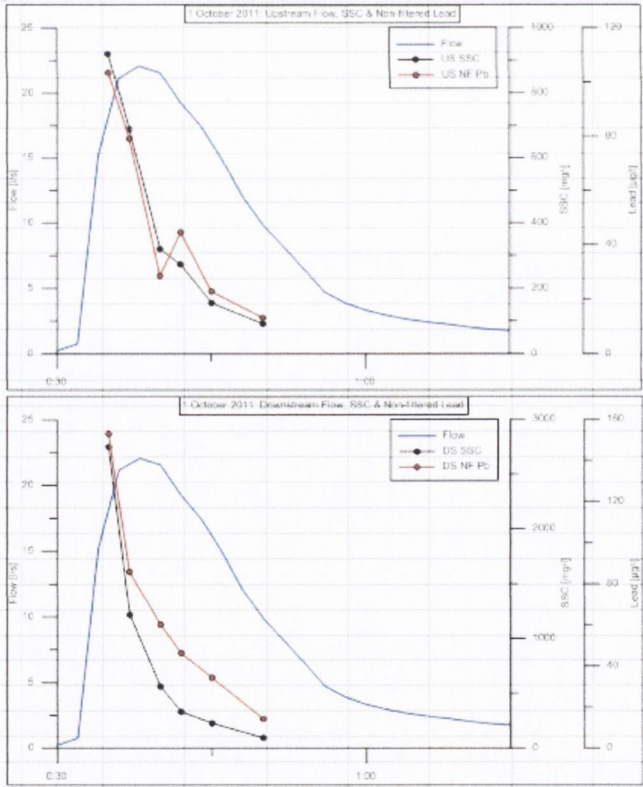
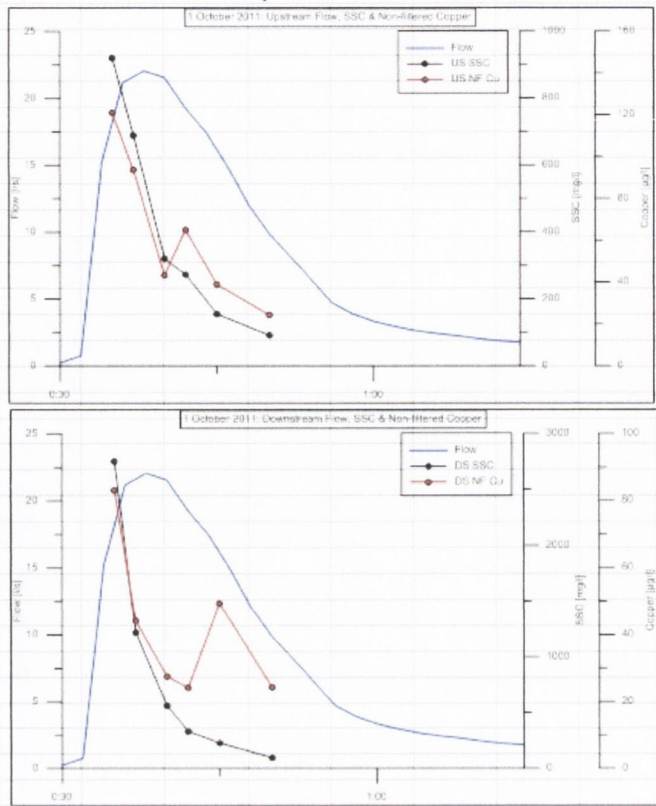
Rainfall	3.5 mm	Av rain intensity	5.3 mm/hr	Analysis			
Runoff	26 m3	Peak hourly intensity	3.5 mm/hr	Single bottle SSC, VSS, PSD, metals, P.			
DCIA	14200 m2	Peak 10min rain intensity	14.4 mm/hr				
Runoff Coeff	0.52	Flow duration	72 minutes	Prev Rain	30/09/2011 19:46	Flow start	01/10/2011 00:32
ADP	0.2 days	Average flow	6 l/s	Rain Start	01/10/2011 00:04	Flow end	01/10/2011 01:44
Rainfall duration	40 min	Peak flow	22 l/s	Rain end	01/10/2011 00:44		

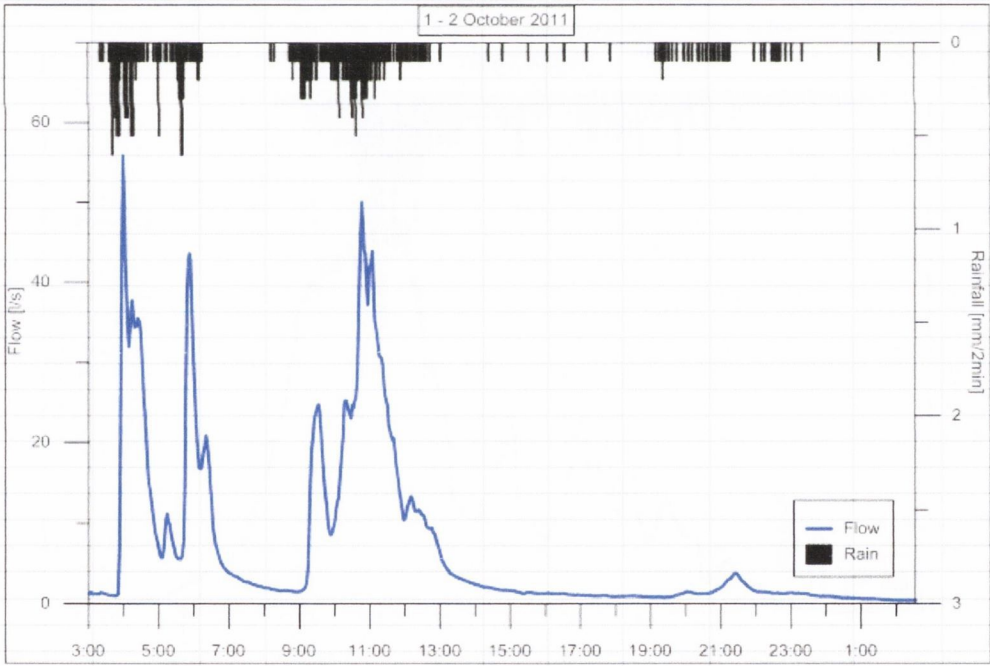
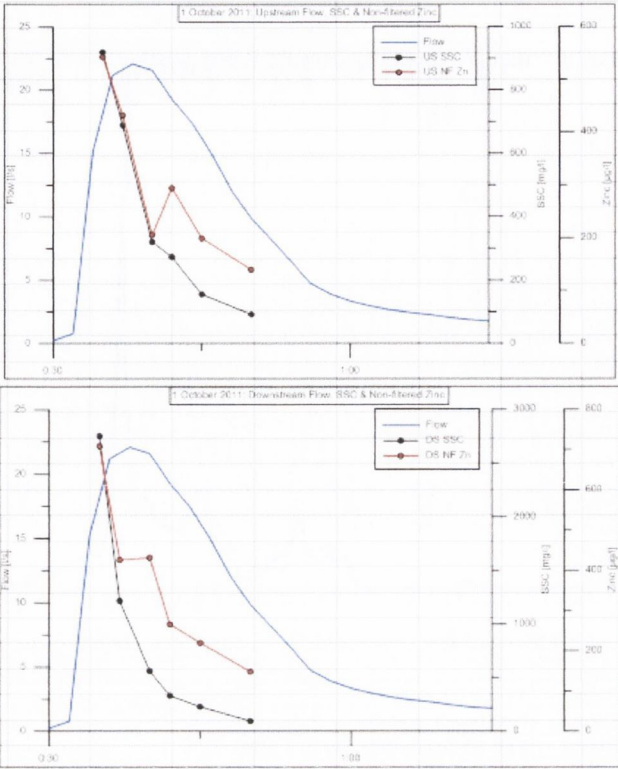
01-Oct-11 Kimmage // Storm Summary															2 of 9		
	Vi	Vj/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90
Sample	[l]		[mg/l]		[g]	[mg/l]			[%]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
US1	4487	0.17	920	159	4126	139	24	624	15	13.3	18.1	27.6	19.1	22.0	8	34	181
US2	3255	0.13	688	86	2241	128	16	416	19	9.8	16.7	29.1	19.5	23.8	10	38	255
US3	3114	0.12	320	38	997	82	10	255	26	6.6	12.6	29.1	24.3	27.3	13	47	218
US4	2652	0.10	273	28	723	74	8	195	27	10.1	16.7	28.1	19.1	24.5	10	39	243
US5	3260	0.13	155	19	505	52	7	170	34	7.2	13.5	32.5	24.9	21.7	13	42	161
US6	9183	0.35	92	32	841	33	12	299	36	6.7	11.9	33.3	27.6	20.5	13	43	144
Min			92			33											
Max			920			139											
Med			297			78									11	41	200
EMC			363			75			21						9	38	192
Total Mass					9434			1959									
DS1	4487	0.17	2752	476	12347	181	31	812	7	9.3	13.0	19.2	15.5	42.9	11	67	294
DS2	3255	0.13	1218	153	3966	98	12	320	8	9.1	14.0	23.0	16.4	36.4	11	53	336
DS3	3114	0.12	563	68	1753	63	8	195	11	6.8	11.9	26.4	21.9	33.0	13	52	250
DS4	2652	0.10	333	34	882	52	5	137	16	6.8	12.4	27.7	22.1	30.7	13	49	260
DS5	3260	0.13	229	29	747	45	6	147	20	7.1	12.4	27.9	23.8	28.4	13	48	232
DS6	9183	0.35	96	34	880	29	10	270	31	6.1	10.3	31.8	30.5	21.3	14	47	136
Min			96			29											
Max			2752			181											
Med			448			57									12	50	250
EMC			793			72			9								
Total Mass					20576			1882									

01 October 2011 Kimmage		Storm Summary						3 of 9	
	F Cu	NF Cu	F Pb	NF Pb	F Zn	NF Zn			
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]			
	5	5	5	5	5	5			
US1	ND	121	ND	103	7	512			
US2	ND	94	ND	79	14	402			
US3	ND	43	ND	29	22	175			
US4	10	65	ND	45	21	264			
US5	7	39	ND	23	30	169			
US6	ND	24	ND	13	24	110			
Min	ND	24	ND	13	7	110			
Max	10	121	ND	103	30	512			
Med		54	ND	37	22	220			
EMC		58		43	20	247			
DS1	ND	83	ND	153	13	679			
DS2	ND	44	ND	86	23	396			
DS3	7	28	ND	60	32	402			
DS4	7	24	ND	46	31	236			
DS5	12	49	ND	34	22	190			
DS6	ND	24	ND	14	39	118			
Min	7	24	ND	14	13	118			
Max	12	83	ND	153	39	679			
Med		36	ND	53	27	316			
EMC		41		59		305			

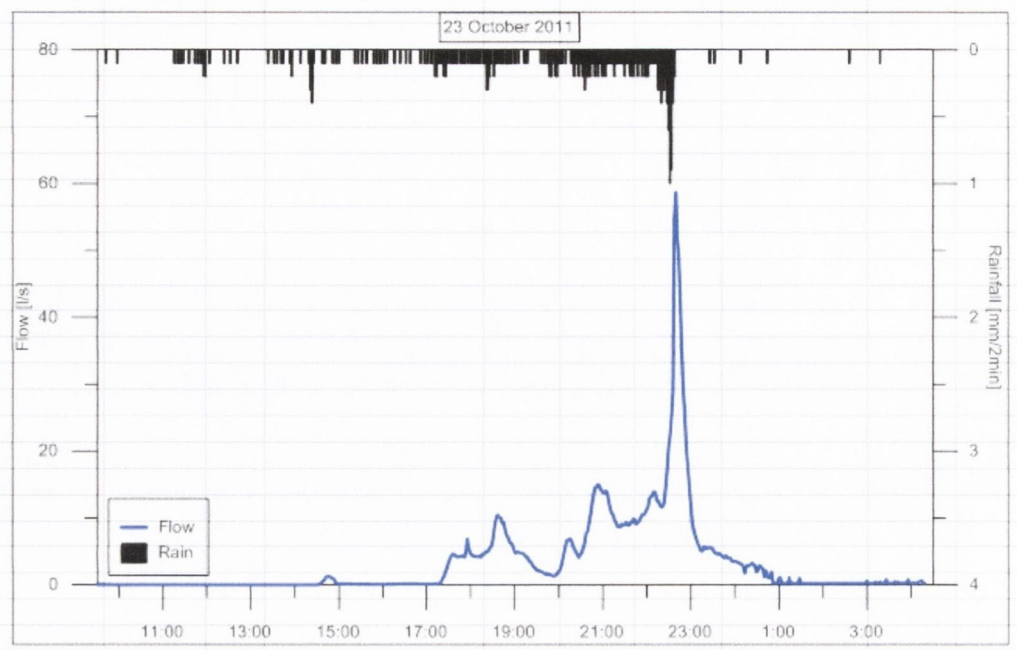




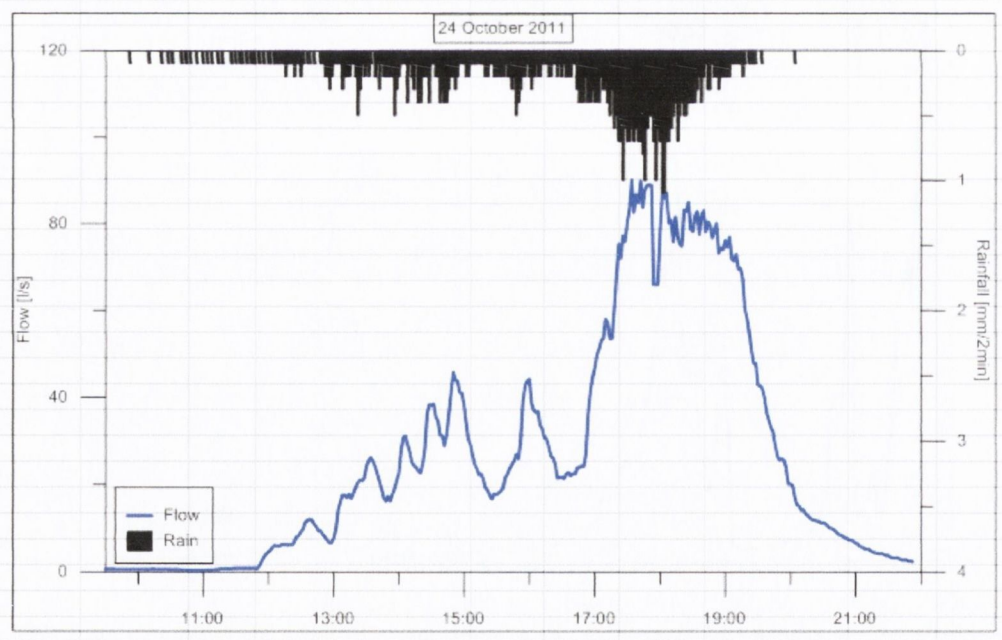




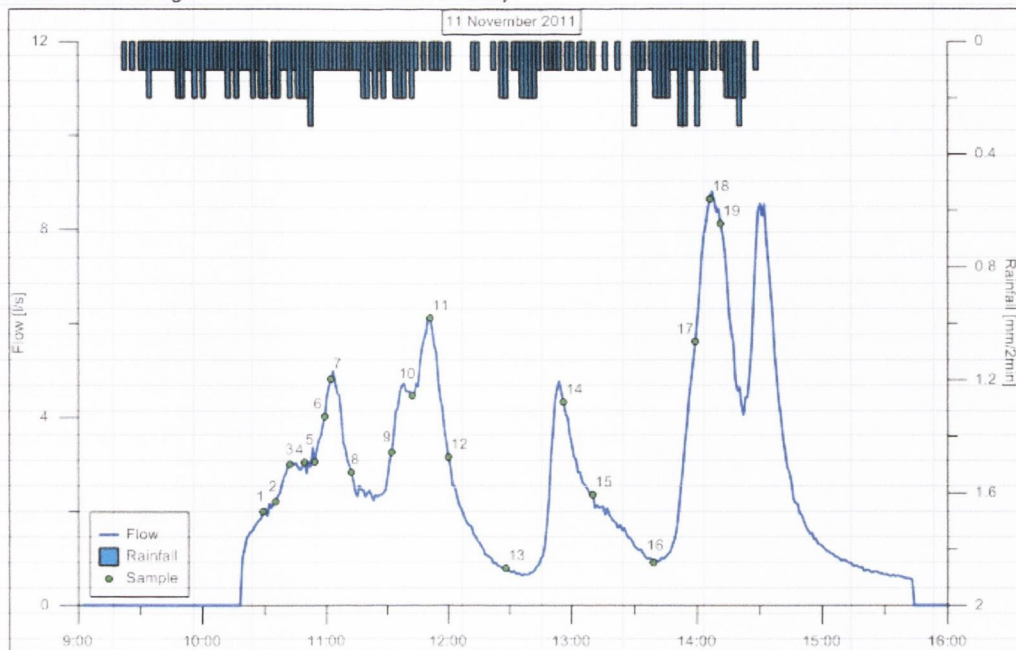
Rainfall	33.8 mm	Av rain intensity	1.5 mm/hr	Analysis			
Runoff	574 m3	Peak hourly intensity	7 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	12.6 mm/hr				
Runoff Coeff	1.2	Flow duration	1360 minutes	Prev Rain	01/10/2011 00:44	Flow start	01/10/2011 03:52
ADP	0.1 days	Average flow	7 l/s	Rain Start	01/10/2011 03:20	Flow end	02/10/2011 02:32
Rainfall duration	1332 min	Peak flow	55.9 l/s	Rain end	02/10/2011 01:32		



Rainfall	27.6 mm	Av rain intensity	1.6 mm/hr	Analysis			
Runoff	224 m3	Peak hourly intensity	7.5 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	19.8 mm/hr				
Runoff Coeff	0.57	Flow duration	822 minutes	Prev Rain	22/10/2011 20:16	Flow start	23/10/2011 14:36
ADP	0.6 days	Average flow	4.5 l/s	Rain Start	23/10/2011 09:42	Flow end	24/10/2011 04:18
Rainfall duration	1056 min	Peak flow	58.7 l/s	Rain end	24/10/2011 03:18		



Rainfall	62.8 mm	Av rain intensity	6.2 mm/hr	Analysis			
Runoff	1186 m3	Peak hourly intensity	21 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	25.8 mm/hr				
Runoff Coeff	1.33	Flow duration	606 minutes	Prev Rain	24/10/2011 03:18	Flow start	24/10/2011 11:46
ADP	0.3 days	Average flow	32.6 l/s	Rain Start	24/10/2011 09:52	Flow end	24/10/2011 21:52
Rainfall duration	612 min	Peak flow	90 l/s	Rain end	24/10/2011 20:04		



Rainfall	17.2 mm	Av rain intensity	3.4 mm/hr	Analysis			
Runoff	54.6 m3	Peak hourly intensity	4.4 mm/hr	Single bottle SSC, VSS, PSD, filtered and non-filtered metals and P.			
DCIA	14200 m2	Peak 10min rain intensity	6.6 mm/hr				
Runoff Coeff	0.22	Flow duration	324 minutes	Prev Rain	09/11/2011 08:42	Flow start	11/11/2011 10:19
ADP	2.0 days	Average flow	2.8 l/s	Rain Start	11/11/2011 09:22	Flow end	11/11/2011 15:43
Rainfall duration	306 min	Peak flow	8.7 l/s	Rain end	11/11/2011 14:28		

	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90
Sample	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
US1	1428	0.026	24	0.63	35	12	0.32	17	50	16.1	24.9	36.3	16.2	6.5	7	24	73
US2	944	0.017	27	0.47	26	13	0.22	12	48	17.4	23.9	33.5	15.5	9.7	6	24	88
US3	1192	0.022	26	0.57	31	12	0.25	14	45	16.4	24.4	34.5	16.3	8.4	7	24	82
US4	1085	0.020	33	0.66	36	13	0.26	14	40	14.5	22.5	37.1	17.9	8.1	8	26	81
US5	1007	0.018	31	0.56	31	15	0.27	15	49	17.6	23.1	31.5	17.1	10.8	6	25	94
US6	969	0.018	22	0.39	21	11	0.19	10	48	16.3	22.3	33.4	17.1	10.7	7	26	94
US7	1572	0.029	24	0.71	39	10	0.28	15	39	15.1	21.8	35.3	18.0	9.8	7	27	89
US8	2651	0.049	23	1.11	60	9	0.43	24	39	16.4	23.6	35.5	16.1	8.5	7	25	82
US9	2819	0.052	10	0.52	28	9	0.45	25	88	15.7	19.0	32.0	19.1	14.1	7	29	111
US10	2768	0.051	16	0.82	45	9	0.43	24	52	15.4	19.4	33.6	21.4	9.7	7	29	91
US11	2664	0.049	17	0.85	46	9	0.45	25	53	16.8	21.4	34.1	19.1	8.7	6	26	84
US12	2471	0.045	24	1.11	60	12	0.53	29	48	16.6	22.0	34.4	16.8	10.1	7	26	91
US13	2707	0.050	8	0.39	21	9	0.43	23									
US14	2712	0.050	19	0.95	52	10	0.50	27	53								
US15	2612	0.048	12	0.57	31	9	0.44	24	76								
US16	2772	0.051	4	0.20	11	8	0.38	21									
US17	3015	0.055	11	0.63	34	9	0.52	28	83	15.5	18.0	29.1	20.9	16.5	7	32	122
US18	2868	0.053	47	2.45	134	13	0.66	36	27	10.6	14.8	34.0	25.9	14.6	9	37	111
US19	16354	0.300	36	10.76	587	16	4.90	267	46	11.5	16.3	33.8	23.7	14.8	9	35	113
Min			4			8											
Max			47			16											
Med			23			10									7	27	90
EMC			24			12			49						7	28	106
Total Mass					1328			651									

11-Nov-11	Kimmage // Storm Summary															3 of 12		
	Vi	Vi/Vt	SSC	SSC~Vi/Vt	M SS	VSS	VSS~Vi/Vt	MVSS	OC	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90	
	[l]		[mg/l]		[g]	[mg/l]			[g]	[%]	[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
Sample																		
DS1	1428	0.026	24	0.64	35	14	0.38	21	59	12.2	17.5	29.0	21.8	18.8	9	35	133	
DS2	944	0.017	28	0.48	26	12	0.21	12	44	18.9	21.4	24.6	18.3	16.8	6	27	116	
DS3	1192	0.022	23	0.51	28	13	0.29	16	57	16.4	21.8	29.6	18.5	13.8	7	27	106	
DS4	1085	0.020	24	0.47	26	13	0.26	14	56	14.4	20.6	30.4	19.5	15.1	8	29	112	
DS5	1007	0.018	21	0.38	21	11	0.21	11	54	15.4	21.3	30.4	18.9	14.1	7	28	108	
DS6	969	0.018	21	0.38	21	15	0.26	14	69	17.7	21.8	27.6	18.0	14.8	7	27	112	
DS7	1572	0.029	42	1.20	65	19	0.55	30	46	13.8	19.7	33.0	20.4	13.1	8	30	105	
DS8	2651	0.049	31	1.51	83	16	0.78	42	51	15.4	22.2	33.3	18.4	10.7	7	27	93	
DS9	2819	0.052	12	0.64	35	11	0.54	30	84	11.6	16.8	34.1	23.3	14.2	9	33	106	
DS10	2768	0.051	21	1.09	59	13	0.66	36	61	13.6	18.4	33.2	21.8	12.8	8	31	103	
DS11	2664	0.049	31	1.50	82	13	0.65	35	43	15.3	21.0	33.9	19.5	10.1	7	28	91	
DS12	2471	0.045	27	1.22	66	11	0.51	28	42	15.7	20.8	30.0	20.8	12.7	7	28	101	
DS13	2707	0.050	12	0.59	32	10	0.51	28	87									
DS14	2712	0.050	18	0.89	49	13	0.65	36	73	11.7	15.0	29.9	25.6	17.8	9	38	119	
DS15	2612	0.048	14	0.66	36	13	0.63	34	94									
DS16	2772	0.051	10	0.51	28	12	0.61	33										
DS17	3015	0.055	13	0.69	38	11	0.62	34	90	12.0	15.0	28.1	27.4	17.5	9	39	113	
DS18	2868	0.053	65	3.42	187	22	1.14	62	33	8.9	13.2	30.7	26.9	20.2	11	42	135	
DS19	16354	0.300	48	14.46	788	19	5.66	308	39	10.7	16.0	34.9	24.0	14.4	9	35	112	
Min			10			10												
Max			65			22												
Med			23			13									7	30	109	
EMC			31			15			48									
Total Mass					1706			826										

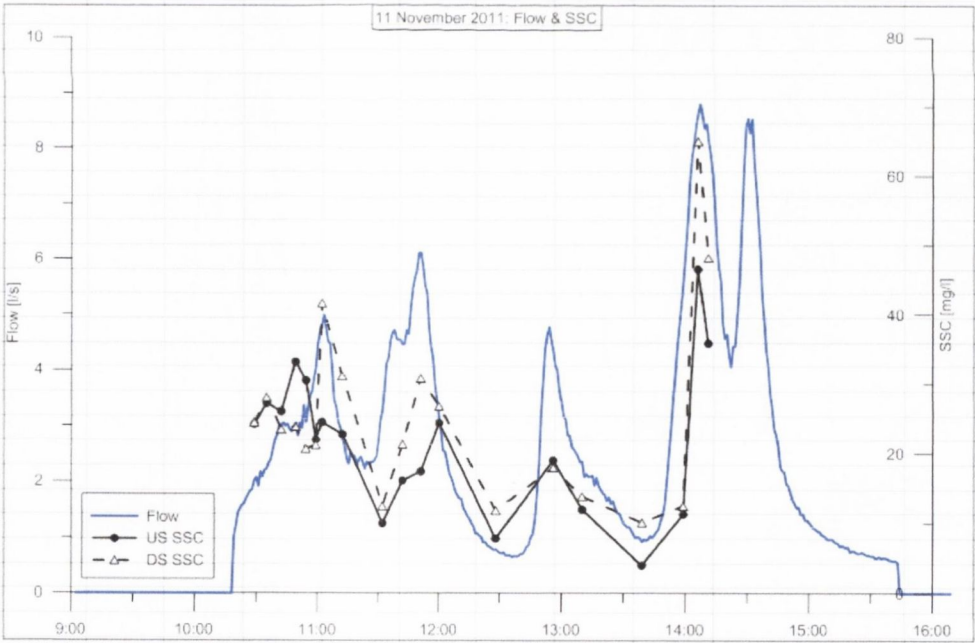
11 November 2011	Kimmage								Storm Summary								4 of 12	
	F P	NF P	F Cd	NF Cd	F Cr	NF Cr			F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn		
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]			[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]		
Detection Limit	5	5	2	2	2	2			5	5	5	5	5	5	5	5		
US1	139	219	ND	ND	4	5			ND	13	ND	8	ND	ND	32	39		
US2	138	187	ND	ND	4	5			ND	14	ND	5	ND	7	28	32		
US3	497	575	ND	ND	4	6			ND	14	ND	6	ND	ND	16	22		
US4	1337	1426	ND	ND	6	7			ND	14	ND	ND	ND	6	21	38		
US5	4620	4906	ND	ND	5	7			ND	13	ND	5	ND	6	20	31		
US6	182	227	ND	ND	4	4			ND	14	ND	6	ND	ND	5	27		
US7	1139	1240	ND	ND	3	3			ND	14	ND	ND	ND	ND	10	39		
US8	167	232	ND	ND	2	3			ND	15	ND	ND	ND	ND	21	38		
US9	169	220	ND	ND	3	3			ND	14	ND	ND	ND	ND	5	26		
US10	176	236	ND	ND	2	3			ND	14	ND	ND	ND	7	20	42		
US11	282	355	ND	ND	2	3			ND	14	ND	5	ND	ND	22	27		
US12	262	324	ND	ND	2	3			ND	13	ND	ND	ND	ND	20	26		
US13	797	848	ND	ND	3	4			ND	13	ND	ND	ND	ND	32	38		
US14	162	204	ND	ND	3	4			ND	14	ND	6	6	7	21	27		
US15	450	582	ND	ND	4	4			ND	12	ND	ND	ND	ND	20	24		
US16	816	871	ND	ND	5	5			ND	11	ND	ND	ND	ND	21	21		
US17	993	1023	ND	ND	4	5			ND	12	ND	ND	ND	6	15	19		
US18	184	262	ND	ND	4	6			ND	10	ND	6	ND	ND	20	32		
US19	52	119	ND	ND	3	4			ND	13	ND	6	ND	ND	19	41		
Min	52	119			2	3				10		5	6	6	5	19		
Max	4620	4906			6	7				15		8	6	7	32	42		
Med	262	324			4	4				14					20	31		
EMC	393	462			3	4				13					22	33		

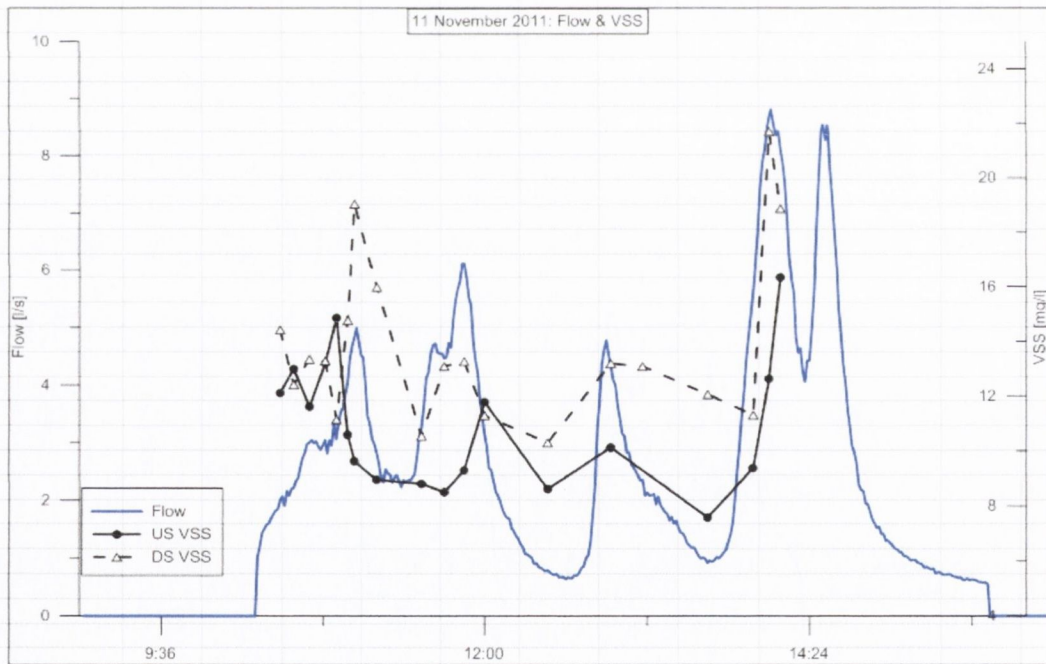
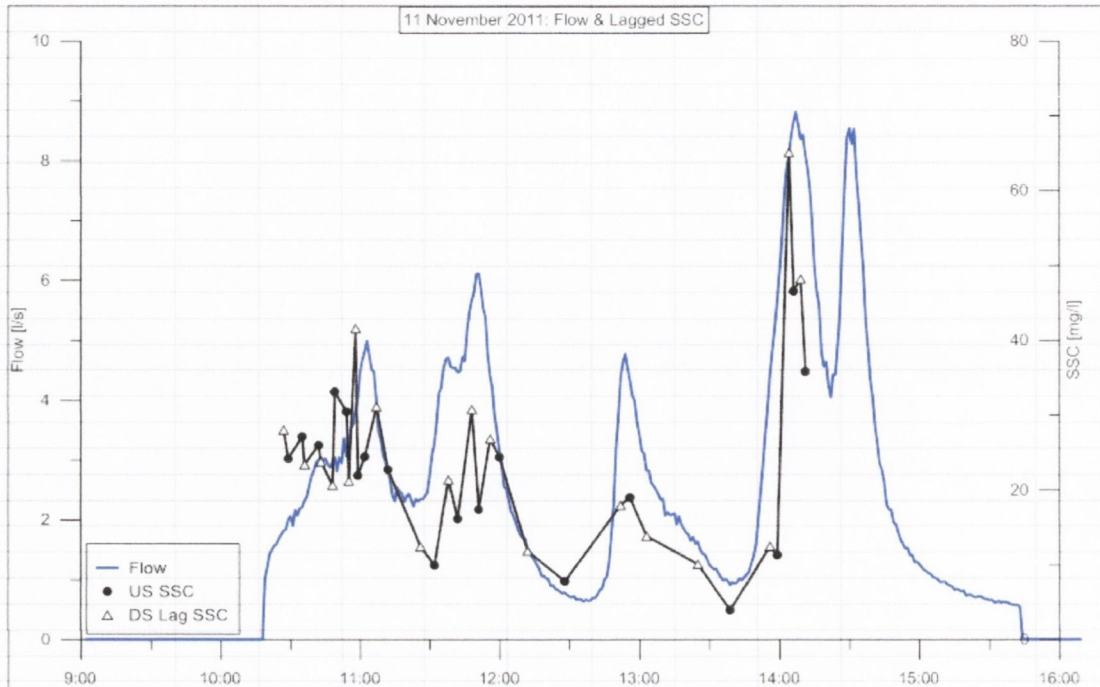
11 November 2011 Kimmage				Storm Summary								5 of 12		
	F P	NF P	F Cd	NF Cd	F Cr	NF Cr	F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]
Detection Limit	5	5	2	2	2	2	5	5	5	5	5	5	5	5
DS 1	69	111	ND	ND	5	6	ND	14	ND	11	ND	ND	33	59
DS 2	75	130	ND	ND	4	7	ND	15	ND	7	ND	4	36	38
DS 3	137	213	ND	ND	4	5	ND	14	ND	6	ND	4	42	49
DS 4	62	117	ND	ND	5	7	ND	14	ND	5	ND	ND	26	30
DS 5	46	99	ND	ND	6	8	ND	15	ND	7	ND	7	45	51
DS 6	203	255	ND	ND	6	7	ND	12	ND	5	ND	ND	41	44
DS 7	521	634	ND	ND	3	5	ND	16	ND	6	ND	ND	35	42
DS 8	221	284	ND	ND	2	3	ND	14	ND	7	ND	7	26	32
DS 9	136	173	ND	ND	3	4	ND	5	ND	ND	ND	6	22	30
DS 10	100	155	ND	ND	2	3	ND	14	ND	ND	ND	ND	28	35
DS 11	369	454	ND	ND	2	3	ND	15	ND	6	ND	6	36	41
DS 12	67	115	ND	ND	2	3	ND	17	ND	6	ND	ND	26	35
DS 13	337	403	ND	ND	3	3	ND	15	ND	7	ND	ND	5	11
DS 14	36	82	ND	ND	3	5	ND	15	ND	ND	ND	16	22	30
DS 15	48	95	ND	ND	4	4	ND	13	ND	ND	ND	ND	8	9
DS 16	25	54	ND	ND	4	4	ND	12	ND	ND	ND	ND	29	34
DS 17	47	70	ND	ND	5	5	ND	11	ND	ND	ND	ND	24	30
DS 18	24	75	ND	ND	4	6	ND	13	ND	5	ND	ND	34	43
DS 19	36	102	ND	ND	3	4	ND	15	ND	6	ND	ND	36	47
Min	24	54			2	3		5		5		4	5	9
Max	521	634			6	8		17		11		16	45	59
Med	69	117			4	5		14					29	35
EMC	104	160			3	4		14						38
DS 6NF REP1		255		ND		7		13		6		ND		43
DS 6NF REP2		255		ND		7		14		5		ND		47
RPD		0.1				0		7		18				9

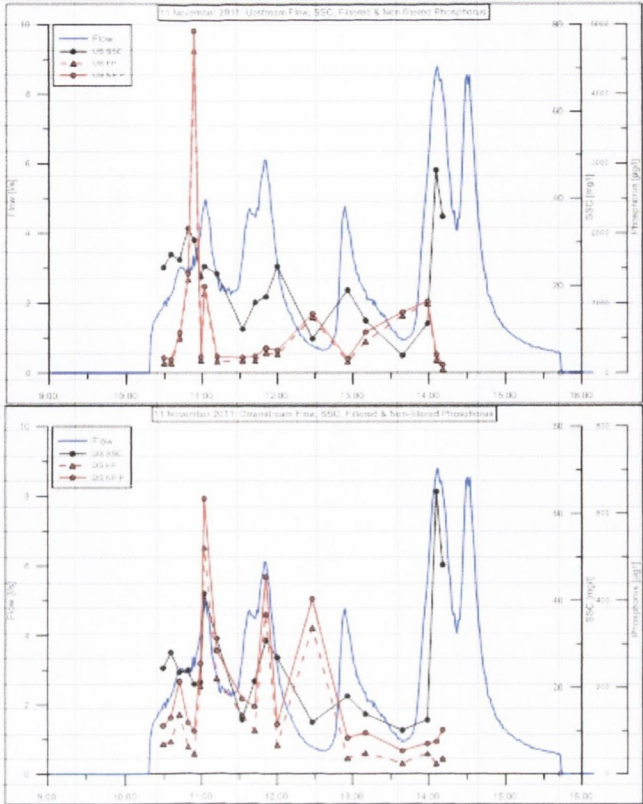
11 November 2011 Kimmage

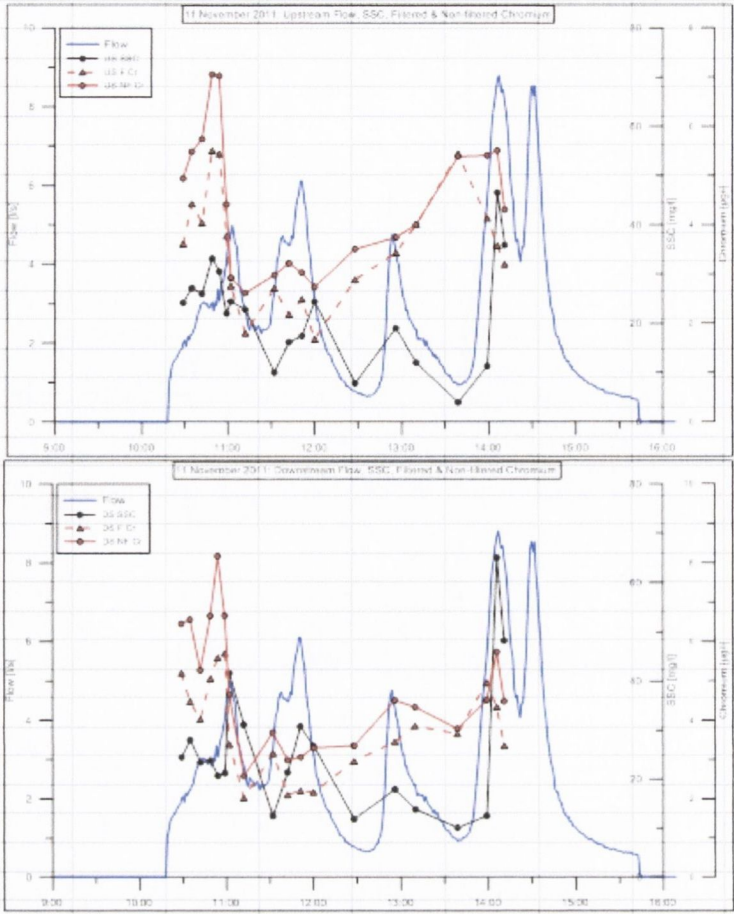
Storm Summary

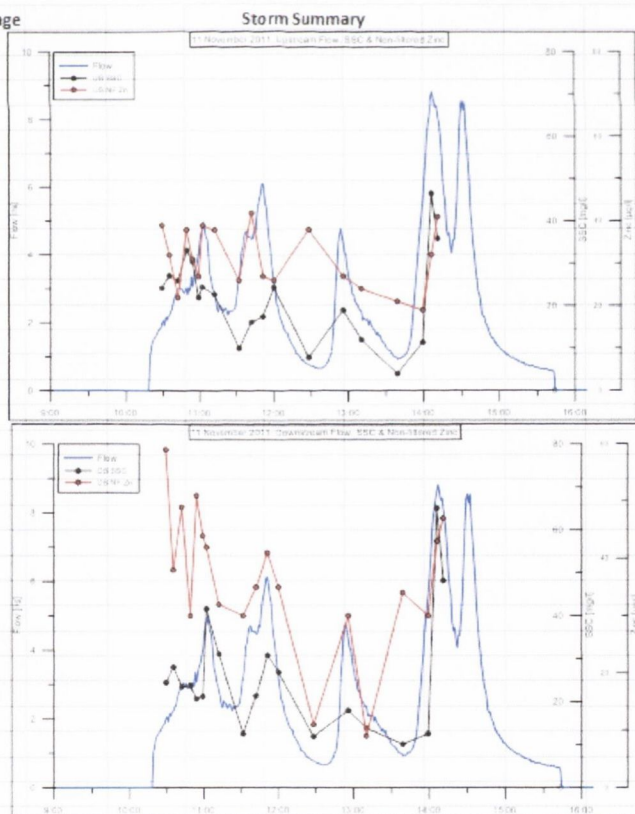
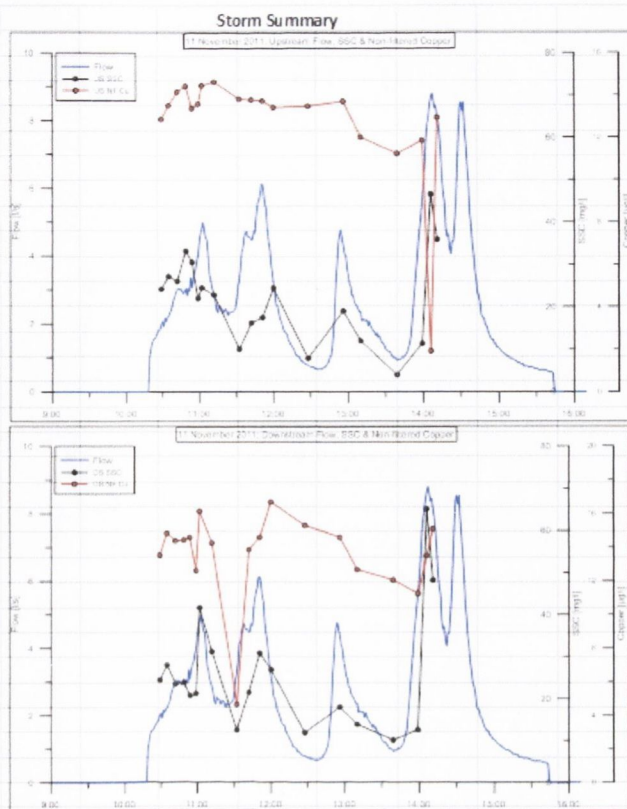
6 of 12

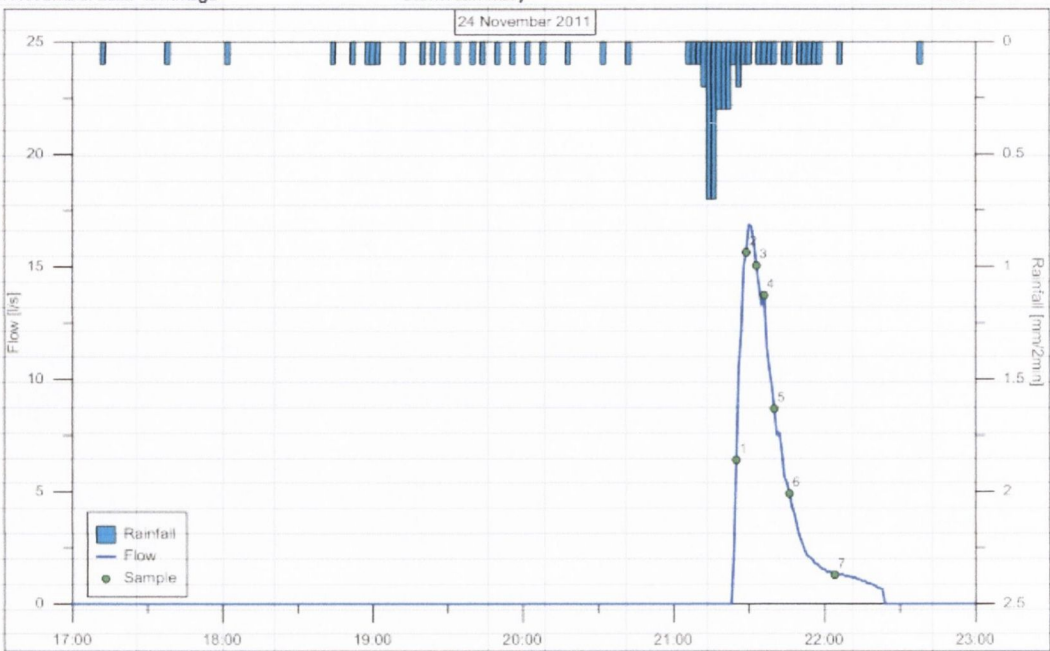








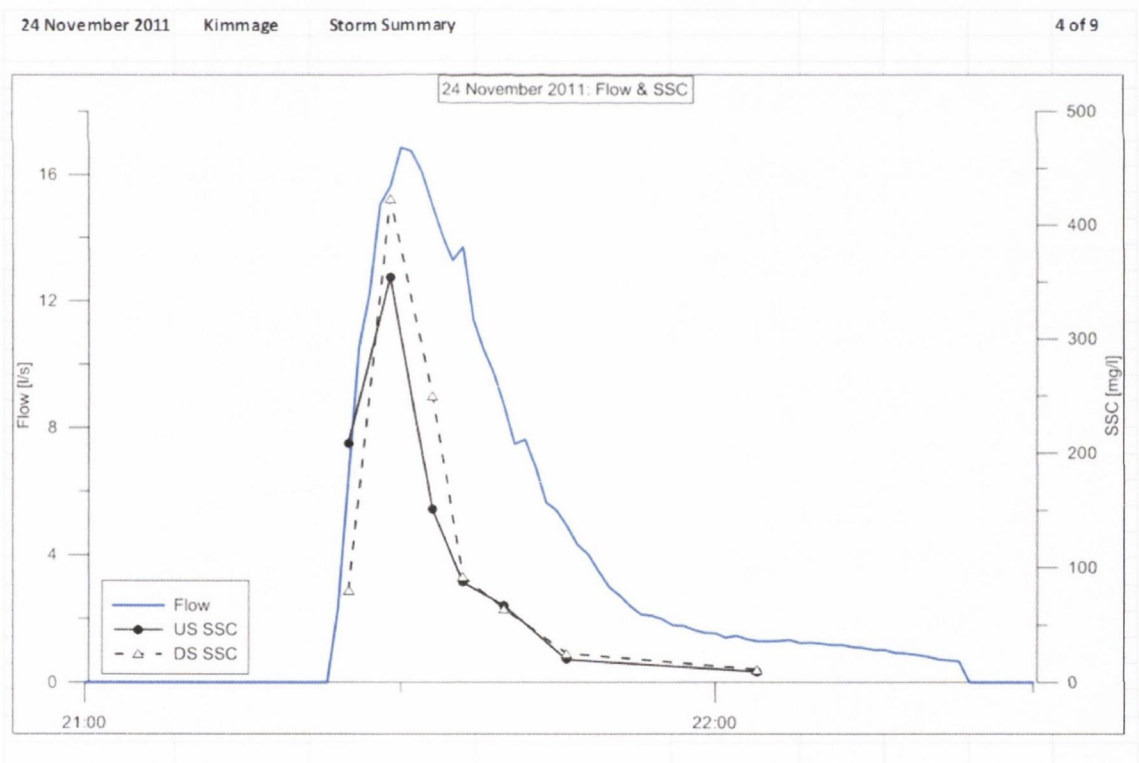


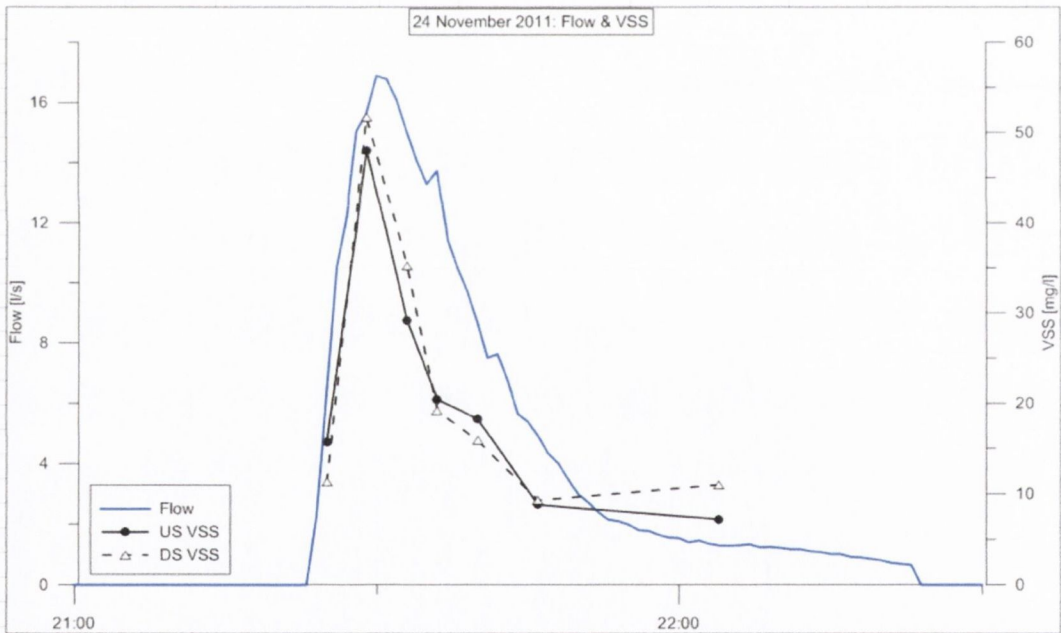
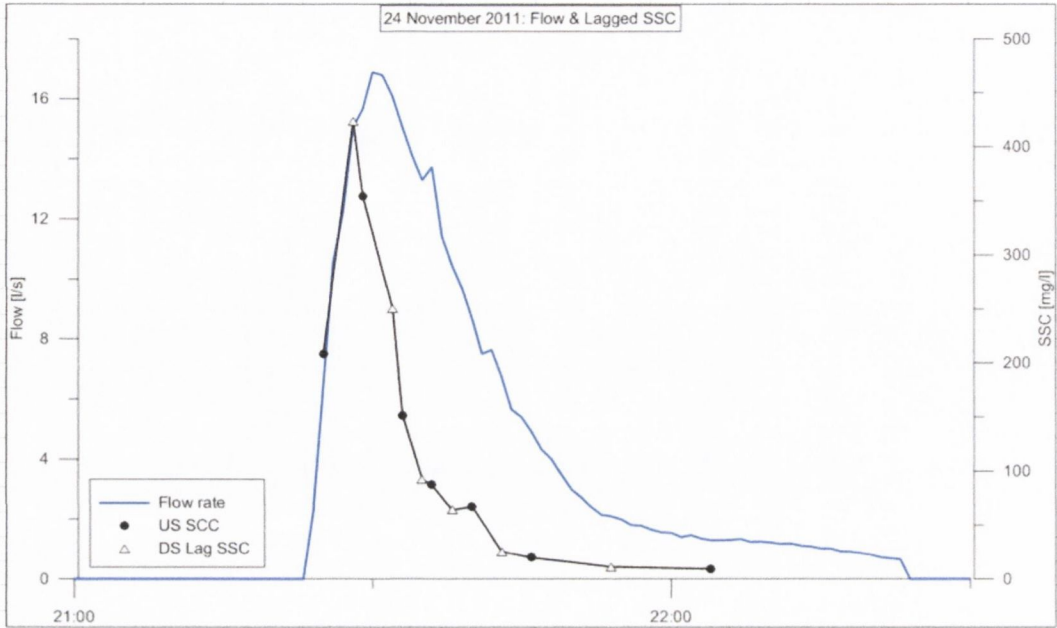


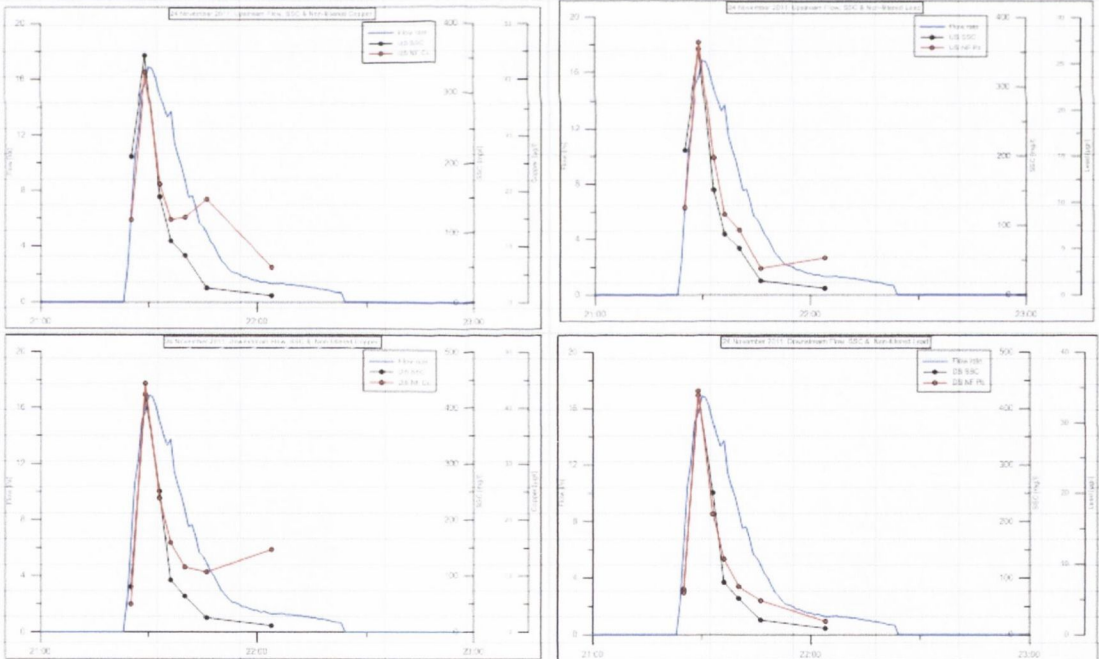
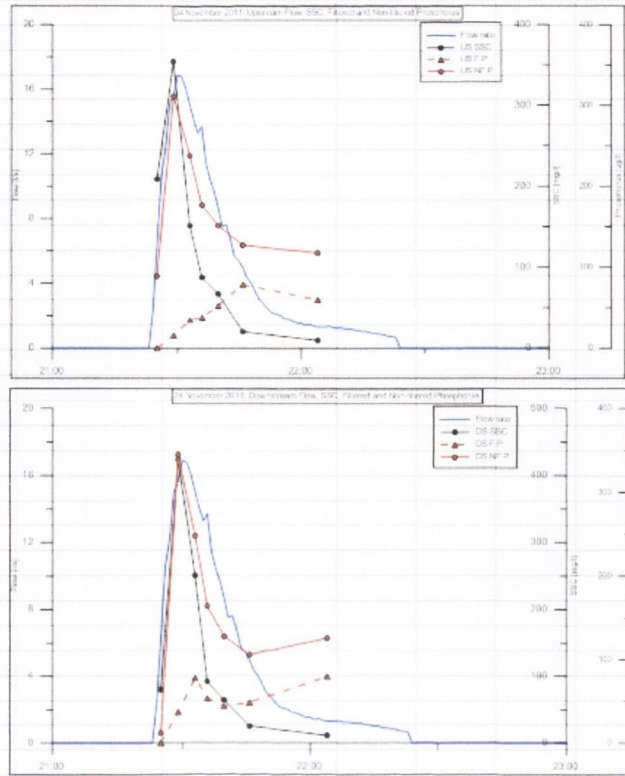
Rainfall	6.8 mm	Av rain intensity	1.3 mm/hr	Analysis			
Runoff	18.4 m3	Peak hourly intensity	4.4 mm/hr	Single bottle SSC, VSS, PSD, filtered and non-filtered metals and P.			
DCIA	14200 m2	Peak 10min rain intensity	13.8 mm/hr				
Runoff Coeff	0.19	Flow duration	59 minutes	Prev rain	16/11/2011 23:24	Flow start	24/11/2011 21:24
ADP	7.7 days	Average flow	5.2 l/s	Rain start	24/11/2011 17:12	Flow end	24/11/2011 22:23
Rainfall duration	326 min	Peak flow	16.9 l/s	Rain end	24/11/2011 22:38		

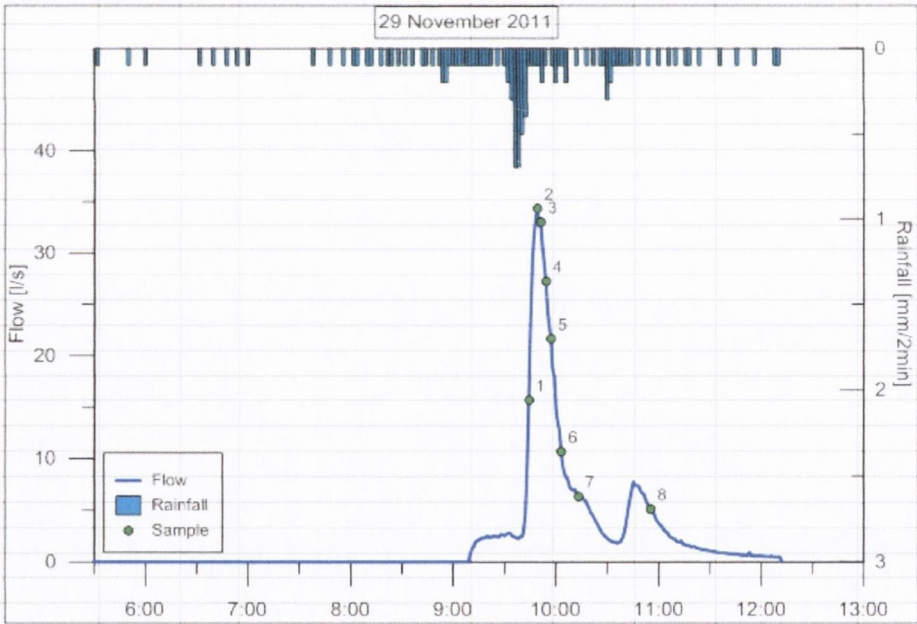
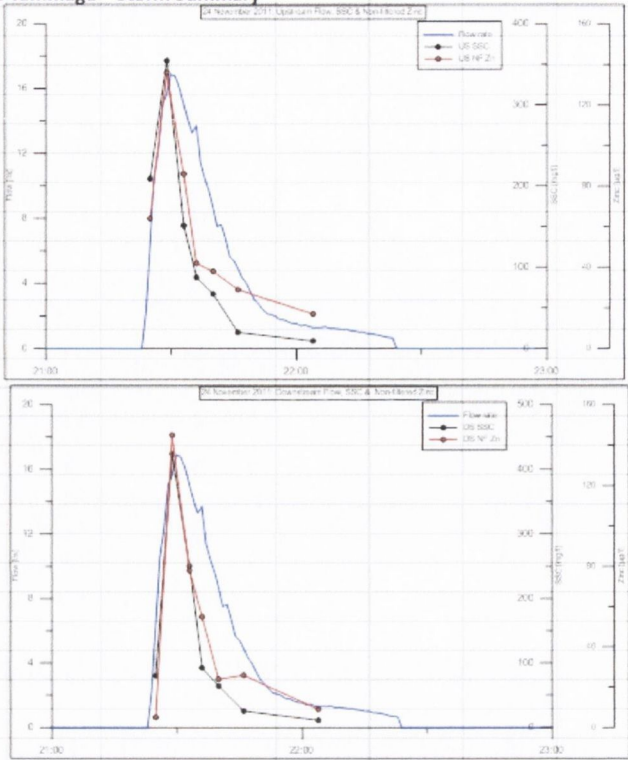
24-Nov-11 Kimmage // Storm Summary																		2 of 9		
Sample	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	%Org	pH	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90		
	[l]		[mg/l]		[g]	[mg/l]		[g]			[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]		
US1	1889	0.10	209		21	394	16	2	30	7	7.8	9.1	14.6	32.6	26.2	17.4	11	39	126	
US2	3786	0.21	355		73	1343	48	10	182	14	7.5	11.5	16.1	29.2	22.4	20.5	9	38	169	
US3	3177	0.17	151		26	481	29	5	93	19	7.5	8.8	13.3	29.6	24.2	23.6	11	43	188	
US4	2442	0.13	87		12	213	20	3	50	23	7.5	8.4	13.0	31.1	25.6	21.8	11	42	156	
US5	2345	0.13	67		9	157	18	2	43	27	7.6	9.2	13.6	32.0	25.9	19.3	11	40	134	
US6	2338	0.13	20		3	47	9	1	20	44	7.5	10.4	13.8	32.2	25.6	18.0	10	39	128	
US7	2392	0.13	9		1	22	7	1	17	77	7.8	14.1	16.6	29.1	22.5	17.7	7	34	120	
Min			9				7													
Max			355				48													
Med			87				18			7.5							11	39	135	
EMC			145				24			16							10	38	156	
Total Mass					2658				434											
DS1	1889	0.10	80		8.3	152	11	1.2	21	14	7.9	7.1	11.6	28.2	28.0	25.1	13	49	153	
DS2	3786	0.21	424		87.3	1604	52	10.6	196	12	7.8	11.4	16.2	30.4	22.8	19.2	9	37	149	
DS3	3177	0.17	251		43.4	797	35	6.1	112	14	7.5	11.7	17.5	31.7	21.5	17.6	9	34	138	
DS4	2442	0.13	92		12.3	226	19	2.6	47	21	7.4	11.5	16.3	29.5	21.7	21.1	9	37	156	
DS5	2345	0.13	64		8.2	150	16	2.0	37	25	7.5	11.2	16.3	31.1	22.8	18.6	9	36	132	
DS6	2338	0.13	25		3.2	60	9	1.2	22	36	7.5	10.4	14.6	30.2	24.0	20.8	10	39	142	
DS7	2392	0.13	11		1.5	27	11	1.4	26	97	7.8	13.6	16.6	25.7	22.4	21.8	8	37	130	
Min			11				9													
Max			424				52													
Med			80				16			7.5							9	37	143	
EMC			164				25			15										
Total Mass					3015				461											

24 November 2011 Kimmage		Storm Summary												3 of 9	
	FP	NF P	F Cd	NF Cd	F Cr	NF Cr	F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn	
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	
Detection Limit	5	5	2	2	2	2	5	5	5	5	5	5	5	5	
US1	ND	89	ND	ND	2	5	5	15	ND	15	ND	9	5	64	
US2	15	311	ND	ND	6	11	8	41	ND	23	ND	27	15	136	
US3	35	238	ND	ND	2	3	10	21	ND	10	ND	15	19	86	
US4	38	177	ND	ND	ND	ND	5	15	ND	5	ND	9	15	42	
US5	52	152	ND	ND	ND	ND	5	15	ND	8	ND	7	9	38	
US6	78	127	ND	ND	ND	ND	12	18	ND	ND	ND	5	19	29	
US7	59	117	ND	ND	ND	ND	8	6	ND	ND	ND	5	24	17	
Min	ND	89			2	3	8	6		5		ND	5	17	
Max	78	311			6	11	12	41		23		27	24	136	
Med	38	152					8	15				9	15	42	
EMC	39	189					8	21				12	16	65	
DS1	ND	12	ND	ND	2	2	ND	5	ND	ND	ND	6	7	5	
DS2	37	345	ND	ND	4	7	ND	44	ND	23	ND	35	15	145	
DS3	78	248	ND	ND	4	5	11	24	ND	12	ND	17	46	78	
DS4	54	164	ND	ND	ND	ND	ND	16	ND	5	ND	11	19	55	
DS5	44	128	ND	ND	ND	ND	10	12	ND	ND	ND	7	12	24	
DS6	49	106	ND	ND	ND	ND	ND	11	ND	ND	ND	ND	19	26	
DS7	80	126	ND	ND	ND	ND	10	15	ND	ND	ND	ND	17	9	
Min	ND	12			2	2	10	5		5		ND	7	5	
Max	80	345			4	7	11	44		23		35	46	145	
Med	49	128						15				7	17	26	
EMC	50	183						20				14		58	
Dig Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	18	
DS1 NF REP1		349		ND		8		45		24		34		152	
DS1 NF REP2		340		ND		7		48		22		35		139	
RPD		3				13		5				3		9	



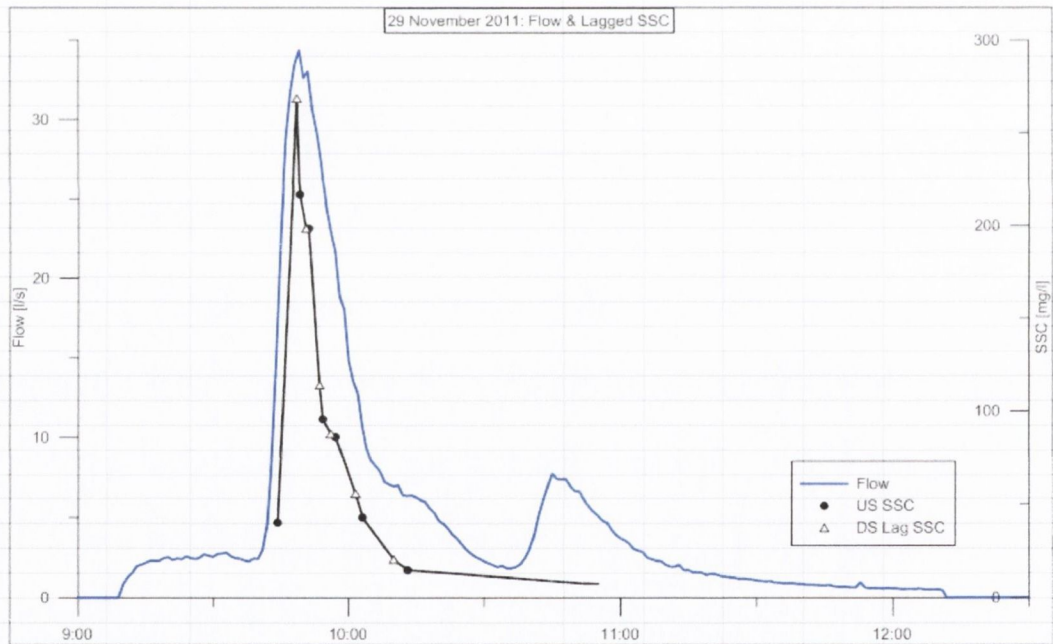
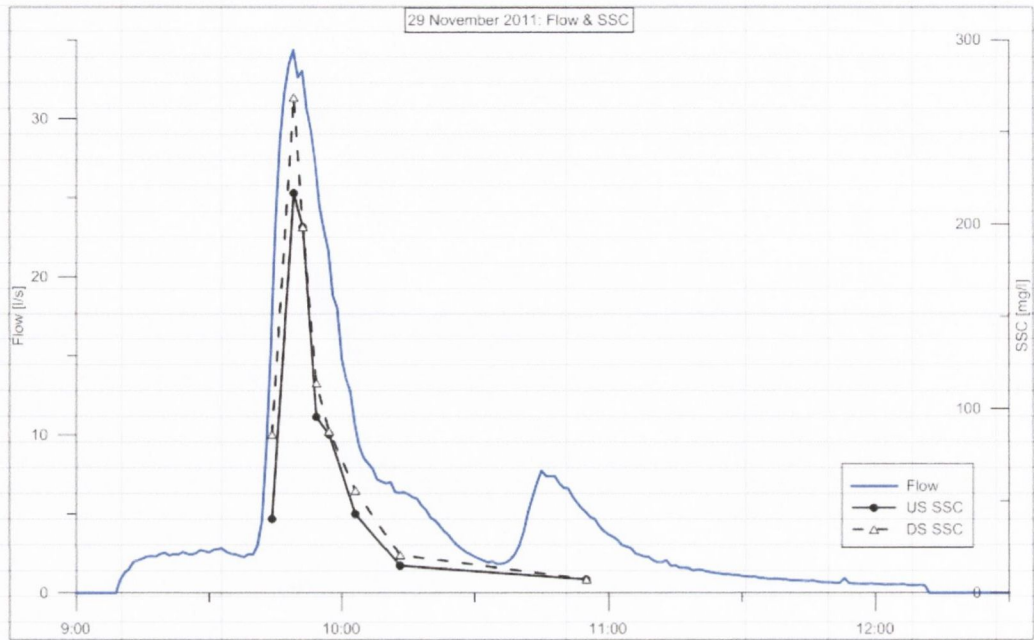


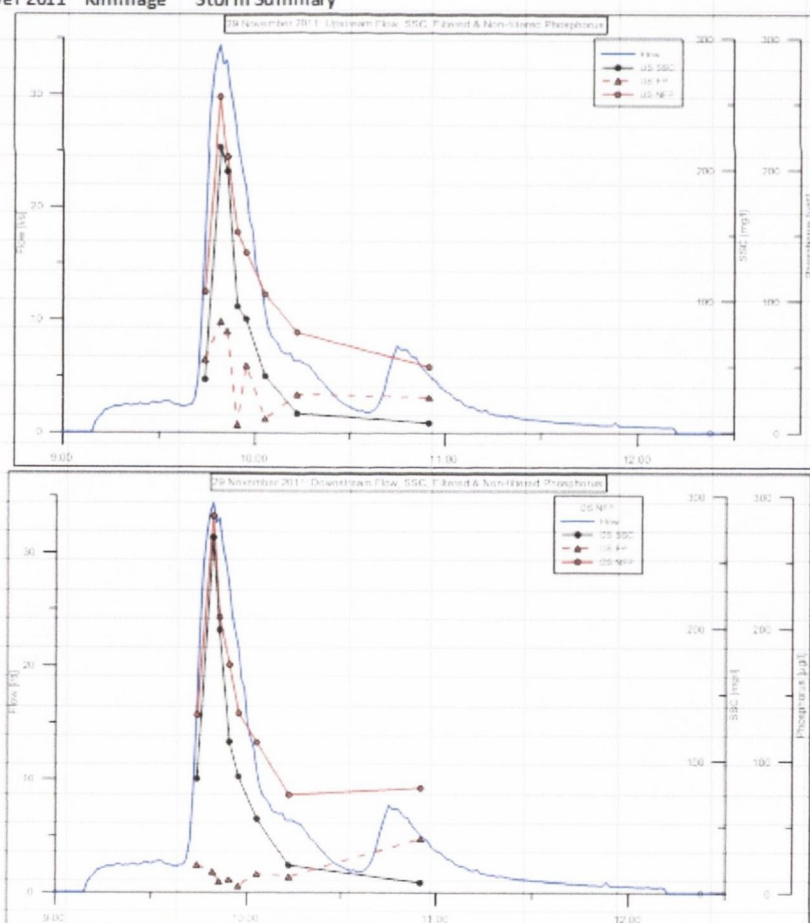
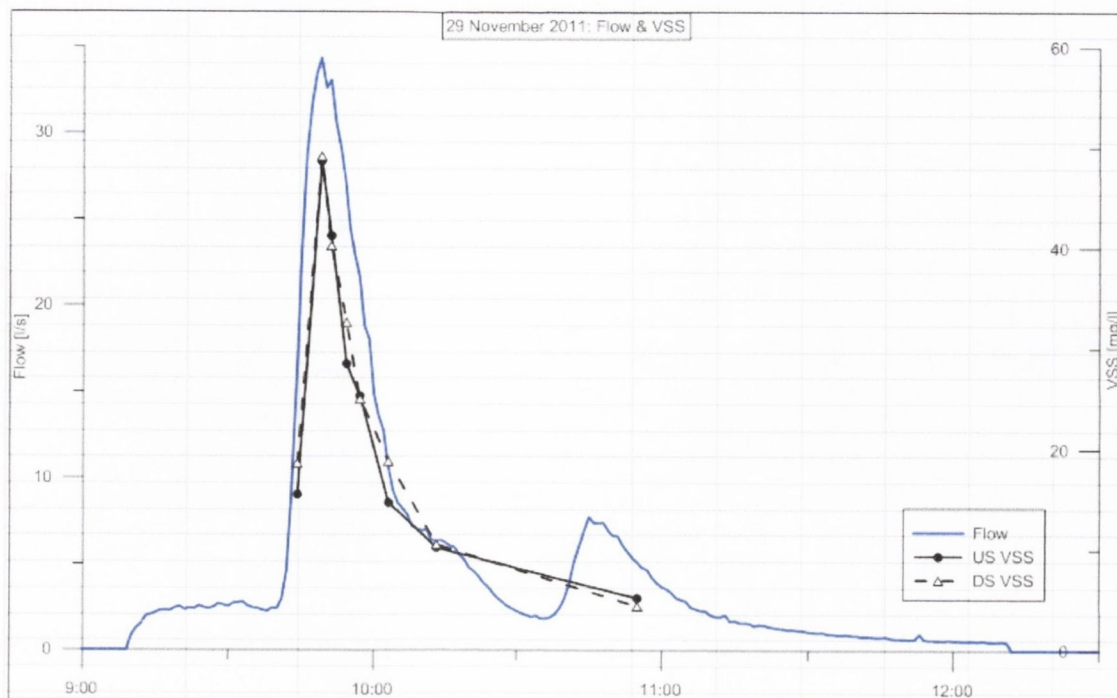


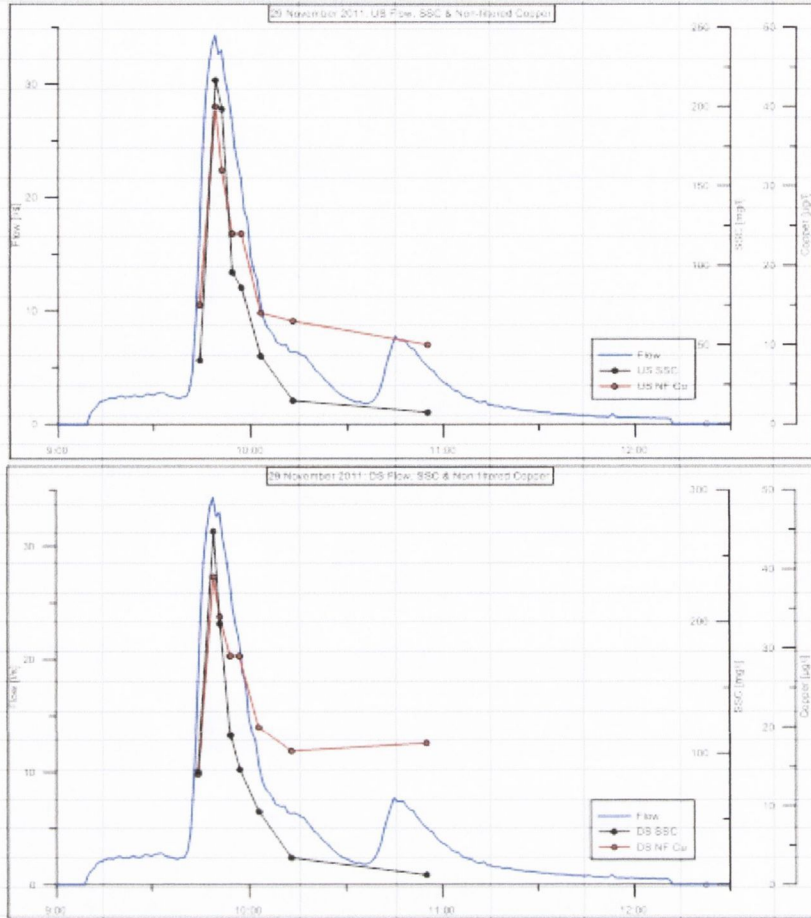


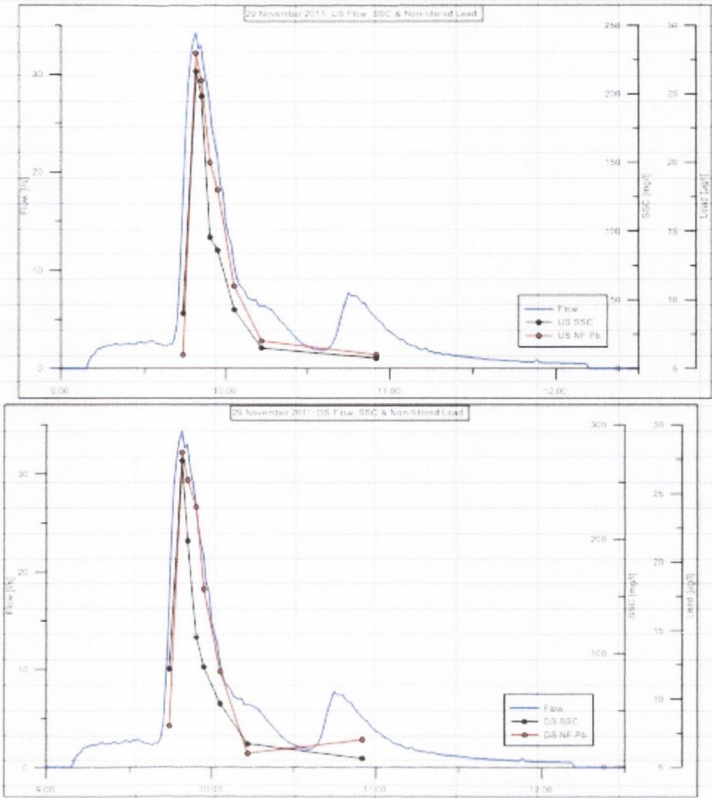
Rainfall	11.5 mm	Av rain intensity	1.7 mm/hr	Analysis	
Runoff	55.8 m3	Peak hourly intensity	5.3 mm/hr		
DCIA	14200 m2	Peak 10min rain intensity	15.6 mm/hr	Single bottle SSC, VSS, PSD, filtered and non-filtered metals and P.	
Runoff Coeff	0.34	Flow duration	181 minutes		
ADP	4.3 days	Average flow	5 l/s	Prev rain	24/11/2011 22:38
Rainfall duration	398 min	Peak flow	34 l/s	Rain start	29/11/2011 05:32
				Rain end	29/11/2011 12:10
				Flow start	29/11/2011 09:10
				Flow end	29/11/2011 12:11

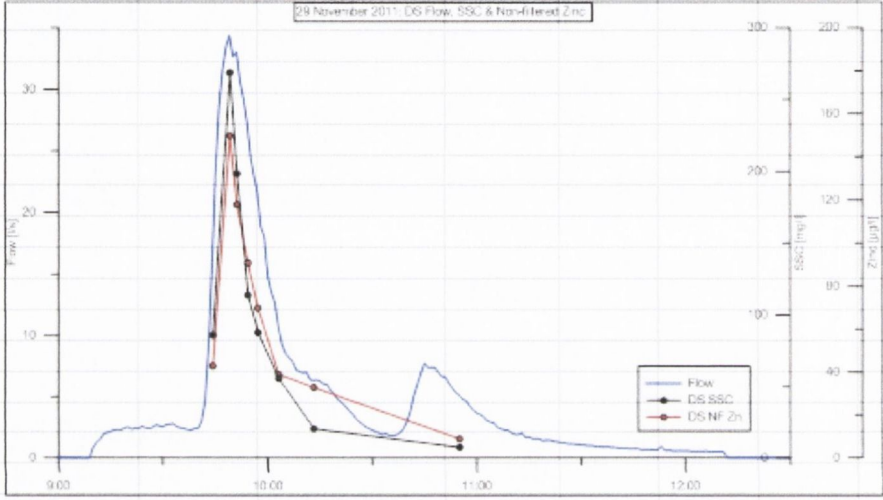
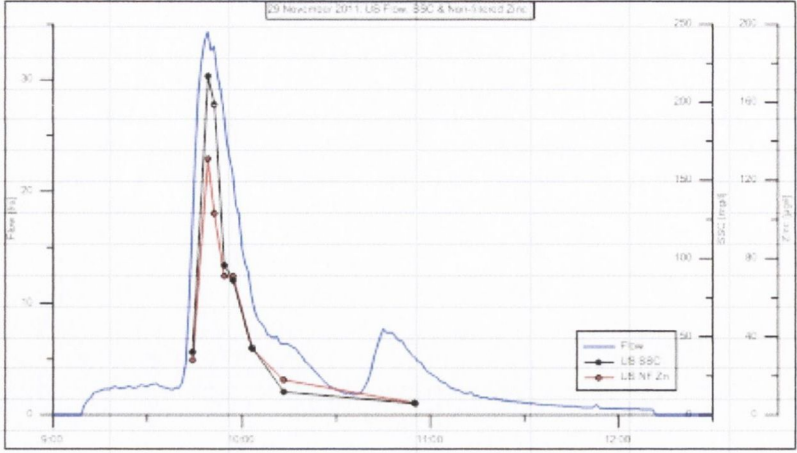
29-Nov-11		Kimmage // Storm Summary													2 of 10			
Sample	VI	VI/Vt	SSC	SSC*VI/Vt	MSS	VSS	VSS*VI/Vt	MVSS	%Org	pH	<10µm	10-20µm	20-45µm	45-90µm	90-1000µm	D10	D50	D90
	[l]		[mg/l]		[g]	[mg/l]		[g]			[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
US1	10825	0.19	40	8	435	16	3	168	39	8.4	8.8	11.8	23.8	24.8	30.6			
US2	6513	0.12	217	25	1412	49	6	316	22	8.2	6.0	9.6	23.4	23.6	36.0	11	53	173
US3	4582	0.08	198	16	909	41	3	189	21	8.4	7.1	11.1	25.9	22.4	32.2	15	62	361
US4	4684	0.08	96	8	448	29	2	134	30	8.2	8.7	12.9	27.8	21.0	29.2	13	53	352
US5	4734	0.08	86	7	407	25	2	120	29	7.7	8.3	12.5	28.2	22.3	28.1	11	46	317
US6	4701	0.08	43	4	202	15	1	69	34	7.9	13.1	16.8	29.7	20.8	19.6	12	46	296
US7	7712	0.14	15	2	114	10	1	79	69	7.8	16.3	17.8	27.9	19.8	18.2	8	35	149
US8	12090	0.22	7	2	90	5	1	63	70	7.8						6	32	130
Min			7			5												
Max			217			49												
Med			64			20				8.1						11	46	300
EMC			72			20			28							11	45	180
Total Mass					4017			1137										
DS1	10825	0.19	86	17	931	19	4	202	22		7.7	11.5	26.5	24.6	29.6			
DS2	6513	0.12	269	31	1750	49	6	320	18		6.4	10.5	26.0	25.0	31.9	12	50	205
DS3	4582	0.08	198	16	909	40	3	184	20		8.3	13.1	28.2	22.6	27.4	14	54	246
DS4	4684	0.08	114	10	534	33	3	153	29		8.9	14.4	30.4	21.6	23.9	11	46	238
DS5	4734	0.08	88	7	416	25	2	118	29		10.3	16.1	30.9	20.8	21.8	11	41	224
DS6	4701	0.08	56	5	262	19	2	89	34		9.8	15.2	30.9	21.5	22.1	10	37	180
DS7	7712	0.14	20	3	158	11	1	81	51		12.4	16.4	31.5	22.4	17.3	10	39	199
DS8	12090	0.22	8	2	91	4	1	53	58							8	35	124
Min			8			4												
Max			269			49												
Med			87			22										11	41	206
EMC			90			21			24									
Total Mass					5051			1199										
29 November 2011		Kimmage										Storm Summary					3 of 10	
		F P	NF P	F Cd	NF Cd	F Cr	NF Cr	F Cu	NF Cu	F Ni	NF Ni	F Pb	NF Pb	F Zn	NF Zn			
		[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]			
Detection Limit		5	5	2	2	2	2	5	5	5	5	5	5	5	5			
US1		55	107	ND	ND	ND	2	13	15	ND	ND	11	6	30	28			
US2		84	255	ND	ND	ND	4	15	40	ND	12	ND	28	7	131			
US3		77	210	ND	ND	ND	3	15	32	ND	9	ND	26	7	103			
US4		6	152	ND	ND	ND	ND	5	24	ND	6	ND	20	17	71			
US5		51	137	ND	ND	ND	2	17	24	ND	ND	14	18	49	71			
US6		11	105	ND	ND	ND	ND	5	14	ND	ND	ND	11	29	34			
US7		29	76	ND	ND	ND	ND	5	13	ND	ND	ND	7	15	18			
US8		27	50	ND	ND	ND	ND	10	10	6	ND	ND	5	6	6			
Min		6	50				2	5	10		6	11	5	6	6			
Max		84	255				4	17	40		12	14	28	49	131			
Med		40	122					12	19				15	16	52			
EMC		43	124					11	20				13	27	49			
DS1		21	134	ND	ND	2	4	ND	14	ND	ND	ND	8	16	43			
DS2		16	285	ND	ND	ND	4	ND	39	ND	15	ND	28	13	150			
DS3		8	208	ND	ND	ND	3	16	34	ND	11	ND	26	22	118			
DS4		10	172	ND	ND	ND	2	ND	29	ND	7	ND	24	nd	91			
DS5		ND	136	ND	ND	ND	2	ND	29	ND	6	ND	18	nd	70			
DS6		14	113	ND	ND	ND	ND	ND	20	ND	ND	ND	12	nd	39			
DS7		12	74	ND	ND	ND	ND	ND	17	ND	ND	ND	6	nd	33			
DS8		41	79	ND	ND	ND	ND	ND	18	ND	ND	ND	7	11	9			
Min		8	74				2	16	14		6		6	11	9			
Max		41	285				4	16	39		15		28	22	150			
Med		14	135						24				15	8	56			
EMC		20	141						23				14		60			

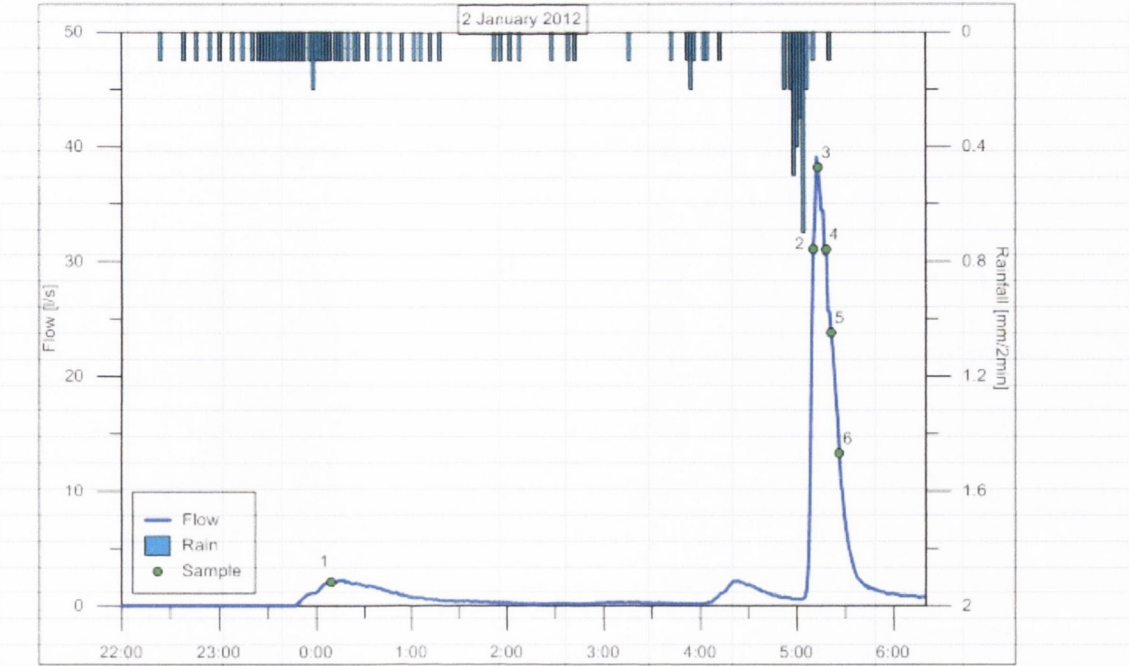






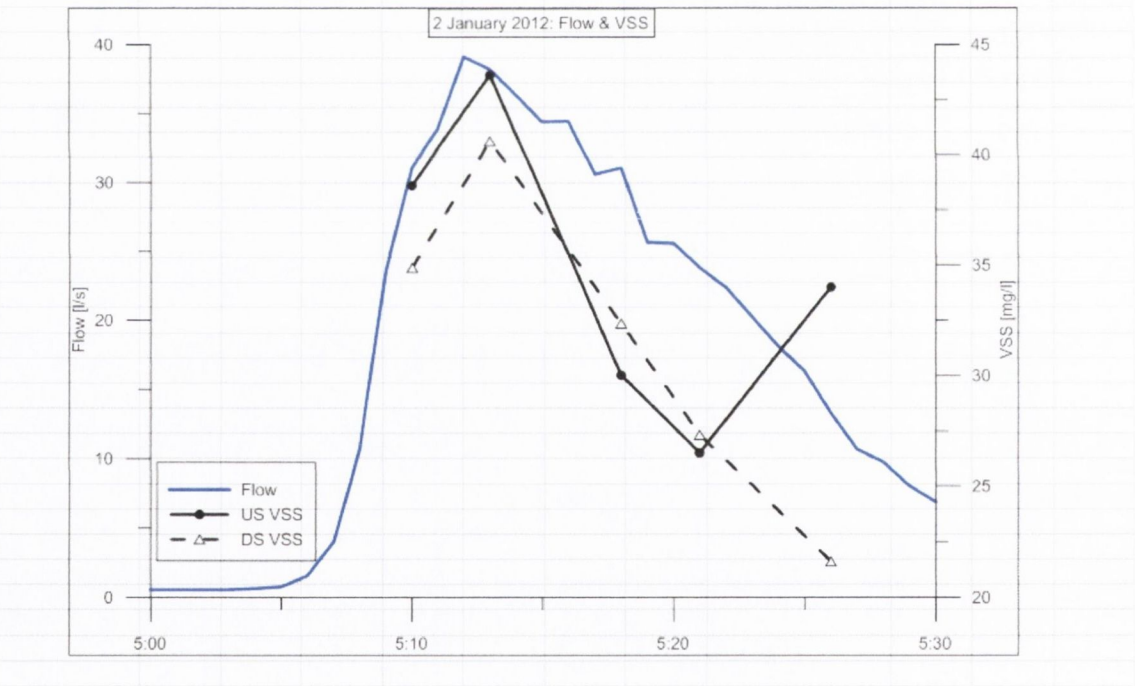
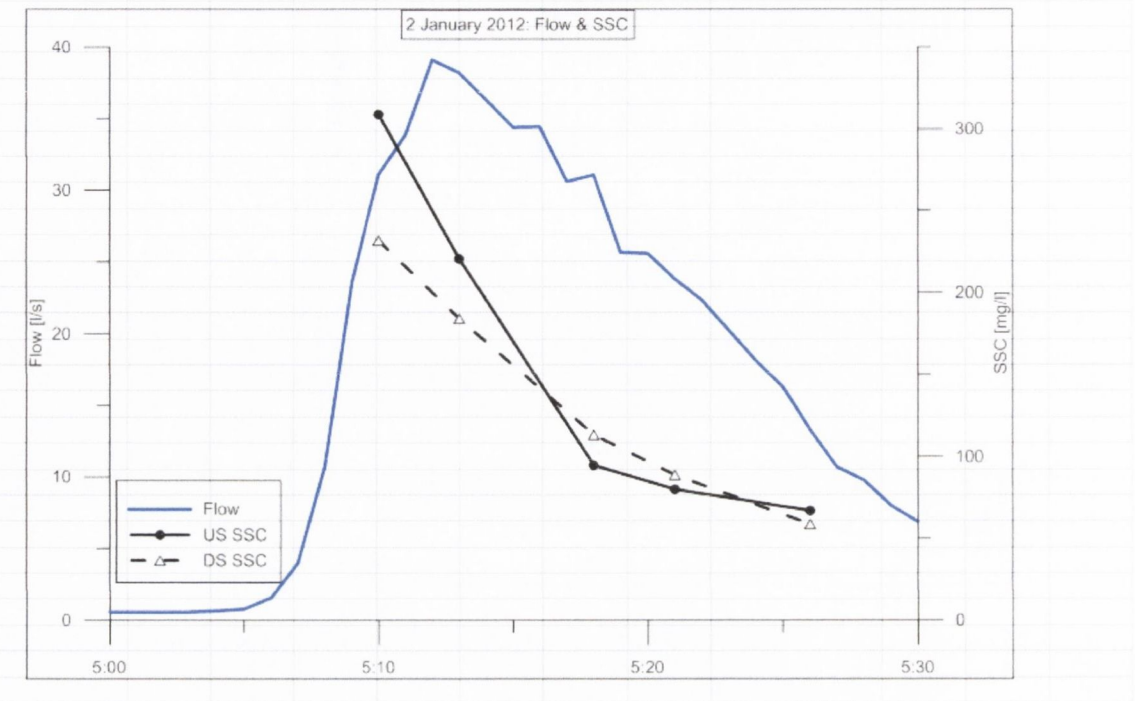


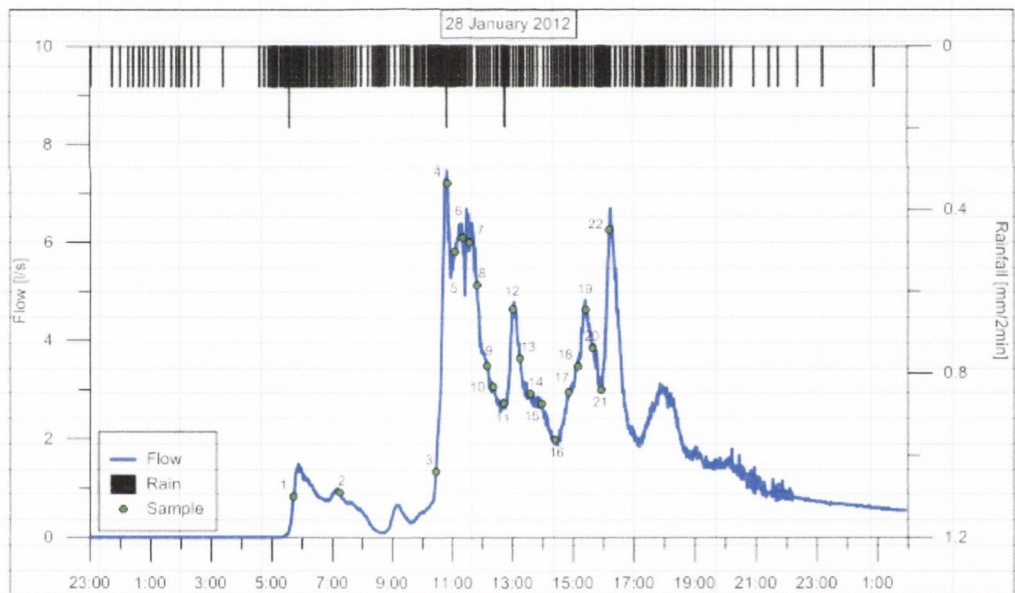
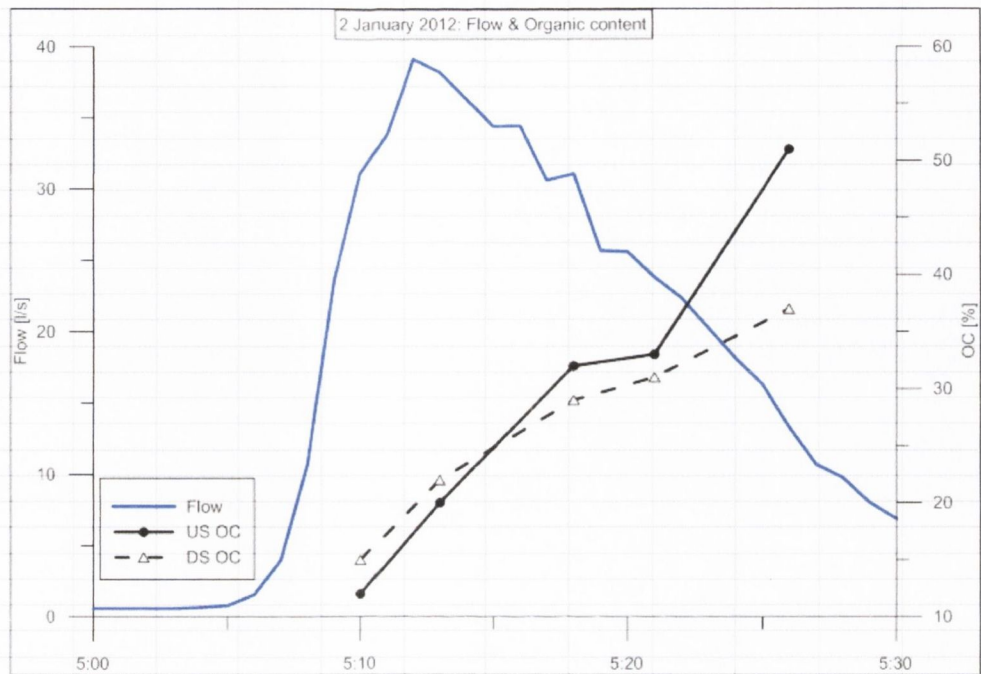




Rainfall	8.8 mm	Av rain intensity	1.3 mm/hr	Analysis			
Runoff	51.5 m3	Peak hourly intensity	2.7 mm/hr	Single bottle SSC & VSS, composite for metals & P(fractionated)			
DCIA	14200 m2	Peak 10min rain intensity	12.6 mm/hr				
Runoff Coeff	0.41	Flow duration	392 minutes	Prev rain	02/01/2012 01:02	Flow start	02/01/2012 23:48
ADP	0.9 days	Average flow	2.2 l/s	Rain start	02/01/2012 22:24	Flow end	03/01/2012 06:20
Rain duration	416 min	Peak flow	39.1 l/s	Rain end	03/01/2012 05:20		

02 January 2012 Kimmage				Storm Summary					
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	MSS [g]	SSC*Vi/Vt	VSS [mg/l]	MVSS [g]	VSS*Vi/Vt	% Organic
US1	18037	0.191	11	199	2	6	100	1	50
US2	3204	0.222	309	990	69	39	124	9	12
US3	8743	0.17	221	1929	38	44	381	7	20
US4	7042	0.137	95	667	13	30	211	4	32
US5	5296	0.103	80	423	8	27	140	3	33
US6	9141	0.178	67	612	12	34	311	6	51
Min			11			6			
Max			309			44			
Med			87			32			
EMC			141			30			21
Total Mass				4820			1267		
DS1	18037	0.191	4	76	1	3	54	1	71
DS2	3204	0.222	232	743	51	35	112	8	15
DS3	8743	0.17	184	1610	31	41	355	7	22
DS4	7042	0.137	113	798	16	32	228	4	29
DS5	5296	0.103	89	470	9	27	145	3	31
DS6	9141	0.178	59	537	10	22	198	4	37
Min			4			3			
Max			232			41			
Med			101			30			
EMC			119			26			22
Total Mass				4232			1091		





Rainfall	21.8 mm	Av rain intensity	0.8 mm/hr	Analysis			
Runoff	141 m3	Peak hourly intensity	2.5 mm/hr	Single bottle SSC, VSS, PSD, metals & P			
DCIA	14200 m2	Peak 10min rain intensity	3.0 mm/hr				
Runoff Coeff	0.46	Flow duration	1233 minutes	Prev rain	26/01/2012 10:44	Flow start	29/01/2012 05:21
ADP	2.5 days	Average flow	1.9 l/s	Rain start	28/01/2012 23:02	Flow end	30/01/2012 01:54
Rain Duration	1552 minutes	Peak flow	7.5 l/s	Rain end	30/01/2012 00:54		

28-Jan-12		Kimmage // Storm Summary													2 of 9			
Sample	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	pH	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90
	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]		[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
US1	3010	0.02	10	0.22	31	8	0.17	24	76	7.9								
US2	5496	0.04	7	0.28	40	7	0.28	40	100	8.1								
US3	5857	0.04	6	0.26	37	6	0.26	37	100	9.7	10.7	18.2	24.6	18.6	27.9	10	40	173
US4	5718	0.04	14	0.55	77	12	0.50	70	91	9.8	19.8	17.2	19.3	20.0	23.7	6	34	145
US5	5574	0.04	10	0.39	55	10	0.39	55	100	8.9	12.8	9.9	14.6	30.4	32.3	8	63	159
US6	5446	0.04	10	0.39	55	10	0.37	52	96	8.9	15.3	18.0	26.2	18.9	21.6	7	33	180
US7	5139	0.04	8	0.29	40	6	0.21	30	75	8.5	17.8	22.5	29.0	15.0	15.7	7	26	129
US8	4999	0.04	7	0.26	36	6	0.20	28	77	9.5	18.4	21.6	24.9	17.4	17.6	6	27	124
US9	3491	0.02	7	0.17	24	5	0.14	19	78	10.1								
US10	2880	0.02	5	0.10	14	4	0.09	13	91	10.3								
US11	3567	0.03	6	0.15	21	5	0.12	16	76	10.3								
US12	3601	0.03	4	0.11	15	4	0.11	15	100	10.4								
US13	3692	0.03	3	0.09	13	3	0.08	11	91	10.2								
US14	3733	0.03	4	0.10	14	3	0.09	12	87	10.3								
US15	3570	0.03	4	0.09	13	3	0.08	11	86	10.2								
US16	3629	0.03	4	0.11	15	3	0.09	13	85	10.4								
US17	3697	0.03	3	0.08	11	3	0.07	11	95	10.5								
US18	3712	0.03	4	0.11	15	3	0.09	12	81	10.3								
US19	3671	0.03	8	0.20	28	4	0.11	15	53	10.2								
US20	3530	0.03	6	0.14	20	4	0.09	13	65	10.1								
US21	3687	0.03	4	0.11	15	4	0.09	13	88	10.1								
US22	52878	0.38	4	1.59	224	3	1.31	184	82	10.1								
Min			3			3												
Max			14			12												
Med			6			4				10.1						7	34	152
EMC			6			5			85									
Total Mass					812			693										
Grab (US8)			7			4												
Grab (US9)			7			5												

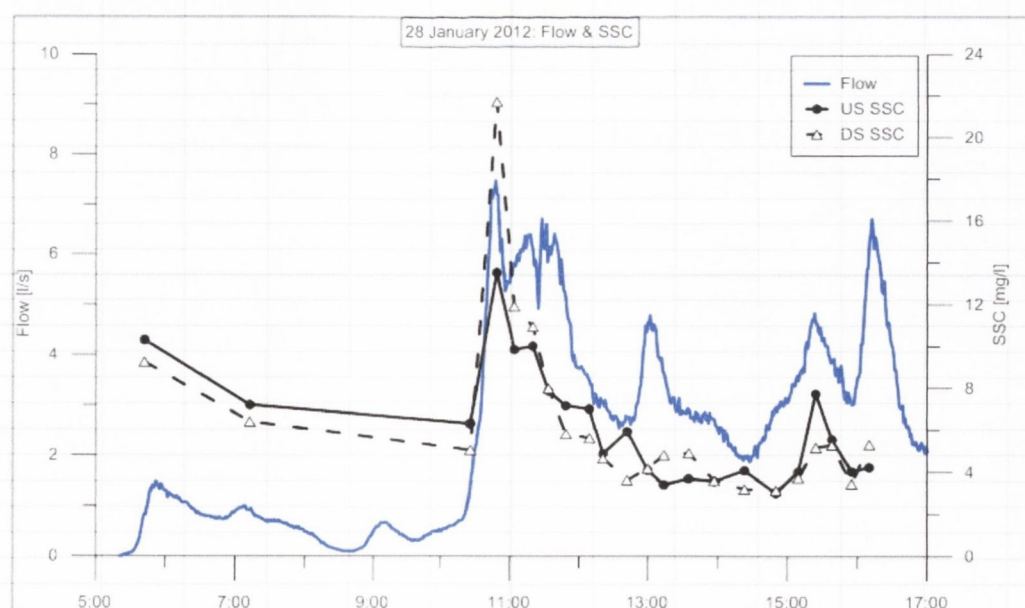
28-Jan-12		Kimmage // Storm Summary													3 of 9		
Sample	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	% Org	<10 µm	10-20 µm	20-45 µm	45-90 µm	90-1000 µm	D10	D50	D90
	[l]		[mg/l]		[g]	[mg/l]		[g]		[%]	[%]	[%]	[%]	[%]	[µm]	[µm]	[µm]
DS1	3010	0.02	9	0.20	28	7	0.14	20	72								
DS2	5496	0.04	6	0.25	35	5	0.19	26	74								
DS3	5857	0.04	5	0.21	30	4	0.15	21	70	15.6	16.4	26.3	23.3	18.4	7	35	119
DS4	5718	0.04	22	0.88	124	10	0.43	60	48	18.1	13.9	14.9	25.6	27.5	6	51	137
DS5	5574	0.04	12	0.47	66	7	0.28	39	59	20.0	15.9	20.2	19.2	24.7	5	35	151
DS6	5446	0.04	11	0.42	60	7	0.28	39	66	10.4	16.0	25.7	19.9	28.0	10	42	212
DS7	5139	0.04	8	0.29	41	3	0.13	18	43	16.2	18.6	24.8	18.8	21.6	7	32	160
DS8	4999	0.04	6	0.21	29	4	0.15	21	71	14.6	17.9	25.7	23.6	18.3	8	35	120
DS9	3491	0.02	6	0.14	20	4	0.10	14	69								
DS10	2880	0.02	5	0.10	13	4	0.08	11	84								
DS11	3567	0.03	4	0.09	13	3	0.08	11	86								
DS12	3601	0.03	4	0.11	15	2	0.05	7	44								
DS13	3692	0.03	5	0.13	18	4	0.12	16	92								
DS14	3733	0.03	5	0.13	18	3	0.09	13	71								
DS15	3570	0.03	4	0.09	13	3	0.09	12	93								
DS16	3629	0.03	3	0.08	12	3	0.08	12	100								
DS17	3697	0.03	3	0.08	12	2	0.06	8	73								
DS18	3712	0.03	4	0.10	14	3	0.07	9	68								
DS19	3671	0.03	5	0.14	19	3	0.08	11	59								
DS20	3530	0.03	5	0.13	19	4	0.09	13	69								
DS21	3687	0.03	3	0.09	13	3	0.07	10	76								
DS22	52878	0.38	5	2.00	281	3	1.27	179	64								
Min			3			2											
Max			22			10											
Med			5			4									7	35	144
EMC			6			4			64								
Total Mass					892			570									

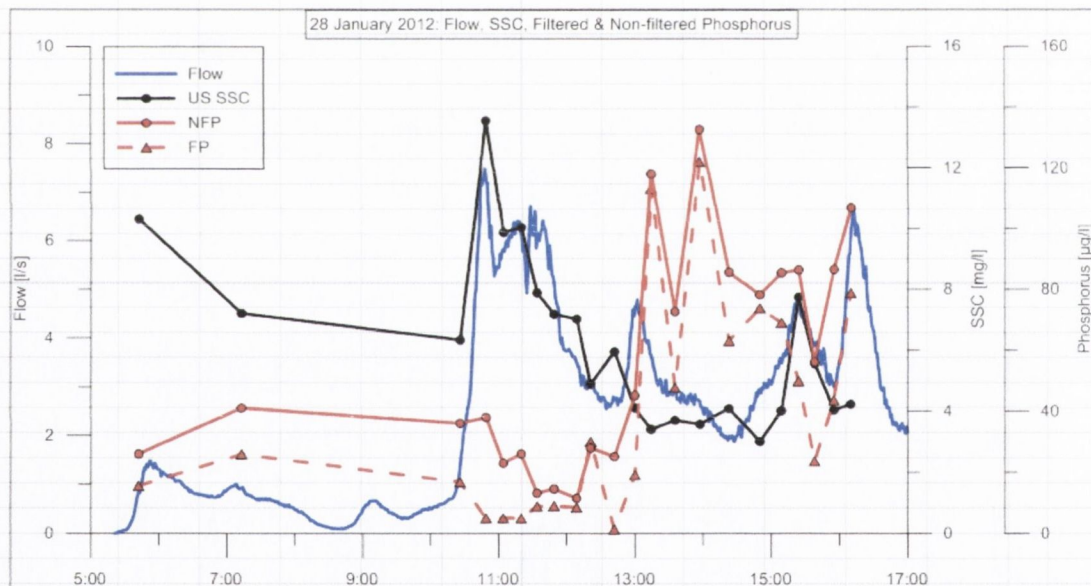
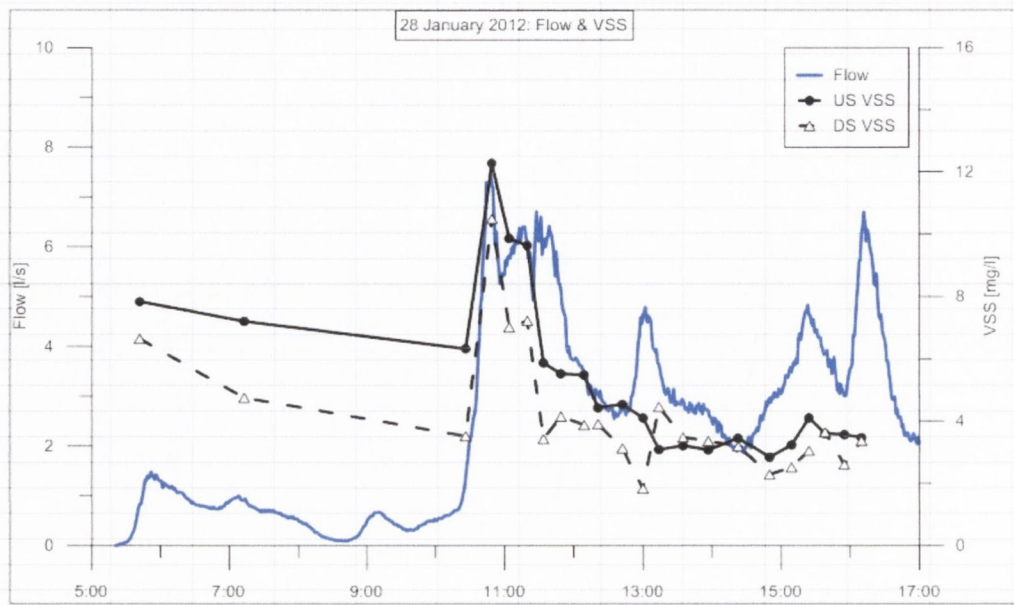
28 January 2012 Kimmage	Storm Summary								4 of 9
	F P	NF P	F Cu	NF Cu	F Pb	NF Pb	F Zn	NF Zn	
	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	[µg/l]	
Detection Limit	5	5	5	5	5	5	5	5	
US1	16	26	-	5	-	-	15	18	
US2	26	41	-	12	-	-	22	29	
US3	17	36	-	11	-	-	5	7	
US4	5	38	-	14	-	-	16	36	
US5	5	23	-	12	-	-	23	32	
US6	5	26	-	11	-	-	24	30	
US7	9	13	-	14	-	-	17	25	
US8	9	15	-	18	-	-	22	35	
US9	9	12	-	11	-	-	18	23	
US10	30	28	-	5	-	-	21	25	
US11	5	25	-	11	-	-	16	18	
US12	19	45	-	10	-	-	32	36	
US13	113	118	-	12	-	-	15	22	
US14	48	73	-	17	-	-	18	19	
US15	122	133	-	16	-	-	11	25	
US16	63	86	10	18	-	-	5	26	
US17	74	78	-	22	-	-	16	22	
US18	69	85	-	18	-	-	9	32	
US19	50	86	11	24	-	-	6	35	
US20	24	56	-	16	-	-	20	34	
US21	44	87	-	11	-	-	5	21	
US22	79	107	12	12	-	-	19	12	
Min	ND	12	ND	ND	ND	ND	ND	7	
Max	122	133	12	24	ND	ND	32	36	
Med	25	43		12			17	25	
EMC	50	72	-	13	-	-	17	21	
Dig BIFiltered		ND		ND		ND		ND	
Dig BIFNon fil		ND		ND		ND		ND	
10% HCl OV. DF		ND		ND		ND		ND	

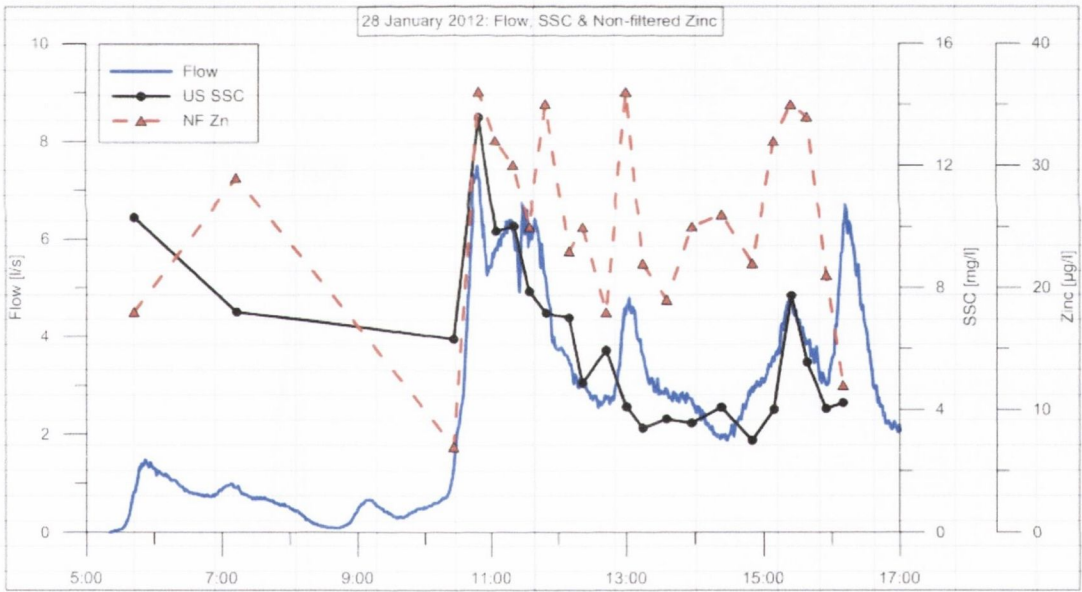
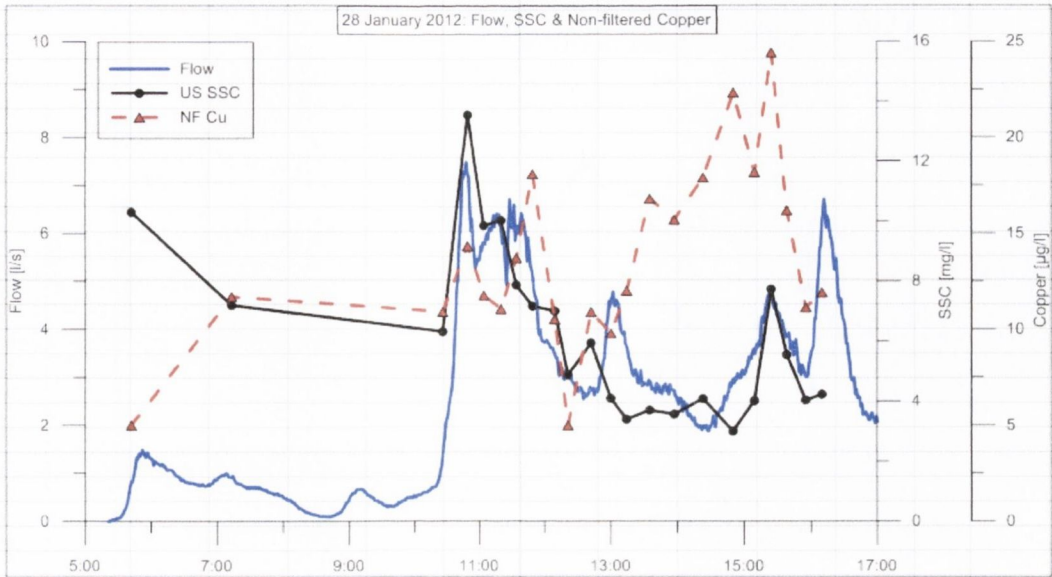
28 January 2012 Kimmage

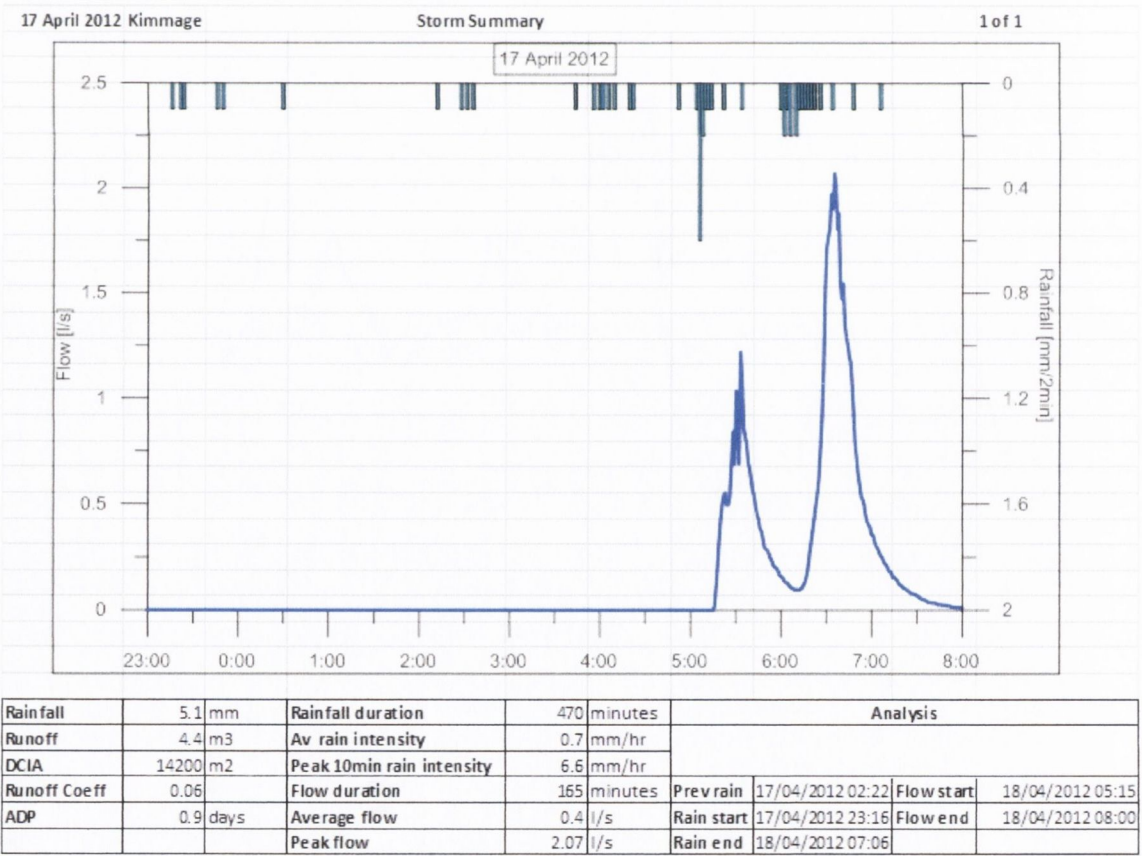
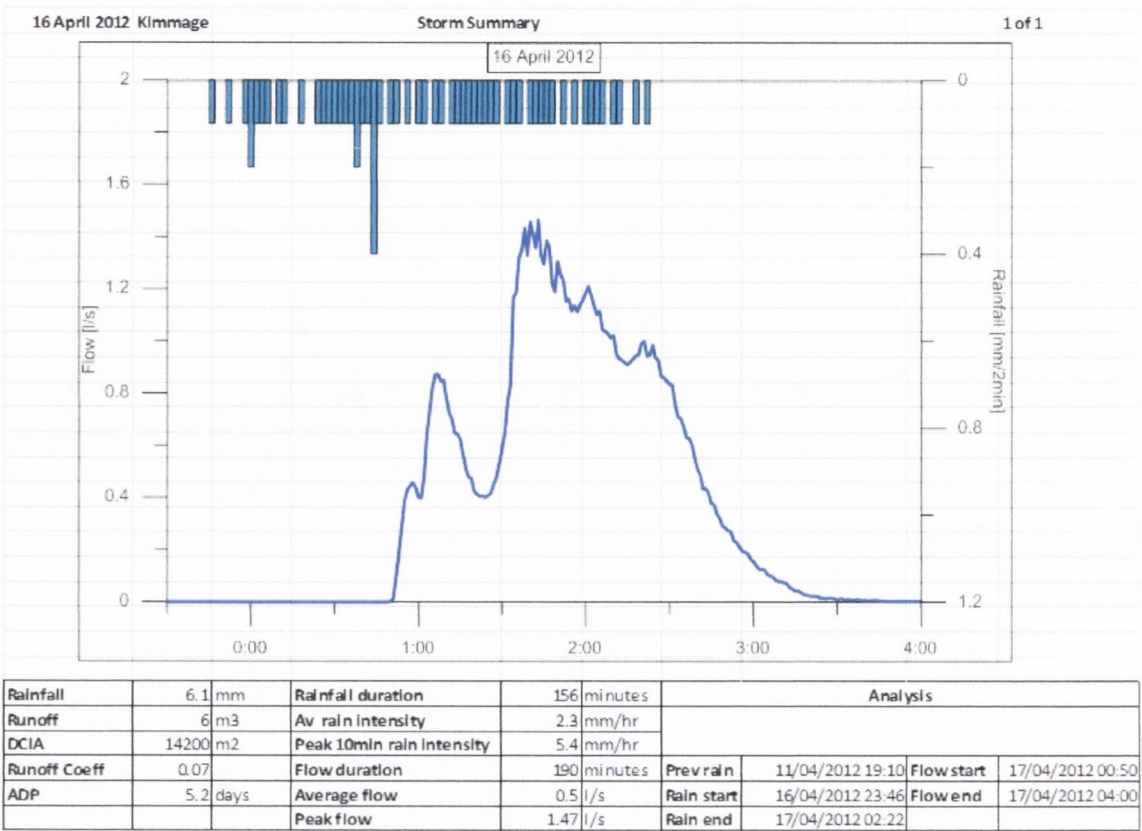
Storm Summary

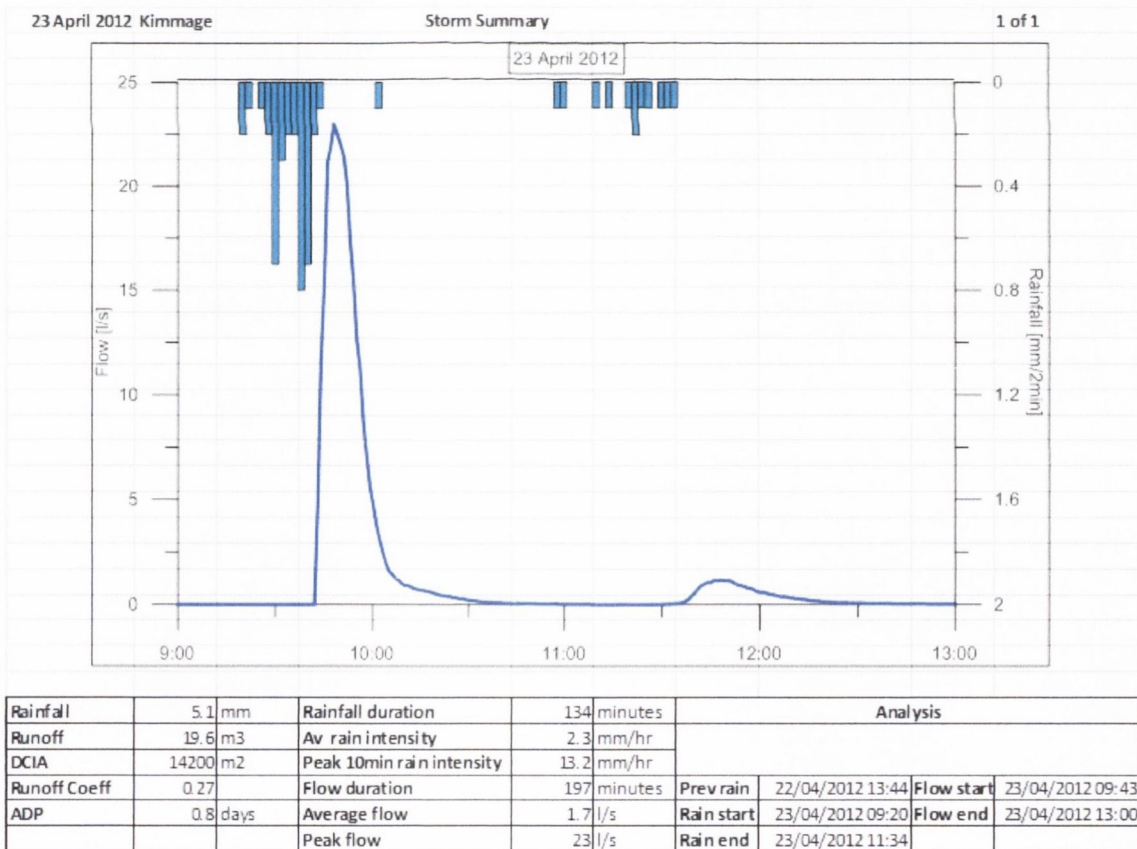
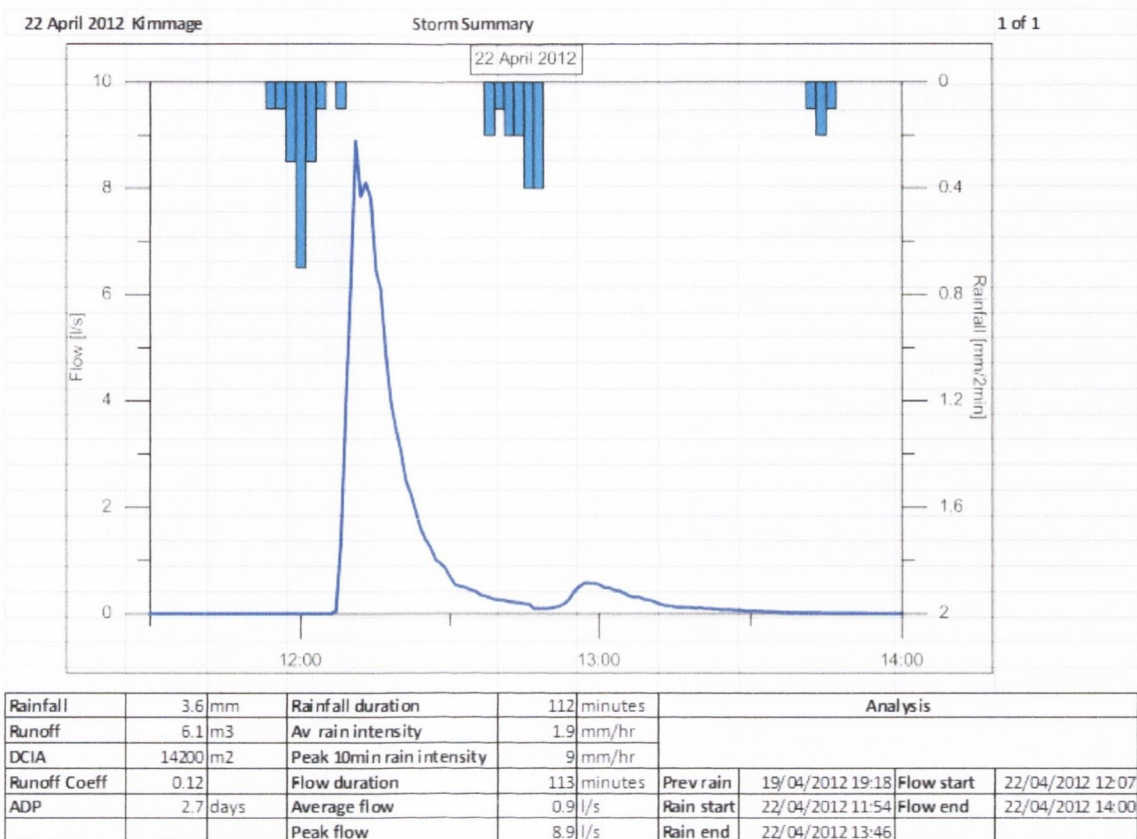
5 of 9

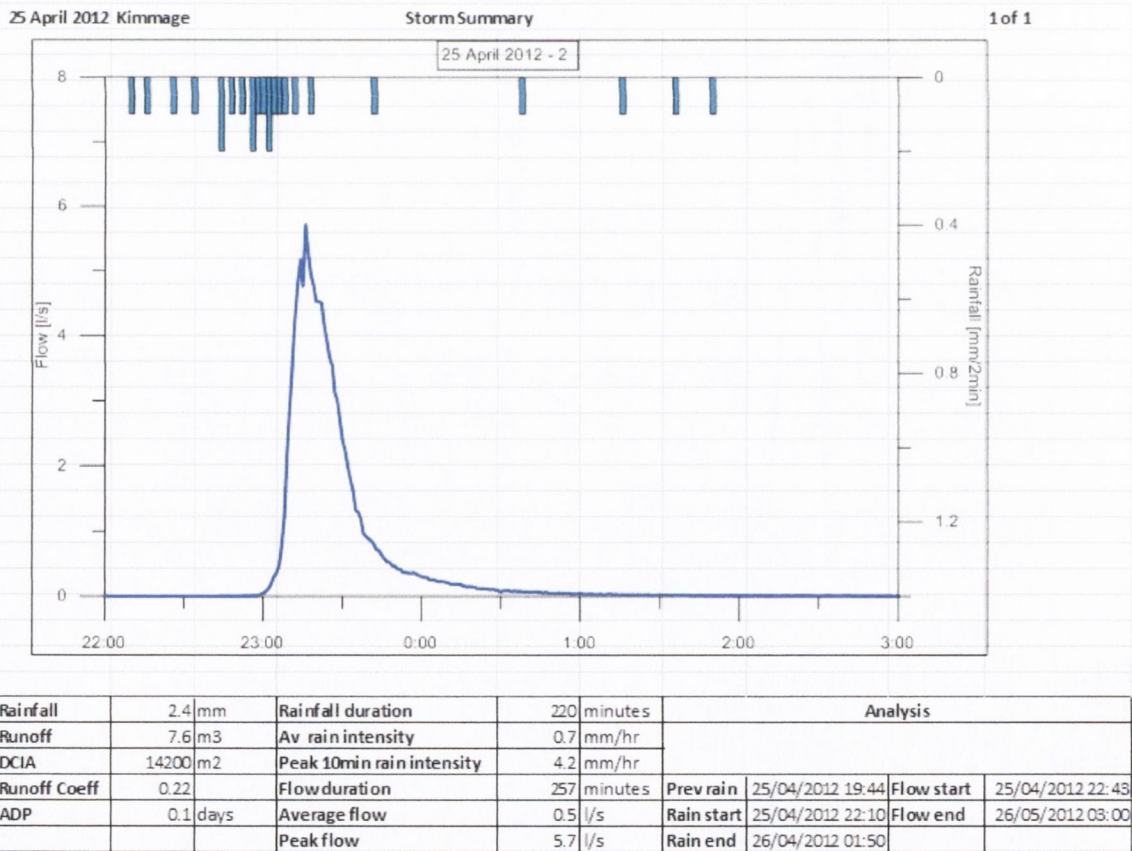
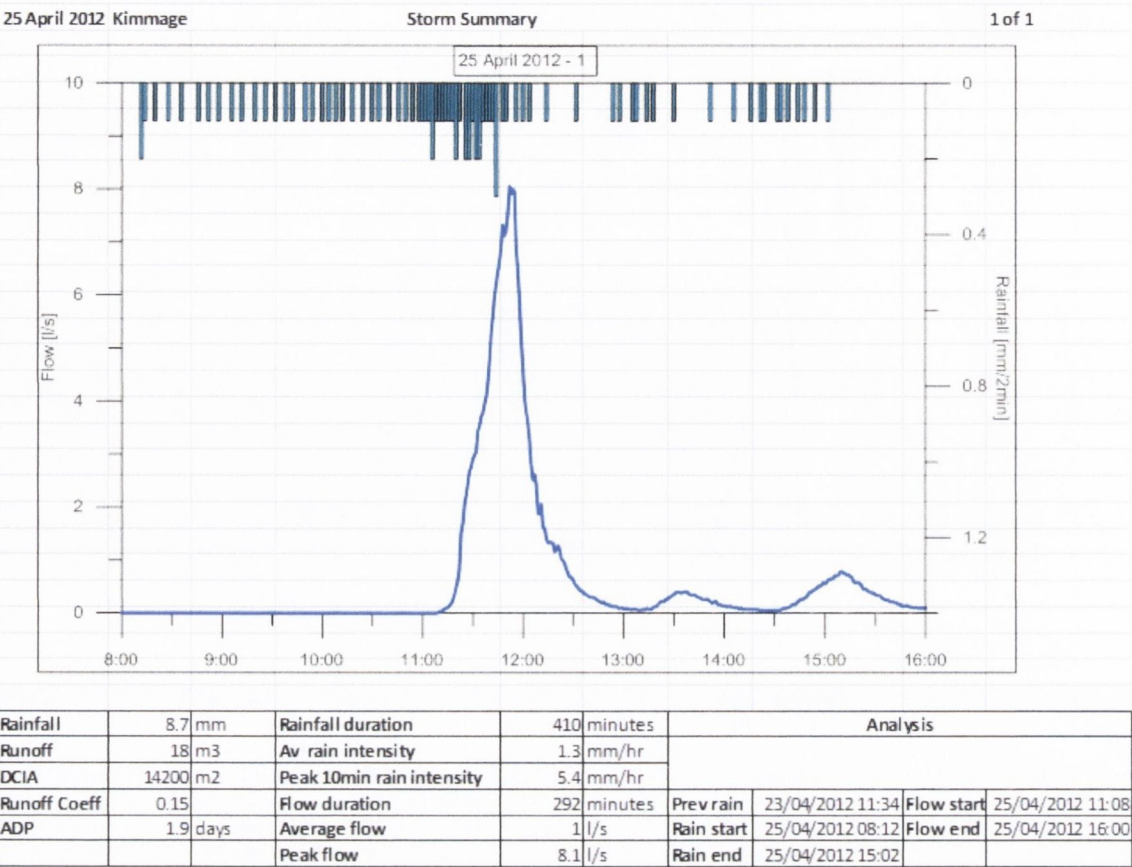


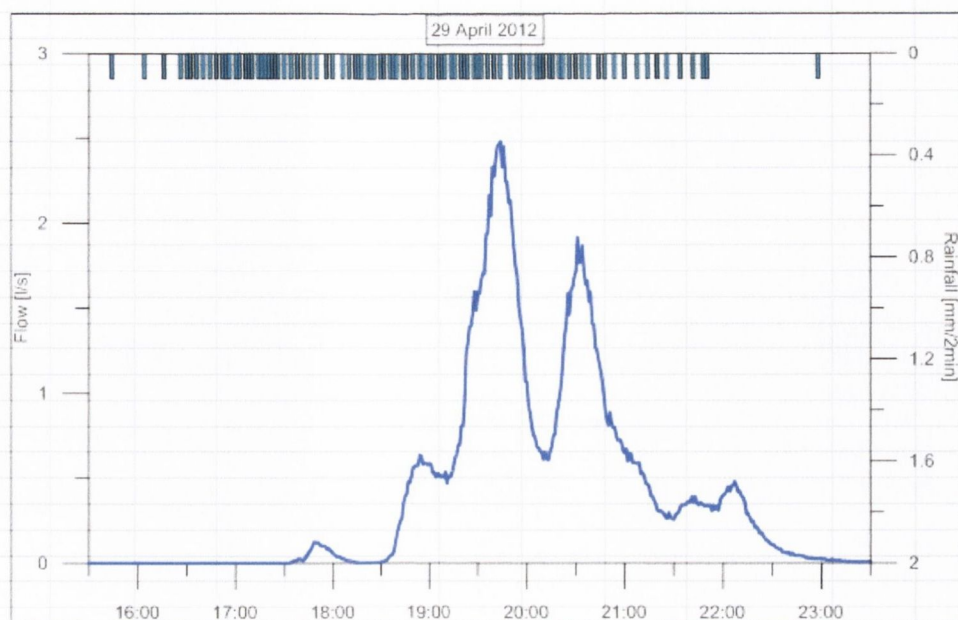




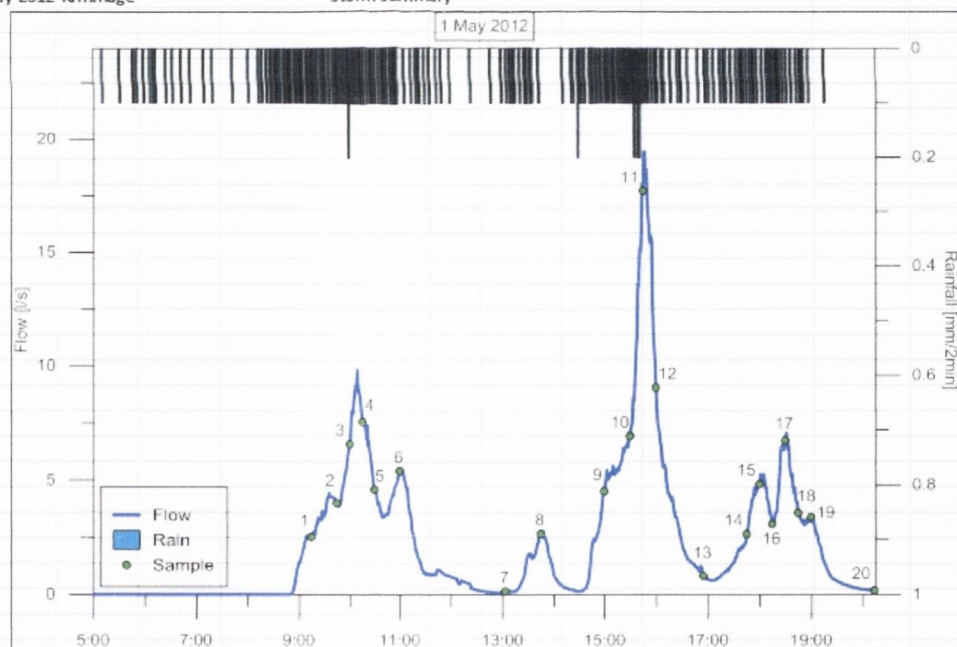








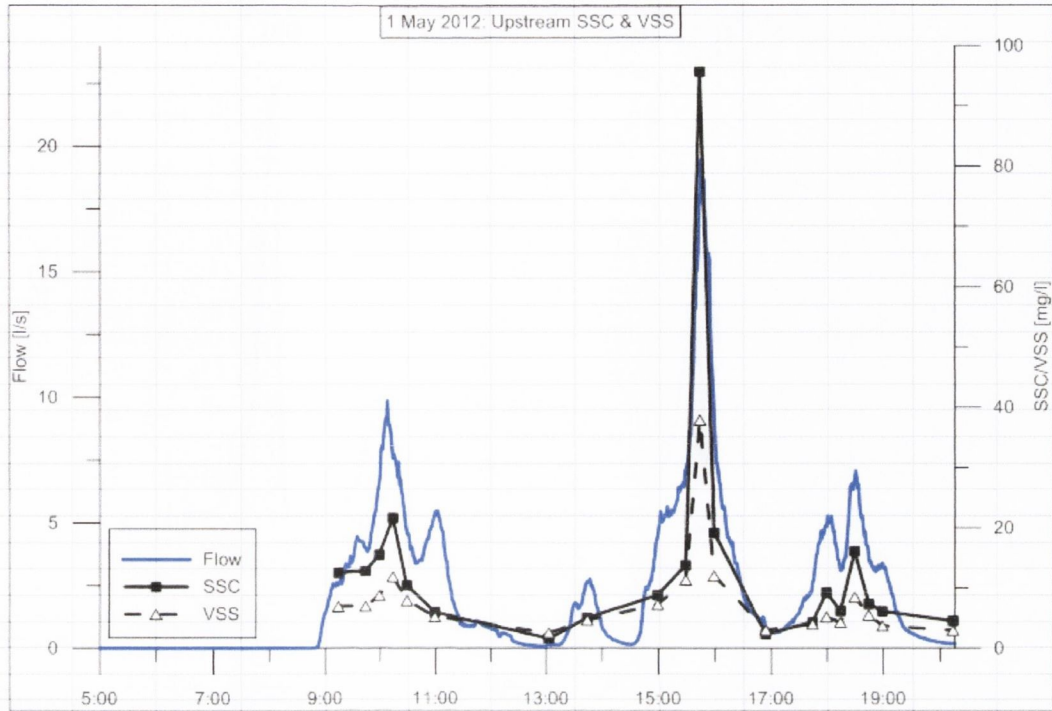
Rainfall	9.5 mm	Rainfall duration	454 minutes	Analysis			
Runoff	11.6 m ³	Av rain intensity	1.3 mm/hr				
DCIA	14200 m ²	Peak 10min rain intensity	3 mm/hr				
Runoff Coeff	0.09	Flow duration	357 minutes	Prev rain	27/04/2012 09:42	Flow start	29/04/2012 17:33
ADP	2.3 days	Average flow	0.5 l/s	Rain start	29/04/2012 15:44	Flow end	29/04/2012 23:30
		Peak flow	2.5 l/s	Rain end	29/04/2012 22:58		



Rainfall	18.1 mm	Av rain intensity	1.3 mm/hr	Analysis			
Runoff	123 m ³	Peak hourly intensity	2.7 mm/hr	Single bottle SSC & VSS. Composite: PSD, metals and phosphorus.			
DCIA	14200 m ²	Peak 10min rain intensity	4.8 mm/hr				
Runoff Coeff	0.47	Flow duration	687 minutes	Prev rain	30/04/2012 01:04	Flow start	01/05/2012 08:48
ADP	1.2 days	Average flow	3 l/s	Rain start	01/05/2012 05:10	Flow end	01/05/2012 20:15
Rain Duration	844 minutes	Peak flow	19.4 l/s	Rain end	01/05/2012 19:14		

01-May-12		Kimmage // Storm Summary								2 of 4
Sample	Vi	Vi/Vt	SSC	SSC*Vi/Vt	MSS	VSS	VSS*Vi/Vt	MVSS	OC	
	[l]		[mg/l]		[g]	[mg/l]		[g]	[%]	
US1	5586	0.05	13	0.57	70	7	0.32	39	55	
US2	5503	0.04	13	0.58	71	7	0.31	39	54	
US3	6062	0.05	16	0.76	94	9	0.43	53	56	
US4	6680	0.05	22	1.18	145	12	0.65	79	55	
US5	6582	0.05	10	0.56	69	8	0.42	52	76	
US6	7813	0.06	6	0.38	47	5	0.33	41	88	
US7	5342	0.04	2	0.07	9	3	0.11	14	156	
US8	4093	0.03	5	0.17	21	5	0.16	19	93	
US9	8013	0.07	9	0.58	71	7	0.47	58	82	
US10	10574	0.09	14	1.19	146	11	0.98	120	82	
US11	12215	0.1	96	9.51	1169	38	3.77	463	40	
US12	12068	0.1	19	1.88	231	12	1.18	145	63	
US13	7068	0.06	2	0.13	17	3	0.18	22	130	
US14	3663	0.03	4	0.13	16	4	0.12	15	92	
US15	3837	0.03	9	0.29	36	5	0.16	20	56	
US16	4219	0.03	6	0.21	26	4	0.15	18	69	
US17	4586	0.04	16	0.60	74	8	0.32	39	53	
US18	3805	0.03	7	0.23	28	6	0.17	21	75	
US19	3368	0.03	6	0.17	21	4	0.10	13	61	
US20	1926	0.02	5	0.07	9	3	0.05	6	66	
Composite										
Min			2			3			40	
Max			96			38			156	
Med			9			6			68	
EMC			19			10			54	
Total Mass					2367			1276		

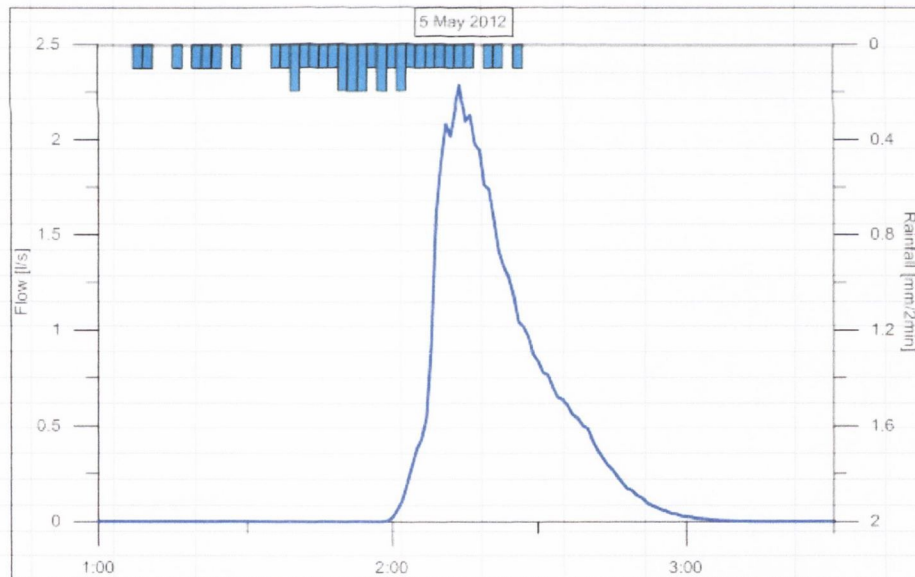
01-May-12		Kimmage // Storm Summary				3 of 4
Sample	P	Cu	Pb	Zn		
	[ug/l]	[ug/l]	[ug/l]	[ug/l]		
Detection Limit	5	5	6	5		
US C F1	33	ND	ND	ND		
US C T1	98	17	ND	ND		
US C T2	98	16	ND	ND		
Mean	98	16	ND	ND		
RPD [%]	0.2	6	-			
Fil Blank	ND	ND	ND	ND		
Dig Blank	5	ND	ND	ND		



05 May 2012 Kimmage

Storm Summary

1 of 1

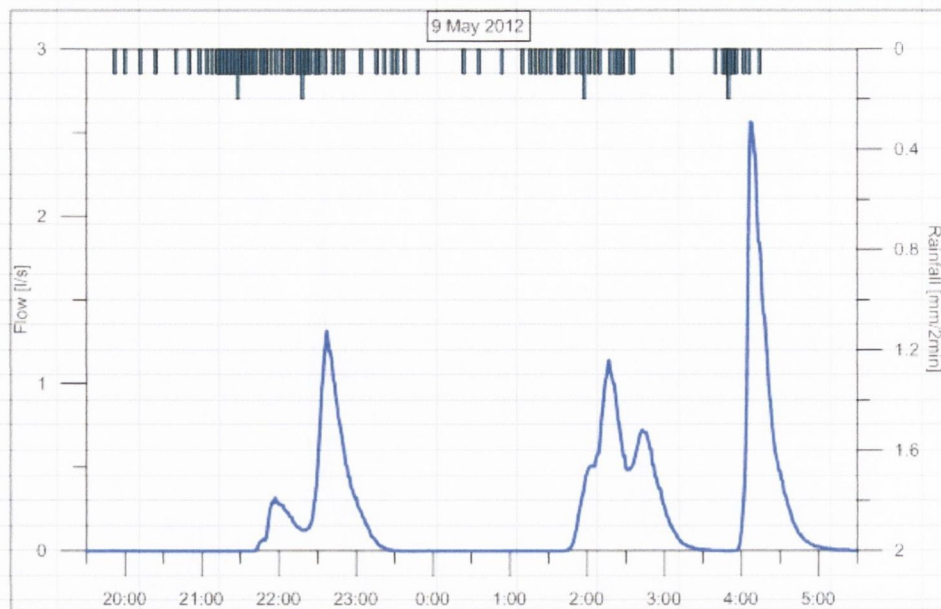


Rainfall	3.7 mm	Rainfall duration	78 minutes	Analysis			
Runoff	2.9 m3	Av rain intensity	2.8 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	5.4 mm/hr				
Runoff Coeff	0.06	Flow duration	91 minutes	Prev rain	01/05/2012 19:14	Flow start	05/05/2012 01:59
ADP	3.3 days	Average flow	0.5 l/s	Rain start	05/05/2012 01:08	Flow end	05/05/2012 03:30
		Peak flow	2.3 l/s	Rain end	05/05/2012 02:26		

09 May 2012 Kimmage

Storm Summary

1 of 1

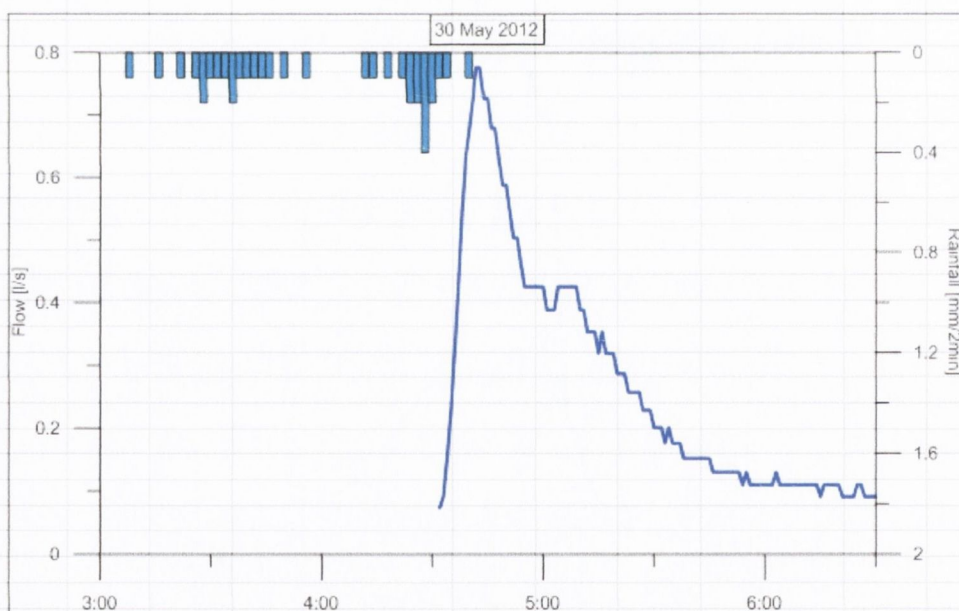


Rainfall	9.5 mm	Rainfall duration	502 minutes	Analysis			
Runoff	7.4 m ³	Av rain intensity	1.1 mm/hr				
DCIA	14200 m ²	Peak 10min rain intensity	3.6 mm/hr				
Runoff Coeff	0.05	Flow duration	468 minutes	Prev rain	07/05/2012 18:52	Flow start	09/05/2012 21:42
ADP	2.0 days	Average flow	0.3 l/s	Rain start	07/05/2012 19:52	Flow end	10/05/2012 05:30
		Peak flow	2.6 l/s	Rain end	10/05/2012 04:14		

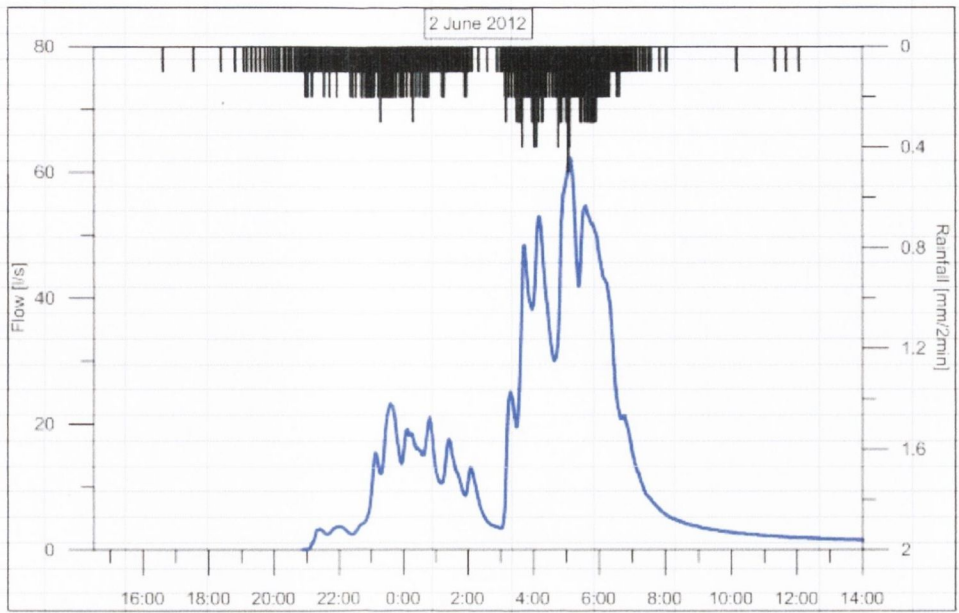
30 May 2012 Kimmage

Storm Summary

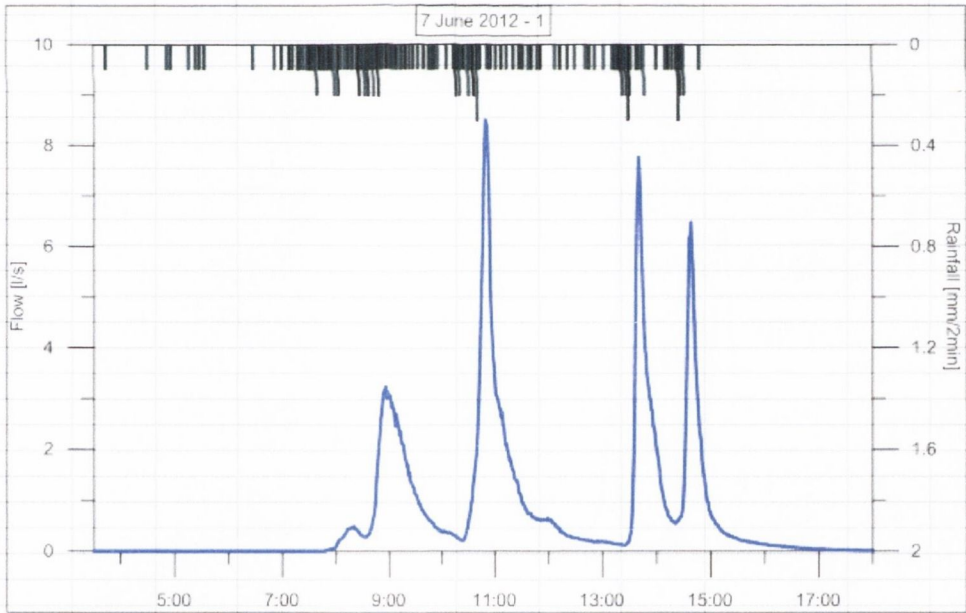
1 of 1



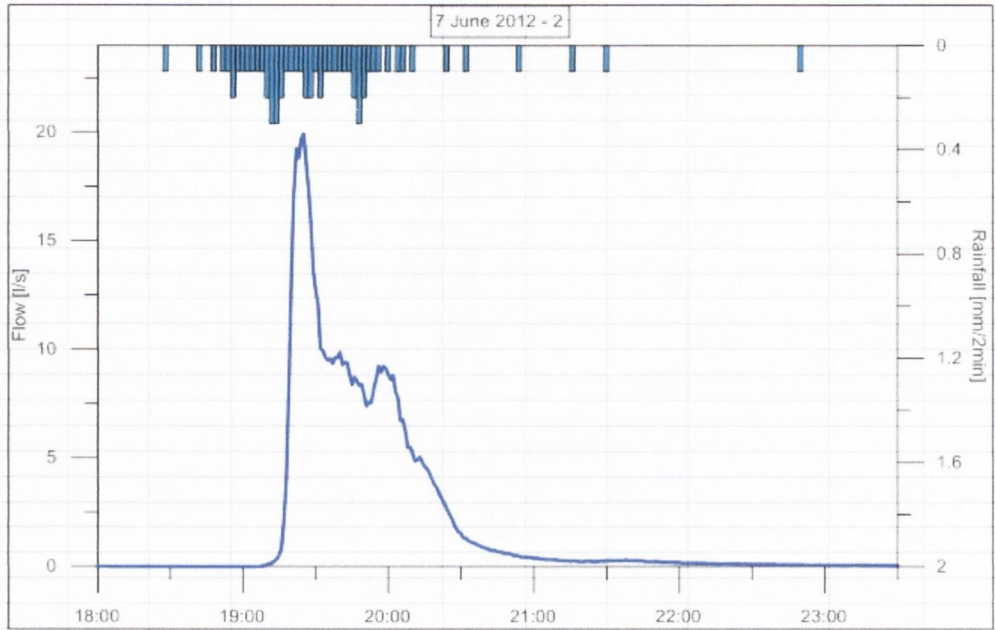
Rainfall	3.5 mm	Rainfall duration	92 minutes	Analysis			
Runoff	1.9 m ³	Av rain intensity	2.3 mm/hr				
DCIA	14200 m ²	Peak 10min rain intensity	6.6 mm/hr				
Runoff Coeff	0.04	Flow duration	118 minutes	Prev rain	19/05/2012 02:14	Flow start	30/05/2012 04:32
ADP	11.0 days	Average flow	0.3 l/s	Rain start	30/05/2012 03:08	Flow end	30/05/2012 06:30
		Peak flow	0.8 l/s	Rain end	30/05/2012 04:40		



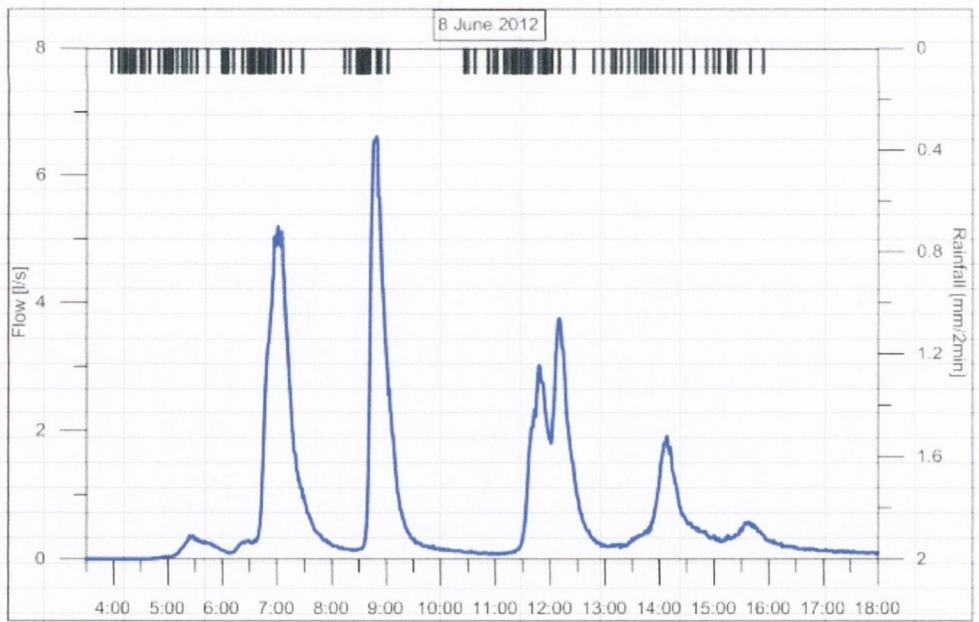
Rainfall	47.7 mm	Rainfall duration	1168 minutes	Analysis			
Runoff	852 m3	Av rain intensity	2.3 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	10.2 mm/hr				
Runoff Coeff	1.3	Flow duration	1028 minutes	Prev rain	31/05/2012 14:46	Flow start	02/06/2012 20:52
ADP	2.0 days	Average flow	13.8 l/s	Rain start	02/06/2012 16:36	Flow end	03/06/2012 14:00
		Peak flow	62 l/s	Rain end	03/06/2012 12:04		



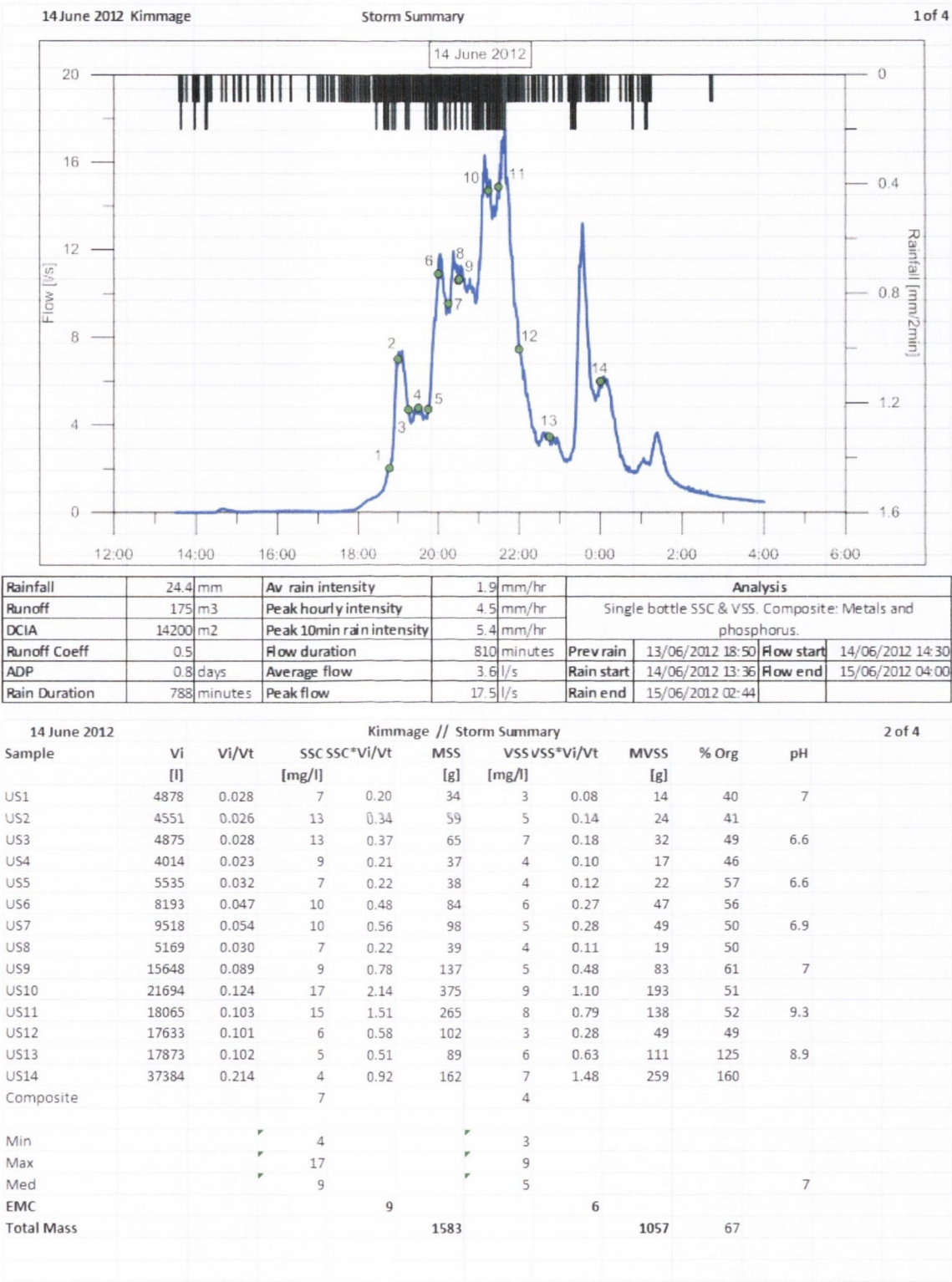
Rainfall	15.4 mm	Rainfall duration	664 minutes	Analysis			
Runoff	37.9 m3	Av rain intensity	1.4 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	6 mm/hr				
Runoff Coeff	0.17	Flow duration	615 minutes	Prev rain	03/06/2012 12:04	Flow start	07/06/2012 07:45
ADP	3.6 days	Average flow	1 l/s	Rain start	07/06/2012 03:44	Flow end	07/06/2012 18:00
		Peak flow	8.5 l/s	Rain end	07/06/2012 14:48		



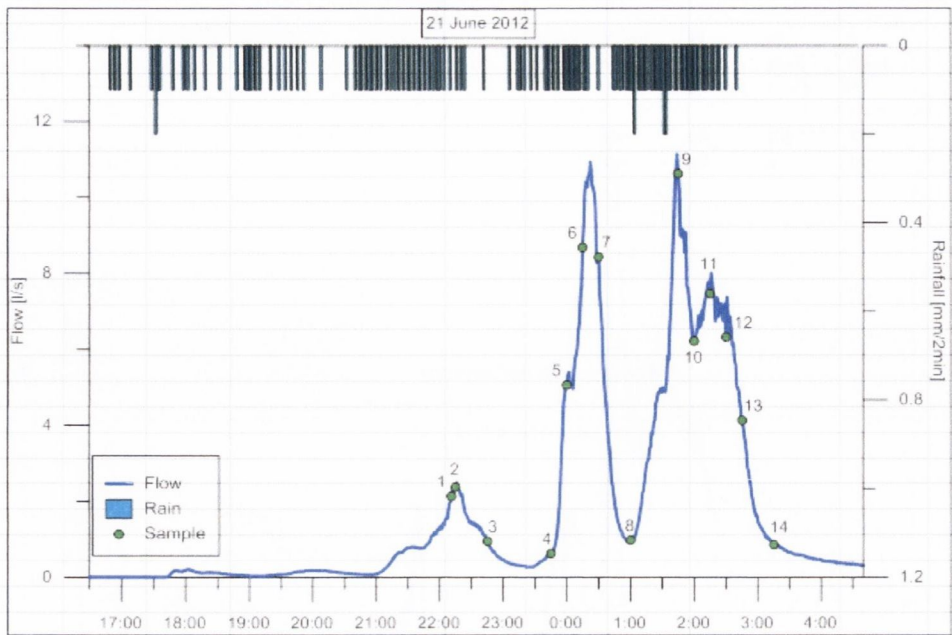
Rainfall	6 mm	Rainfall duration	262 minutes	Analysis			
Runoff	39.6 m3	Av rain intensity	1.4 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	6.6 mm/hr				
Runoff Coeff	0.46	Flow duration	263 minutes	Prev rain	07/06/2012 14:48	Flow start	07/06/2012 19:07
ADP	0.1 days	Average flow	2.5 l/s	Rain start	07/06/2012 18:28	Flow end	07/06/2012 23:30
		Peak flow	19.9 l/s	Rain end	07/06/2012 22:50		



Rainfall	10.5 mm	Rainfall duration	716 minutes	Analysis			
Runoff	35.7 m3	Av rain intensity	0.9 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	3 mm/hr				
Runoff Coeff	0.24	Flow duration	772 minutes	Prev rain	07/06/2012 22:50	Flow start	08/06/2012 05:08
ADP	0.2 days	Average flow	0.8 l/s	Rain start	08/06/2012 08:58	Flow end	08/06/2012 18:00
		Peak flow	6.6 l/s	Rain end	08/06/2012 15:54		



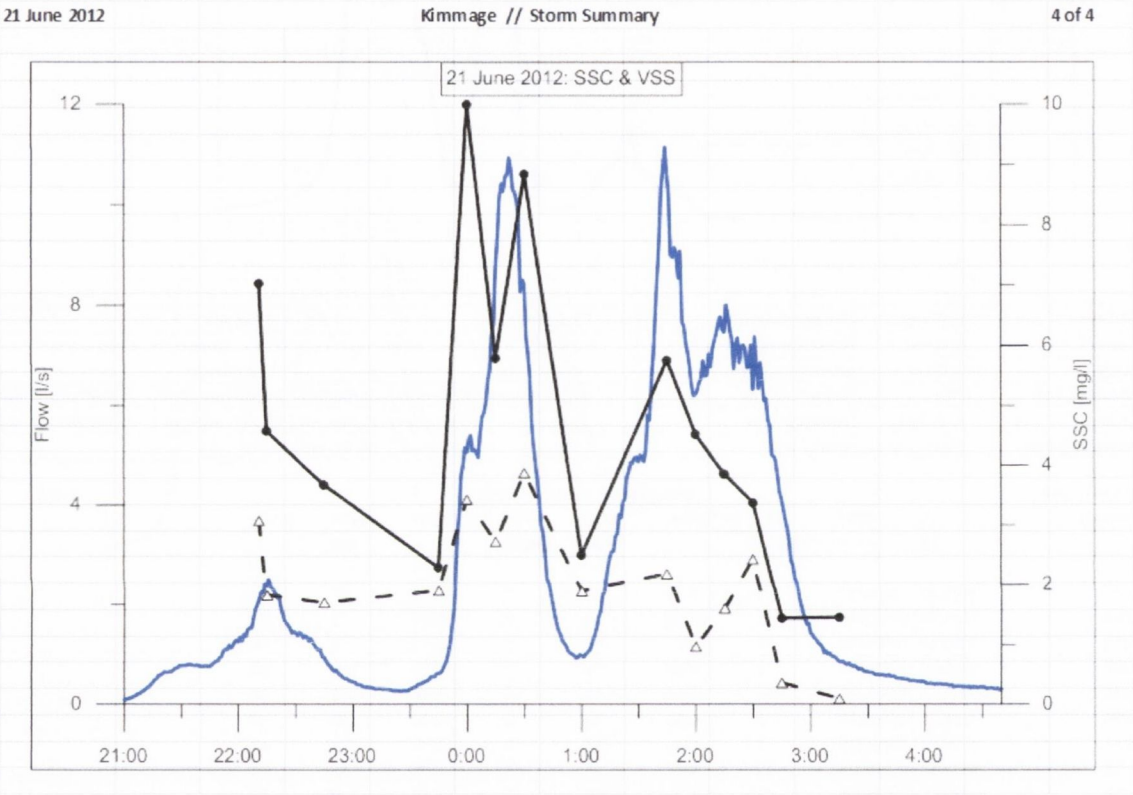
75

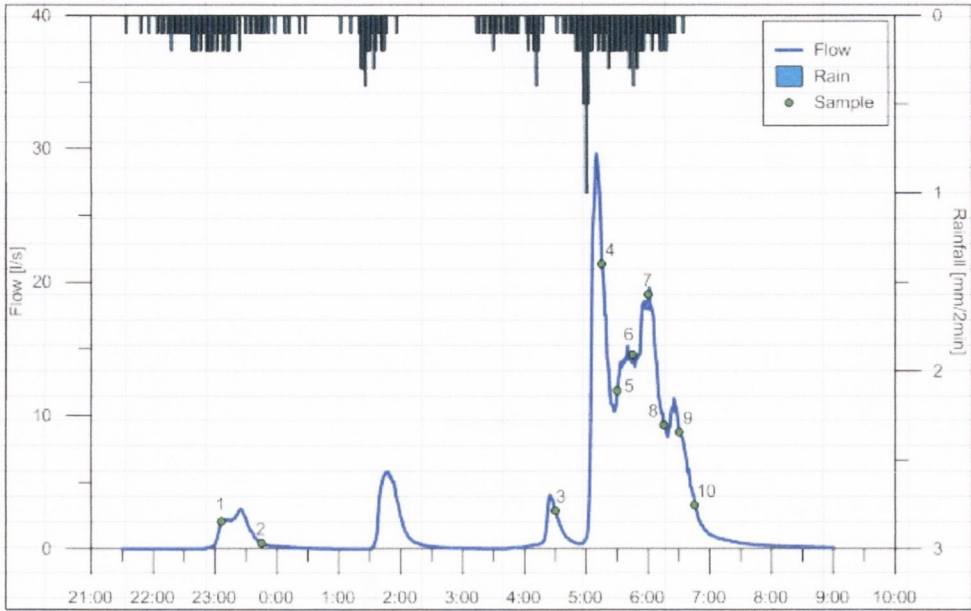


Rainfall	12.9 mm	Av. rain intensity	1.3 mm/hr	Analysis Single bottle SSC & VSS. Composite: Metals and phosphorus.			
Runoff	74.2 m3	Peak hourly intensity	2.8 mm/hr				
DCIA	14200 m2	Peak 10min rain intensity	4.2 mm/hr	Prev rain	21/06/2012 10:04	Flow start	21/06/2012 17:38
Runoff Coeff	0.41	Flow duration	652 minutes	Rain start	21/06/2012 16:50	Flow end	22/06/2012 04:40
ADP	0.3 days	Average flow	1.9 l/s	Rain end	22/06/2012 02:40		
Rain Duration	590 minutes	Peak flow	11.2 l/s				

21 June 2012 Kimmage // Storm Summary										2 of 4	
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	MSS [g]	VSS [mg/l]	VSS*Vi/Vt	MVSS [g]	% Org		
US1	5065.89	0.06827	7	0.48	36	3	0.21	16	44		
US2	1686.24	0.022725	5	0.10	8	2	0.04	3	40		
US3	2183.37	0.029424	4	0.11	8	2	0.05	4	46		
US4	1913.97	0.025794	2	0.06	4	2	0.05	4	83		
US5	3867.87	0.052125	10	0.52	39	3	0.18	13	34		
US6	7186.35	0.096847	6	0.56	42	3	0.26	20	47		
US7	6925.83	0.093336	9	0.83	61	4	0.36	27	44		
US8	8522.64	0.114855	3	0.29	21	2	0.22	16	76		
US9	9625.5	0.129718	6	0.75	55	1	0.13	9	17		
US10	6735.12	0.090766	5	0.41	30	2	0.15	11	36		
US11	6383.28	0.086024	4	0.33	25	2	0.21	16	63		
US12	5778.36	0.077872	3	0.26	19	0	0.03	2	11		
US13	4179.12	0.05632	1	0.08	6	0	0.01	0	7		
US14	4149.9	0.055926	1	0.08	6	0	0.01	0	7		
Min			1			0					
Max			10			4					
Med			4			2					
EMC				5			2		39		
Total mass					361			141			

21 June 2012	Kimmage // Storm Summary				3 of 4
Sample	P	Cu	Pb	Zn	
	[ug/l]	[ug/l]	[ug/l]	[ug/l]	
Detection Limit	5	5	6	5	
USC F1	46	ND	ND	ND	
USC T1	81	8	ND	ND	

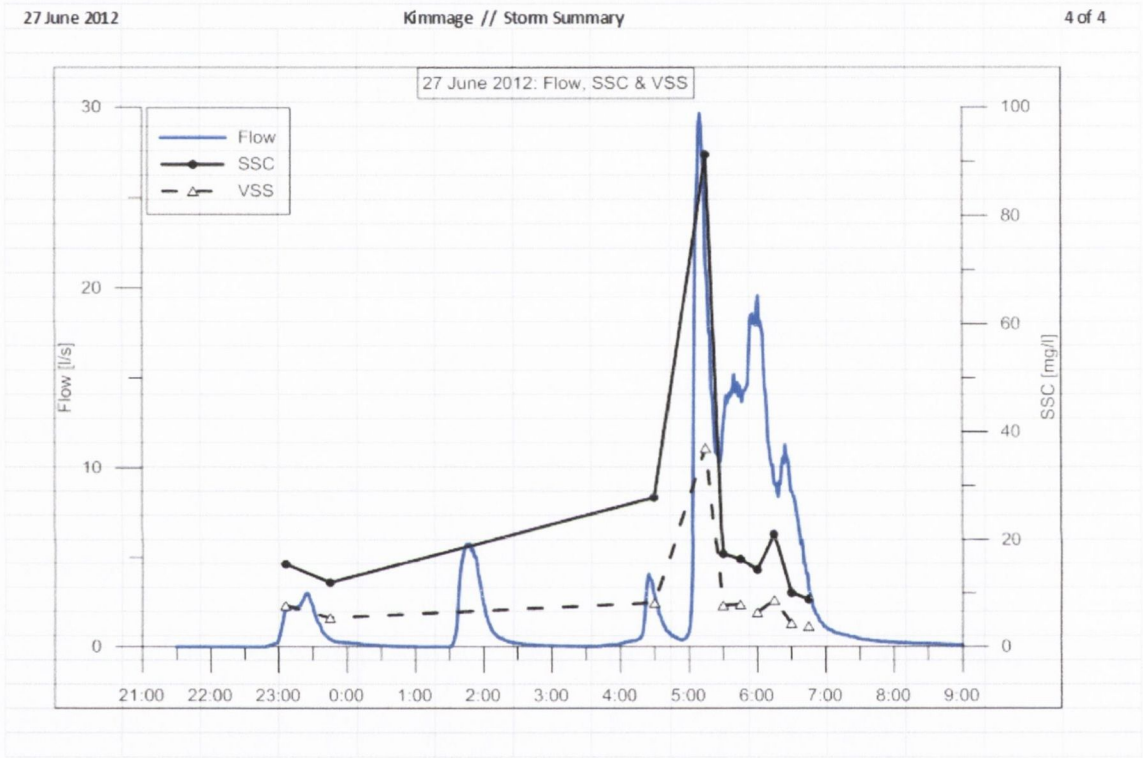


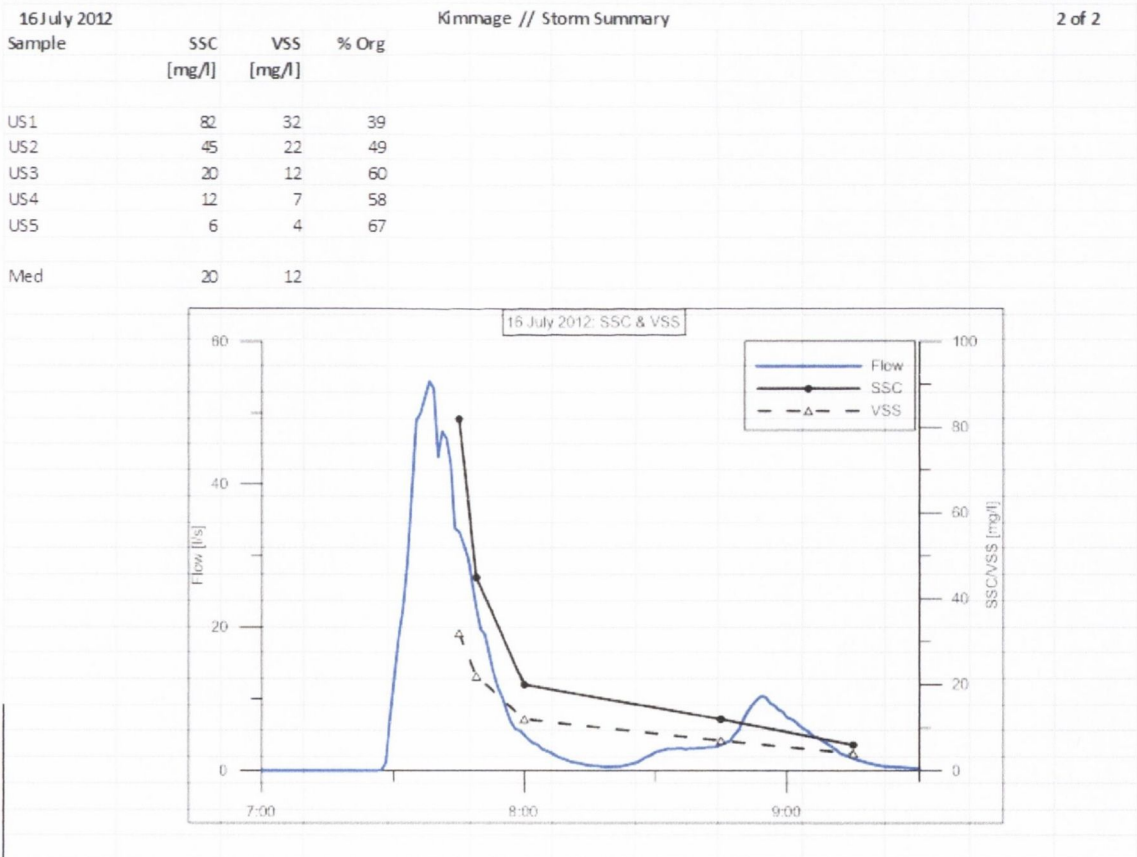
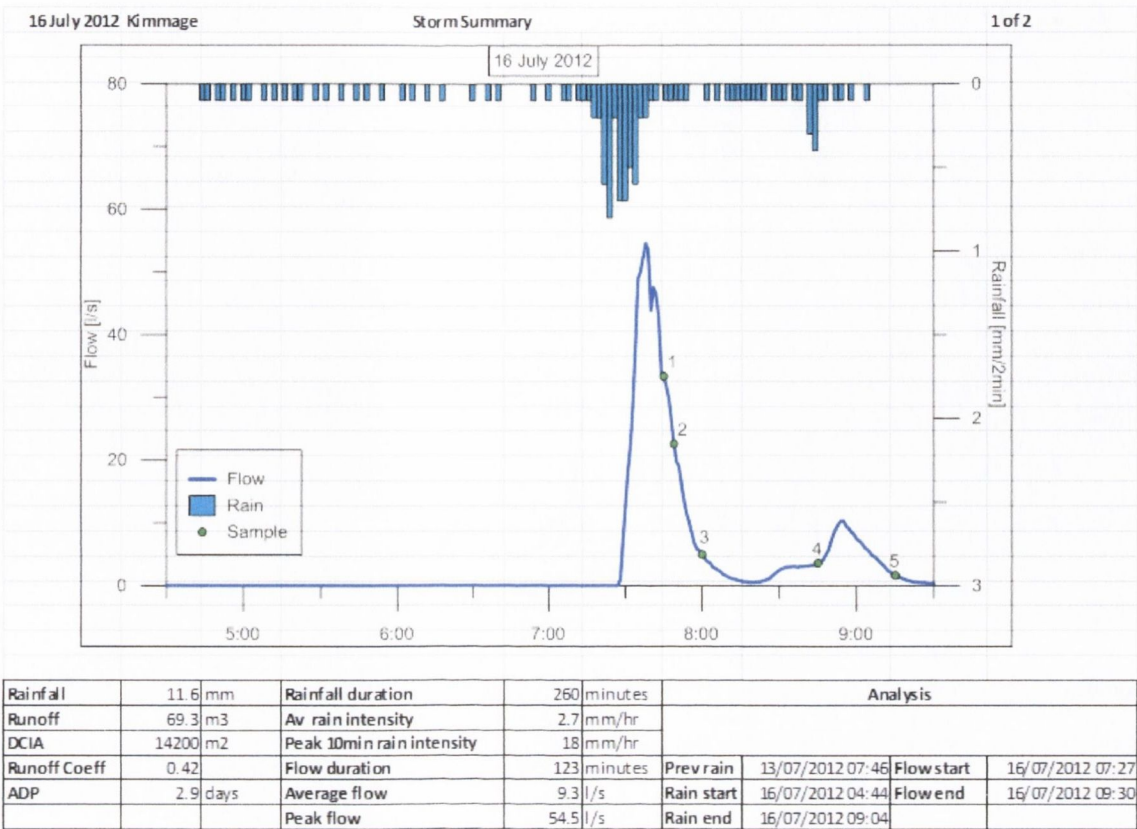


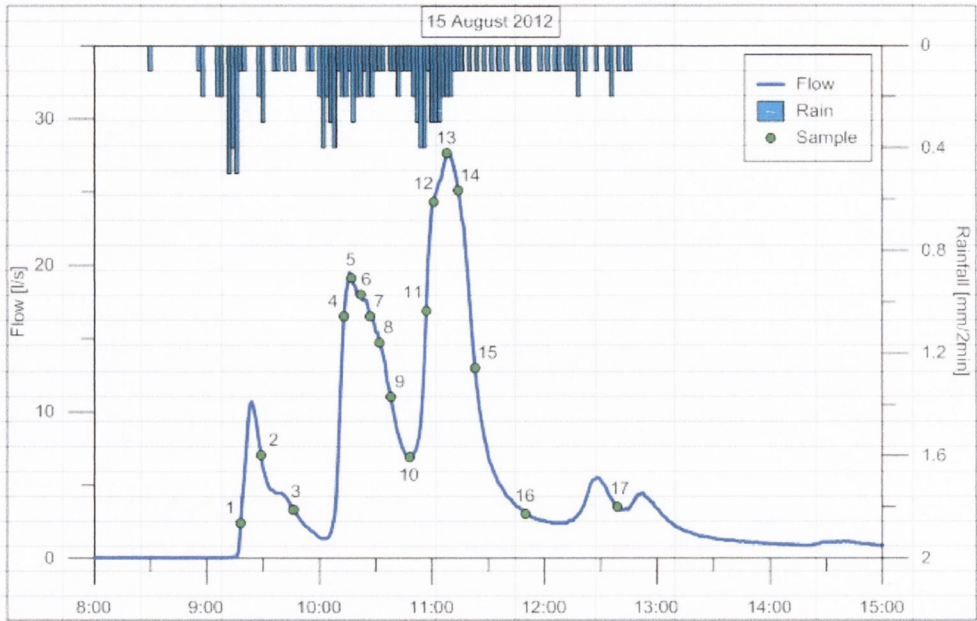
Rainfall	23.8 mm	Av rain intensity	2.6 mm/hr	Analysis			
Runoff	106 m3	Peak hourly intensity	7.3 mm/hr	Single bottle SSC & VSS, PSD/settling velocities. Composite: Metals and phosphorus.			
DCIA	14200 m2	Peak 10min rain intensity	14.4 mm/hr				
Runoff Coeff	0.31	Flow duration	612 minutes	Prev rain	27/06/2012 07:00	Flow start	27/06/2012 22:48
ADP	0.6 days	Average flow	2.9 l/s	Rain start	27/06/2012 21:34	Flow end	28/06/2012 09:00
Rain Duration	540 minutes	Peak flow	29.6 l/s	Rain end	28/06/2012 06:34		

27 June 2012		Kimmage // Storm Summary								2 of 4
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	MSS [g]	VSS [mg/l]	VSS*Vi/Vt	MVSS [g]	% Org	
US1	2784	0.026	15	0.40	43	8	0.20	21	50	
US2	7701	0.073	12	0.87	92	5	0.39	41	45	
US3	15234	0.144	28	3.99	424	8	1.17	125	29	
US4	15852	0.149	91	13.63	1446	37	5.53	587	41	
US5	12461	0.117	17	2.03	216	8	0.91	96	45	
US6	13676	0.129	16	2.11	223	8	1.01	108	48	
US7	13652	0.129	14	1.84	196	6	0.82	87	45	
US8	10680	0.101	21	2.12	225	9	0.88	93	41	
US9	7143	0.067	10	0.68	72	4	0.30	31	44	
US10	6896	0.065	9	0.57	61	4	0.25	27	44	
Composite			27			10				
Min			9			4				
Max			91			37				
Med			16			8				
EMC				28			11		41	
Total Mass					2997			1216		

27 June 2012		Kimmage // Storm Summary			3 of 4
Sample	P [ug/l]	Cu [ug/l]	Pb [ug/l]	Zn [ug/l]	
Detection Limit	5	5	6	5	
USC F1	38	ND	ND	ND	
USC T1	99	ND	ND	13	



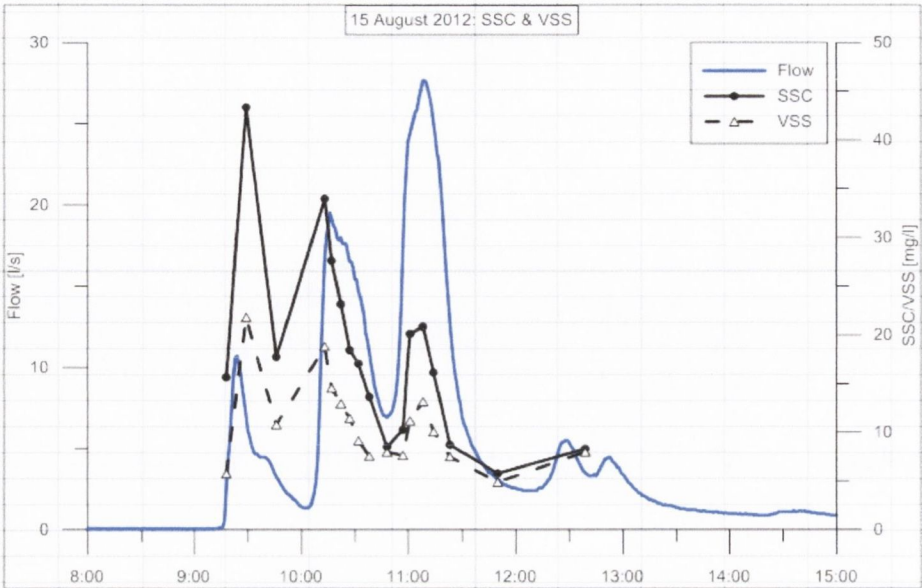




Rainfall	13.6 mm	Rainfall duration	256 minutes	Analysis			
Runoff	120 m3	Av rain intensity	3.2 mm/hr	Single bottle SSC & VSS. Composite: metals & P.			
DCIA	14200 m2	Peak 10min rain intensity	9.6 mm/hr				
Runoff Coeff	0.62	Flow duration	346 minutes	Prev rain	05/08/2012 17:56	Flow start	15/08/2012 09:14
ADP	9.6 days	Average flow	5.8 l/s	Rain start	15/08/2012 08:30	Flow end	15/08/2012 15:00
		Peak flow	27.6 l/s	Rain end	15/08/2012 12:46		

15 August 2012	Kimmage	Storm Summary								2 of 4
Sample	Vi [l]	Vi/Vt	SSC [mg/l]	SSC*Vi/Vt	MSS [g]	VSS [mg/l]	VSS*Vi/Vt	MVSS [g]	% Org	
US1	2937	0.024	16	0.38	46.0	6	0.14	17.0	37	
US2	5056	0.042	43	1.82	219.2	22	0.92	110.3	50	
US3	5228	0.043	18	0.77	92.8	11	0.47	56.4	61	
US4	5174	0.043	34	1.46	175.8	19	0.81	97.3	55	
US5	4995	0.042	28	1.15	137.9	15	0.60	72.7	53	
US6	5327	0.044	23	1.02	123.3	13	0.57	68.9	56	
US7	4941	0.041	18	0.76	91.0	11	0.47	56.6	62	
US8	4640	0.039	17	0.66	79.2	9	0.35	42.4	54	
US9	4727	0.039	14	0.54	64.5	8	0.30	35.8	55	
US10	5084	0.042	9	0.36	43.3	8	0.34	40.6	94	
US11	5368	0.045	10	0.46	55.0	8	0.34	41.0	75	
US12	8205	0.068	20	1.37	165.1	11	0.76	91.8	56	
US13	10284	0.085	21	1.78	214.3	13	1.12	135.1	63	
US14	9947	0.083	16	1.34	160.7	10	0.83	100.0	62	
US15	9721	0.081	9	0.71	84.9	8	0.61	72.9	86	
US16	9587	0.080	6	0.46	55.4	5	0.39	46.9	85	
US17	19102	0.159	8	1.32	158.7	8	1.27	152.6	96	
Min			6			5				
Max			43			22				
Med			17			10				
EMC				16			10			
Total mass					1967			1238	63	

15 August 2012 Kimmage		Storm Summary			3 of 4
Sample	P	Cu	Pb	Zn	
	[ug/l]	[ug/l]	[ug/l]	[ug/l]	
Detection Limit	5	5	5	5	
USC F1	75	ND	ND	5	
USC T1	169	20	6	38	
USC T2	184	23	7	33	
Mean	176	22	6	36	
RPD	9	12	25	14	
Digestion Blank	ND	ND	ND	ND	



Appendix C: Matlab code for SWMM runoff auto-calibration tool

```

% Function runGlobalSearch sets up solver problem and calls myfunction at
% each iteration

problem
createOptimProblem('fmincon','x0',[2;2],'lb',[0.01;0.01],'ub',[5;6],'obje' =
ctive',@myfunc);

gs
GlobalSearch('Display','iter','NumTrialPoints',25,'NumStageOnePoints',5); =

tic; [x,f] = run(gs,problem); toc

% Function myfunc allows multiple parameters to be optimized by
% GlobalSearch solver, calls function swmm_run at each iteration

function f = myfunc(x)

min_inf = x(1);
decay_rate = x(2);

f = swmm_run(min_inf,decay_rate);

end

% Function swmm_run
% creates input file inp_file from arguments (max rate, min rate)
%

function y = swmm_run(min_rate,decay)

% load line no file for template changes
%load 'inp_line_no.txt';
% load subcatchment numbers
load 'subcatchment_no.txt';

% create pointer to template file for read only
fid_inp = fopen('template_blanks.inp', 'r');

% copy template file
copyfile('template_blanks.inp','new_template.inp','f');

% create pointer to new template, writable
fid_new = fopen('new_template.inp','wt');

% set format for num2str command
formatSpec = '%2.2f\n';

% read down file
for k = 1:836

    tline = fgetl(fid_inp);

    if k == 66

% write line to template...string only so number inputs

```

```

% changed to strings using num2str(formatSpec)

        tline = ['S11',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

% print line in file and skip to next line

        fprintf(fid_new,'%s\n',tline);

elseif k == 67

        tline = ['S12',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 68

        tline = ['S13',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 69

        tline = ['S14',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 70

        tline = ['S15',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 71

        tline = ['S16',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 72

        tline = ['S17',' ', '0.012', ' ', ...
'0.012', ' ', '1.0', ' ', '1.0', ' ', ...
'0.0', ' ', 'PERV', ' ', '12.9'];

```



```

        fprintf(fid_new, '%s\n', tline);

elseif k == 73

        tline = ['S18', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 74

        tline = ['S19', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 75

        tline = ['S20', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 76

        tline = ['S21', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 77

        tline = ['S22', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 78

        tline = ['S23', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

        fprintf(fid_new, '%s\n', tline);

elseif k == 79

        tline = ['S24', ' ', ' ', '0.012', ' ', ' ', ...
'0.012', ' ', ' ', '1.0', ' ', ' ', '1.0', ' ', ' ', ...
'0.0', ' ', ' ', 'PERV', ' ', ' ', '12.9'];

```

```

        fprintf(fid_new,'%s\n',tline);

elseif k == 80

        tline = ['S25','                ','0.012','                ','...
'0.012','                ','1.0','                ','1.0','                ','...
'0.0','                ','PERV','                ','12.9'];

        fprintf(fid_new,'%s\n',tline);

elseif k == 85

        tline = ['S11',...
                ','21.8',...
                ',num2str(min_rate,formatSpec),...
                ',num2str(decay,formatSpec),...
                ',num2str(1),...
                ',num2str(0)];

        fprintf(fid_new,'%s\n',tline);

elseif k == 86

        tline = ['S12',...
                ','21.8',...
                ',num2str(min_rate,formatSpec),...
                ',num2str(decay,formatSpec),...
                ',num2str(1),...
                ',num2str(0)];

        fprintf(fid_new,'%s\n',tline);

elseif k == 87

        tline = ['S13',...
                ','21.8',...
                ',num2str(min_rate,formatSpec),...
                ',num2str(decay,formatSpec),...
                ',num2str(1),...
                ',num2str(0)];

        fprintf(fid_new,'%s\n',tline);

elseif k == 88

        tline = ['S14',...
                ','21.8',...
                ',num2str(min_rate,formatSpec),...
                ',num2str(decay,formatSpec),...
                ',num2str(1),...
                ',num2str(0)];

        fprintf(fid_new,'%s\n',tline);

elseif k == 89

        tline = ['S15',...

```

```

'          ', '21.8', ...
'      ', num2str(min_rate, formatSpec), ...
'      ', num2str(decay, formatSpec), ...
'      ', num2str(1), ...
'      ', num2str(0)];

    fprintf(fid_new, '%s\n', tline);

    elseif k == 90

        tline = ['S16', ...
            ', '21.8', ...
            ', num2str(min_rate, formatSpec), ...
            ', num2str(decay, formatSpec), ...
            ', num2str(1), ...
            ', num2str(0)];

        fprintf(fid_new, '%s\n', tline);

        elseif k == 91

            tline = ['S17', ...
                ', '21.8', ...
                ', num2str(min_rate, formatSpec), ...
                ', num2str(decay, formatSpec), ...
                ', num2str(1), ...
                ', num2str(0)];

            fprintf(fid_new, '%s\n', tline);

            elseif k == 92

                tline = ['S18', ...
                    ', '21.8', ...
                    ', num2str(min_rate, formatSpec), ...
                    ', num2str(decay, formatSpec), ...
                    ', num2str(1), ...
                    ', num2str(0)];

                fprintf(fid_new, '%s\n', tline);

                elseif k == 93

                    tline = ['S19', ...
                        ', '21.8', ...
                        ', num2str(min_rate, formatSpec), ...
                        ', num2str(decay, formatSpec), ...
                        ', num2str(1), ...
                        ', num2str(0)];

                    fprintf(fid_new, '%s\n', tline);

                    elseif k == 94

                        tline = ['S20', ...
                            ', '21.8', ...
                            ', num2str(min_rate, formatSpec), ...
                            ', num2str(decay, formatSpec), ...

```

```

' ,num2str(1),...
' ,num2str(0)];

fprintf(fid_new,'%s\n',tline);

elseif k == 95

    tline = ['S21',...
' , '21.8',...
' ,num2str(min_rate,formatSpec),...
' ,num2str(decay,formatSpec),...
' ,num2str(1),...
' ,num2str(0)];

fprintf(fid_new,'%s\n',tline);

elseif k == 96

    tline = ['S22',...
' , '21.8',...
' ,num2str(min_rate,formatSpec),...
' ,num2str(decay,formatSpec),...
' ,num2str(1),...
' ,num2str(0)];

fprintf(fid_new,'%s\n',tline);

elseif k == 97

    tline = ['S23',...
' , '21.8',...
' ,num2str(min_rate,formatSpec),...
' ,num2str(decay,formatSpec),...
' ,num2str(1),...
' ,num2str(0)];

fprintf(fid_new,'%s\n',tline);

elseif k == 98

    tline = ['S24',...
' , '21.8',...
' ,num2str(min_rate,formatSpec),...
' ,num2str(decay,formatSpec),...
' ,num2str(1),...
' ,num2str(0)];

fprintf(fid_new,'%s\n',tline);

elseif k == 99

    tline = ['S25',...
' , '21.8',...
' ,num2str(min_rate,formatSpec),...
' ,num2str(decay,formatSpec),...
' ,num2str(1),...
' ,num2str(0)];

```



```

        fprintf(fid_new, '%s\n', tline);

    else
        fprintf(fid_new, '%s\n', tline);
    end

end

% copy the new_template to template1 etc

copyfile('new_template.inp', 'template.inp');

fclose('all');

% run SWMM
d_command = ('swmm5.exe template.inp report.rpt');
status = dos(d_command);

% name report file
rpt_file_1 = 'report.rpt';
% name results file
res_file_1 = 'results.rpt';

% set pointer to the report file for read only
fid_1_3 = fopen(rpt_file_1, 'r');

% get size of report file (no. lines)
nlines = 0;
while (fgets(fid_1_3) ~= -1)
    nlines = nlines + 1;
end

fid_1_4 = fopen(rpt_file_1, 'r');
% find start and end dates
cline = 1;
for i = 1:nlines

    tline = fgetl(fid_1_4);

    if strcmp('    FEB-01-2011 00:02:00          0.000          0.000          0.000
0.0', tline) == 1
        start_line = cline;
    end

    if strcmp('    AUG-15-2012 18:00:00          0.000          0.000          0.000
0.0', tline) == 1
        end_line = cline;
    end
    cline = cline + 1;
end

% set new pointer to results file
fid_1_5 = fopen(rpt_file_1, 'r');

% set pointer to file written to
fid_1_6 = fopen(res_file_1, 'w');

```

```

cline = 1;

for k = 1:end_line

    tline = fgetl(fid_1_5);

    % if current line >= startline print the line%
    if cline >= start_line

        fprintf(fid_1_6,'%s\n',tline);

    end

    cline = cline + 1;
end

%name results file
sim_results_1 = 'results.rpt';

% create pointer to results file
fid_1_7 = fopen(sim_results_1);

C = textscan(fid_1_7,'%s %s %f %f %f %f');

% create empty array for flow values
mod_flow = zeros((end_line-start_line),1);

% copy flows from C
for i = 1:(end_line-start_line)
    mod_flow(i,1) = C{3}(i);
end

% calculate N-S index
nse19;

create_events_cal;

y = NSE_flow_19;

fclose('all');

% delete results file
delete('results.rpt');

end

% Function create_events_cal creates arrays for calibration events and
% computes evaluation funtions for total volume and peak flow

% load observed flow
load('obs_flow.txt');
% load event references
load('event_ref_ssc.txt');

% events matrix (obs_ and mod_) will contain 40 columns each row

```

```

% contains observed or modelled flow or zeros
obs_events_cal = zeros(623,19);
mod_events_cal = zeros(623,19);

for k = 1:19
    % set start row of event
    event_row = event_ref_ssc(k,2);
    % loop from start to end of each event
    for i = 1:event_ref_ssc(k,4)
        obs_events_cal(i,k) = obs_flow(event_row);
        mod_events_cal(i,k) = mod_flow(event_row);
        event_row = event_row + 1;
    end
end

% Peak flow of cal events

for i = 1:19

    obs_PF_cal(i,1) = max(obs_events_cal(:,i));

    mod_PF_cal(i,1) = max(mod_events_cal(:,i));

end

% Total volume of cal events

for i = 1:19

    obs_TV_cal(i,1) = (sum(obs_events_cal(:,i)))*0.12;

    mod_TV_cal(i,1) = (sum(mod_events_cal(:,i)))*0.12;

end

% Total vol and peak flow err

for i = 1:19

    TV_err_cal(i,1) = (obs_TV_cal(i,1) - mod_TV_cal(i,1))^2;

    PF_err_cal(i,1) = (obs_PF_cal(i,1) - mod_PF_cal(i,1))^2;

end

Sum_TV_err_cal = sum(TV_err_cal);

Sum_PF_err_cal = sum(PF_err_cal);

% Function nsel9 calculates Nash-Sutcliffe Efficiency of calibration
events

% ///create time series of 19 events with no gaps...cont_events ///
mod_cont_events_cal = zeros(2792,1);
obs_cont_events_cal = zeros(2792,1);

```

```

% load observed flow
load('obs_flow.txt');
% load event references
load('event_ref_ssc.txt');

k = 1;

for i = 1:19

    l = event_ref_ssc(i,2);

    for j = 1:event_ref_ssc(i,4)

        mod_cont_events_cal(k,1) = mod_flow(l);
        l = l + 1;
        k = k + 1;

    end

end

k = 1;

for i = 1:19

    l = event_ref_ssc(i,2);

    for j = 1:event_ref_ssc(i,4)

        obs_cont_events_cal(k,1) = obs_flow(l);
        l = l + 1;
        k = k + 1;

    end

end

% create zero array for obs-mod flow, obs-mean flow

obs_minus_mod_flow_19 = zeros(2792,1);

obs_minus_mean_flow_19 = zeros(2792,1);

for i = 1:2792

    obs_minus_mod_flow_19(i,1) = mod_cont_events_cal(i,1) -
    obs_cont_events_cal(i,1);

end

obs_minus_mod_flow_19_sq = obs_minus_mod_flow_19.^2;

% calculate SSO sum of square differences

SSO_flow_19 = sum(obs_minus_mod_flow_19_sq);

```



```

% calculate mean of observed flows

mean_flow_19 = mean(obs_cont_events_cal);

for i = 1:2792

    obs_minus_mean_flow_19(i,1) = obs_cont_events_cal(i,1) -
mean_flow_19;

end

obs_minus_mean_flow_19_sq = obs_minus_mean_flow_19.^2;

% calculate SSE sum of square error

SSE_flow_19 = sum(obs_minus_mean_flow_19_sq);

% Calculate NSE

NSE_flow_19 = SSO_flow_19/SSE_flow_19;

Total_vol_cal = (sum(mod_cont_events_cal))*0.12;

```

Appendix D: SWMM input file for Kimmage runoff model

```

[OPTIONS]
FLOW_UNITS          LPS
INFILTRATION        HORTON
FLOW_ROUTING        DYNWAVE
START_DATE          02/01/2011
START_TIME          00:00:00
REPORT_START_DATE   02/01/2011
REPORT_START_TIME   00:00:00
END_DATE            08/18/2012
END_TIME            18:00:00
SWEEP_START         02/01
SWEEP_END           11/16
DRY_DAYS            0
REPORT_STEP         00:02:00
WET_STEP            00:00:15
DRY_STEP            24:00:00
ROUTING_STEP        0:00:15
ALLOW_PONDING       NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP       0.75
LENGTHENING_STEP   0
MIN_SURFAREA        0
NORMAL_FLOW_LIMITED BOTH
SKIP_STEADY_STATE   NO
FORCE_MAIN_EQUATION H-W
LINK_OFFSETS        DEPTH
MIN_SLOPE           0

```

```

[EVAPORATION]
;;Type      Parameters
;;-----
TIMESERIES  EvaporationKimmage
DRY_ONLY    YES

```

```

[RAINGAGES]
;;          Rain      Time      Snow      Data
;;Name      Type      Intrvl  Catch      Source
;;-----
RG1          VOLUME      00:02      0          FILE
"C:\Users\Dell\Documents\Project\SWMM\Input
Data\Rainfall\KimmageRain2011-2012_offset2.txt" 1          MM

```

```

[SUBCATCHMENTS]
;;
Pcnt.      Curb      Snow      Total      Pcnt.
;;Name      Rainage      Outlet      Area      Imperv
Width      Slope      Length  Pack
;;-----
S11          RG1          J1          0.088      29.0      44
0.9          0
S12          RG1          J2          0.022      30.0      11
0.8          0
S13          RG1          J3          0.122      48.0      61
0.8          0
S14          RG1          J4          0.189      34.0      95
1.2          0
S15          RG1          J5          0.089      30.0      45
1          0

```

S16		RG1	J6	0.055	46.0	28
0.5	0					
S17		RG1	J7	0.047	25.0	24
0.8	0					
S18		RG1	J8	0.176	38.0	88
0.6	0					
S19		RG1	J9	0.13	50.0	65
2.2	0					
S20		RG1	J10	0.068	33.0	34
0.8	0					
S21		RG1	J11	0.153	39.0	77
0.8	0					
S22		RG1	J12	0.027	34.0	14
0.5	0					
S23		RG1	J13	0.029	36.0	15
0.5	0					
S24		RG1	J14	0.1	58.0	50
0.8	0					
S25		RG1	J14	0.122	62.0	61
0.8	0					

[SUBAREAS]

;;Subcatchment	N-Imperv	N-Perv	S-Imperv	S-Perv	PctZero	
RouteTo	PctRouted					
;;						
S11		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S12		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S13		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S14		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S15		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S16		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S17		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S18		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S19		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S20		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S21		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S22		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S23		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S24		0.012	0.012	1.0	1.0	0.0
PERV	12.9					
S25		0.012	0.012	1.0	1.0	0.0
PERV	12.9					

[INFILTRATION]

;;Subcatchment	MaxRate	MinRate	Decay	DryTime	MaxInfil
;;					
S11	21.8	3.00	5.60	1	0

S12	21.8	3.00	5.60	1	0
S13	21.8	3.00	5.60	1	0
S14	21.8	3.00	5.60	1	0
S15	21.8	3.00	5.60	1	0
S16	21.8	3.00	5.60	1	0
S17	21.8	3.00	5.60	1	0
S18	21.8	3.00	5.60	1	0
S19	21.8	3.00	5.60	1	0
S20	21.8	3.00	5.60	1	0
S21	21.8	3.00	5.60	1	0
S22	21.8	3.00	5.60	1	0
S23	21.8	3.00	5.60	1	0
S24	21.8	3.00	5.60	1	0
S25	21.8	3.00	5.60	1	0

[JUNCTIONS]

;;	Invert	Max.	Init.	Surcharge	Ponded
;;Name	Elev.	Depth	Depth	Depth	Area

J1	38.01	1.26	0	0	0
J2	37.87	0.9	0	0	0
J3	37.09	1.34	0	0	0
J4	35.325	1.42	0	0	0
J5	34.905	1.42	0	0	0
J6	33.649	2.36	0	0	0
J7	38.867	1.26	0	0	0
J8	38.083	1.2	0	0	0
J9	36.709	1.1	0	0	0
J10	35.6	1.305	0	0	0
J11	34.587	1.4	0	0	0
J12	34.459	0.8	0	0	0
J13	34.277	1	0	0	0
J14	33.616	2.4	0	0	0
J15	33.102	2.5	0	0	0
J16	32.873	2.81	0	0	0
J17	32.74	2.888	0	0	0

[OUTFALLS]

;;	Invert	Outfall	Stage/Table	Tide
;;Name	Elev.	Type	Time Series	Gate

OF1	32.7	FREE		NO

[CONDUITS]

;;	Inlet	Outlet	Inlet	Outlet	Manning
;;Name	Offset	Offset	Node	Node	Length

C1			J1	J3	106.44
0	0		0	0	0.012
C2			J2	J3	38.86
0	0		0	0	0.012
C3			J3	J4	95.94
0	0		0	0	0.012
C4			J4	J5	56.51
0	0.075		0	0	0.012
C5			J5	J6	155.02
0	0		0	0	0.012

C6		J6		J15	50.89	0.012
0	0	0	0			
C17		J17		OF1	8.11	0.012
0	0	0	0			
C14		J14		J15	61.05	0.012
0	0.15	0	0			
C10		J10		J11	111.51	0.012
0	0	0	0			
C13		J13		J14	74.75	0.012
0	0	0	0			
C12		J12		J13	30.61	0.012
0	0	0	0			
C11		J11		J14	3.65	0.012
0	0.9	0	0			
C9		J9		J10	65.48	0.012
0	0.075	0	0			
C8		J8		J9	91.48	0.012
0	0	0	0			
C7		J7		J8	137.42	0.012
0	0	0	0			
C15		J15		J16	61.86	0.012
0	0	0	0			

[OUTLETS]

;;	Inlet	Flap	Outlet	Outflow	Outlet
Qcoeff/					
;;Name	Node		Node	Height	Type
QTable	Qexpon	Gate			
1	J16		J17		0
TABULAR/DEPTH	DDcurve		NO		

[XSECTIONS]

;;Link	Shape	Geom1	Geom2	Geom3
Geom4	Barrels			
C1	CIRCULAR	0.225	0	0
1				
C2	CIRCULAR	0.225	0	0
1				
C3	CIRCULAR	0.225	0	0
1				
C4	CIRCULAR	0.225	0	0
1				
C5	CIRCULAR	0.3	0	0
1				
C6	CIRCULAR	0.3	0	0
1				
C17	CIRCULAR	0.45	0	0
1				
C14	CIRCULAR	0.3	0	0
1				
C10	CIRCULAR	0.3	0	0
1				
C13	CIRCULAR	0.225	0	0
1				
C12	CIRCULAR	0.3	0	0
1				

C11	CIRCULAR	0.3	0	0	0
1					
C9	CIRCULAR	0.225	0	0	0
1					
C8	CIRCULAR	0.225	0	0	0
1					
C7	CIRCULAR	0.225	0	0	0
1					
C15	CIRCULAR	0.45	0	0	0
1					

[LOSSES]

;;Link	Inlet	Outlet	Average	Flap Gate
;;-----	-----	-----	-----	-----

[CURVES]

;;Name	Type	X-Value	Y-Value
;;-----	-----	-----	-----
DDCurve	Rating	0	0
DDCurve		0.02	0.2
DDCurve		0.04	0.25
DDCurve		0.061	0.335
DDCurve		0.070	0.774
DDCurve		0.074	0.966
DDCurve		0.081	1.080
DDCurve		0.082	1.041
DDCurve		0.086	1.186
DDCurve		0.091	1.255
DDCurve		0.092	1.522
DDCurve		0.094	1.832
DDCurve		0.095	2.016
DDCurve		0.097	2.093
DDCurve		0.099	2.340
DDCurve		0.101	2.705
DDCurve		0.104	3.107
DDCurve		0.107	3.295
DDCurve		0.111	3.417
DDCurve		0.115	4.239
DDCurve		0.119	5.139
DDCurve		0.127	6.843
DDCurve		0.138	7.896
DDCurve		0.144	9.428
DDCurve		0.150	11.045
DDCurve		0.164	11.921
DDCurve		0.191	12.922
DDCurve		0.232	16.517
DDCurve		0.262	18.021
DDCurve		0.286	20.336
DDCurve		0.310	23.912
DDCurve		0.344	25.407
DDCurve		0.394	32.256
DDCurve		0.436	37.386
DDCurve		0.487	43.947
DDCurve		0.600	58.084
DDCurve		0.800	83.198
DDCurve		1.000	108.312
DDCurve		1.200	133.426
DDCurve		1.400	158.54

[TIMESERIES]

;;Name	Date	Time	Value
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;;-----
EvaporationKimmage 2/1/11      01:00      0.4
EvaporationKimmage 2/2/11      01:00      0.7
EvaporationKimmage 2/3/11      01:00      0.5
EvaporationKimmage 2/4/11      01:00      0.6
EvaporationKimmage 2/5/11      01:00      0.3
EvaporationKimmage 2/6/11      01:00      0.4
EvaporationKimmage 2/7/11      01:00      0.5
EvaporationKimmage 2/8/11      01:00      0.5
EvaporationKimmage 2/9/11      01:00      0.4
EvaporationKimmage 2/10/11     01:00      0.3
EvaporationKimmage 2/11/11     01:00      0.4
EvaporationKimmage 2/12/11     01:00      0.4
EvaporationKimmage 2/13/11     01:00      0.4
EvaporationKimmage 2/14/11     01:00      0.8
EvaporationKimmage 2/15/11     01:00      0.7
EvaporationKimmage 2/16/11     01:00      0.7
EvaporationKimmage 2/17/11     01:00      0.3
EvaporationKimmage 2/18/11     01:00      0.6
EvaporationKimmage 2/19/11     01:00      0.7
EvaporationKimmage 2/20/11     01:00      0.7
EvaporationKimmage 2/21/11     01:00      0.6
EvaporationKimmage 2/22/11     01:00      0.5
EvaporationKimmage 2/23/11     01:00      0.9
EvaporationKimmage 2/24/11     01:00      1.2
EvaporationKimmage 2/25/11     01:00      1
EvaporationKimmage 2/26/11     01:00      0.7
EvaporationKimmage 2/27/11     01:00      0.9
EvaporationKimmage 2/28/11     01:00      0.8
EvaporationKimmage 3/1/11      01:00      0.9
EvaporationKimmage 3/2/11      01:00      0.7
EvaporationKimmage 3/3/11      01:00      0.6
EvaporationKimmage 3/4/11      01:00      0.7
EvaporationKimmage 3/5/11      01:00      0.6
EvaporationKimmage 3/6/11      01:00      0.7
EvaporationKimmage 3/7/11      01:00      1
EvaporationKimmage 3/8/11      01:00      0.7
EvaporationKimmage 3/9/11      01:00      1.2
EvaporationKimmage 3/10/11     01:00      1.1
EvaporationKimmage 3/11/11     01:00      0.6
EvaporationKimmage 3/12/11     01:00      0.9
EvaporationKimmage 3/13/11     01:00      0.9
EvaporationKimmage 3/14/11     01:00      1.1
EvaporationKimmage 3/15/11     01:00      1
EvaporationKimmage 3/16/11     01:00      1.1
EvaporationKimmage 3/17/11     01:00      1.1
EvaporationKimmage 3/18/11     01:00      1.4
EvaporationKimmage 3/19/11     01:00      1.5
EvaporationKimmage 3/20/11     01:00      1.5
EvaporationKimmage 3/21/11     01:00      1.3
EvaporationKimmage 3/22/11     01:00      1.5
EvaporationKimmage 3/23/11     01:00      1.4
EvaporationKimmage 3/24/11     01:00      1.7
EvaporationKimmage 3/25/11     01:00      1.4
EvaporationKimmage 3/26/11     01:00      0.8
EvaporationKimmage 3/27/11     01:00      1.6
EvaporationKimmage 3/28/11     01:00      1.4
EvaporationKimmage 3/29/11     01:00      0.9
EvaporationKimmage 3/30/11     01:00      2
EvaporationKimmage 3/31/11     01:00      2.1
EvaporationKimmage 4/1/11      01:00      1.2

```


EvaporationKimmage	4/2/11	01:00	1.6
EvaporationKimmage	4/3/11	01:00	1.8
EvaporationKimmage	4/4/11	01:00	2.1
EvaporationKimmage	4/5/11	01:00	1.6
EvaporationKimmage	4/6/11	01:00	2.7
EvaporationKimmage	4/7/11	01:00	1.5
EvaporationKimmage	4/8/11	01:00	2.2
EvaporationKimmage	4/9/11	01:00	4
EvaporationKimmage	4/10/11	01:00	2.5
EvaporationKimmage	4/11/11	01:00	1.4
EvaporationKimmage	4/12/11	01:00	2
EvaporationKimmage	4/13/11	01:00	1.7
EvaporationKimmage	4/14/11	01:00	1
EvaporationKimmage	4/15/11	01:00	2.4
EvaporationKimmage	4/16/11	01:00	1.7
EvaporationKimmage	4/17/11	01:00	1.6
EvaporationKimmage	4/18/11	01:00	2.4
EvaporationKimmage	4/19/11	01:00	2.7
EvaporationKimmage	4/20/11	01:00	2.8
EvaporationKimmage	4/21/11	01:00	3
EvaporationKimmage	4/22/11	01:00	3.1
EvaporationKimmage	4/23/11	01:00	2.3
EvaporationKimmage	4/24/11	01:00	2
EvaporationKimmage	4/25/11	01:00	1.6
EvaporationKimmage	4/26/11	01:00	2
EvaporationKimmage	4/27/11	01:00	2.8
EvaporationKimmage	4/28/11	01:00	3.1
EvaporationKimmage	4/29/11	01:00	2.8
EvaporationKimmage	4/30/11	01:00	3.1
EvaporationKimmage	5/1/11	01:00	3.3
EvaporationKimmage	5/2/11	01:00	3.7
EvaporationKimmage	5/3/11	01:00	3
EvaporationKimmage	5/4/11	01:00	2.7
EvaporationKimmage	5/5/11	01:00	2.1
EvaporationKimmage	5/6/11	01:00	2.6
EvaporationKimmage	5/7/11	01:00	2
EvaporationKimmage	5/8/11	01:00	2.9
EvaporationKimmage	5/9/11	01:00	2.6
EvaporationKimmage	5/10/11	01:00	2.9
EvaporationKimmage	5/11/11	01:00	2.9
EvaporationKimmage	5/12/11	01:00	2.3
EvaporationKimmage	5/13/11	01:00	1.9
EvaporationKimmage	5/14/11	01:00	2.2
EvaporationKimmage	5/15/11	01:00	1.5
EvaporationKimmage	5/16/11	01:00	2.5
EvaporationKimmage	5/17/11	01:00	2
EvaporationKimmage	5/18/11	01:00	2
EvaporationKimmage	5/19/11	01:00	2.2
EvaporationKimmage	5/20/11	01:00	2.7
EvaporationKimmage	5/21/11	01:00	1.7
EvaporationKimmage	5/22/11	01:00	3.1
EvaporationKimmage	5/23/11	01:00	2.3
EvaporationKimmage	5/24/11	01:00	3.8
EvaporationKimmage	5/25/11	01:00	2.2
EvaporationKimmage	5/26/11	01:00	2.1
EvaporationKimmage	5/27/11	01:00	2
EvaporationKimmage	5/28/11	01:00	2.8
EvaporationKimmage	5/29/11	01:00	2.9
EvaporationKimmage	5/30/11	01:00	2.5
EvaporationKimmage	5/31/11	01:00	3
EvaporationKimmage	6/1/11	01:00	2.6

EvaporationKimmage	6/2/11	01:00	3.3
EvaporationKimmage	6/3/11	01:00	4.4
EvaporationKimmage	6/4/11	01:00	3.3
EvaporationKimmage	6/5/11	01:00	1.2
EvaporationKimmage	6/6/11	01:00	2.4
EvaporationKimmage	6/7/11	01:00	2.4
EvaporationKimmage	6/8/11	01:00	2.5
EvaporationKimmage	6/9/11	01:00	2.4
EvaporationKimmage	6/10/11	01:00	2.8
EvaporationKimmage	6/11/11	01:00	2.9
EvaporationKimmage	6/12/11	01:00	1.1
EvaporationKimmage	6/13/11	01:00	2.9
EvaporationKimmage	6/14/11	01:00	3.2
EvaporationKimmage	6/15/11	01:00	3.1
EvaporationKimmage	6/16/11	01:00	2.9
EvaporationKimmage	6/17/11	01:00	1.6
EvaporationKimmage	6/18/11	01:00	2.6
EvaporationKimmage	6/19/11	01:00	2.5
EvaporationKimmage	6/20/11	01:00	2.5
EvaporationKimmage	6/21/11	01:00	2.8
EvaporationKimmage	6/22/11	01:00	2.6
EvaporationKimmage	6/23/11	01:00	3.4
EvaporationKimmage	6/24/11	01:00	0.9
EvaporationKimmage	6/25/11	01:00	2.7
EvaporationKimmage	6/26/11	01:00	3.9
EvaporationKimmage	6/27/11	01:00	2.3
EvaporationKimmage	6/28/11	01:00	3.2
EvaporationKimmage	6/29/11	01:00	2.5
EvaporationKimmage	6/30/11	01:00	2.9
EvaporationKimmage	7/1/11	01:00	3.4
EvaporationKimmage	7/2/11	01:00	3.6
EvaporationKimmage	7/3/11	01:00	4.1
EvaporationKimmage	7/4/11	01:00	3.7
EvaporationKimmage	7/5/11	01:00	3.6
EvaporationKimmage	7/6/11	01:00	2.6
EvaporationKimmage	7/7/11	01:00	2.6
EvaporationKimmage	7/8/11	01:00	1.8
EvaporationKimmage	7/9/11	01:00	3.5
EvaporationKimmage	7/10/11	01:00	2.2
EvaporationKimmage	7/11/11	01:00	2.2
EvaporationKimmage	7/12/11	01:00	2.8
EvaporationKimmage	7/13/11	01:00	3.9
EvaporationKimmage	7/14/11	01:00	3.2
EvaporationKimmage	7/15/11	01:00	1.7
EvaporationKimmage	7/16/11	01:00	2.7
EvaporationKimmage	7/17/11	01:00	1.4
EvaporationKimmage	7/18/11	01:00	1.7
EvaporationKimmage	7/19/11	01:00	2
EvaporationKimmage	7/20/11	01:00	2
EvaporationKimmage	7/21/11	01:00	0.9
EvaporationKimmage	7/22/11	01:00	2
EvaporationKimmage	7/23/11	01:00	3.6
EvaporationKimmage	7/24/11	01:00	2.5
EvaporationKimmage	7/25/11	01:00	2.2
EvaporationKimmage	7/26/11	01:00	2.4
EvaporationKimmage	7/27/11	01:00	3.3
EvaporationKimmage	7/28/11	01:00	1.6
EvaporationKimmage	7/29/11	01:00	1.9
EvaporationKimmage	7/30/11	01:00	2.5
EvaporationKimmage	7/31/11	01:00	1.8
EvaporationKimmage	8/1/11	01:00	2.1

EvaporationKimmage	8/2/11	01:00	2.6
EvaporationKimmage	8/3/11	01:00	2.3
EvaporationKimmage	8/4/11	01:00	1.7
EvaporationKimmage	8/5/11	01:00	1.4
EvaporationKimmage	8/6/11	01:00	2.1
EvaporationKimmage	8/7/11	01:00	2.1
EvaporationKimmage	8/8/11	01:00	2.1
EvaporationKimmage	8/9/11	01:00	2
EvaporationKimmage	8/10/11	01:00	1.5
EvaporationKimmage	8/11/11	01:00	2.2
EvaporationKimmage	8/12/11	01:00	2
EvaporationKimmage	8/13/11	01:00	2
EvaporationKimmage	8/14/11	01:00	2.4
EvaporationKimmage	8/15/11	01:00	2.3
EvaporationKimmage	8/16/11	01:00	2.1
EvaporationKimmage	8/17/11	01:00	2.3
EvaporationKimmage	8/18/11	01:00	1.6
EvaporationKimmage	8/19/11	01:00	1.6
EvaporationKimmage	8/20/11	01:00	2.1
EvaporationKimmage	8/21/11	01:00	2.1
EvaporationKimmage	8/22/11	01:00	2.2
EvaporationKimmage	8/23/11	01:00	2.1
EvaporationKimmage	8/24/11	01:00	2.6
EvaporationKimmage	8/25/11	01:00	2.4
EvaporationKimmage	8/26/11	01:00	2.3
EvaporationKimmage	8/27/11	01:00	1.9
EvaporationKimmage	8/28/11	01:00	2.1
EvaporationKimmage	8/29/11	01:00	1.6
EvaporationKimmage	8/30/11	01:00	1.4
EvaporationKimmage	8/31/11	01:00	1.5
EvaporationKimmage	9/1/11	01:00	2.5
EvaporationKimmage	9/2/11	01:00	2.3
EvaporationKimmage	9/3/11	01:00	1.1
EvaporationKimmage	9/4/11	01:00	1.5
EvaporationKimmage	9/5/11	01:00	1.3
EvaporationKimmage	9/6/11	01:00	1.4
EvaporationKimmage	9/7/11	01:00	1.2
EvaporationKimmage	9/8/11	01:00	1.6
EvaporationKimmage	9/9/11	01:00	2.2
EvaporationKimmage	9/10/11	01:00	2.1
EvaporationKimmage	9/11/11	01:00	1.6
EvaporationKimmage	9/12/11	01:00	1.5
EvaporationKimmage	9/13/11	01:00	2.4
EvaporationKimmage	9/14/11	01:00	1.4
EvaporationKimmage	9/15/11	01:00	1.6
EvaporationKimmage	9/16/11	01:00	1.8
EvaporationKimmage	9/17/11	01:00	1.1
EvaporationKimmage	9/18/11	01:00	1.4
EvaporationKimmage	9/19/11	01:00	1.3
EvaporationKimmage	9/20/11	01:00	1.2
EvaporationKimmage	9/21/11	01:00	1.6
EvaporationKimmage	9/22/11	01:00	1.2
EvaporationKimmage	9/23/11	01:00	1.7
EvaporationKimmage	9/24/11	01:00	1.9
EvaporationKimmage	9/25/11	01:00	1.5
EvaporationKimmage	9/26/11	01:00	1.6
EvaporationKimmage	9/27/11	01:00	1.7
EvaporationKimmage	9/28/11	01:00	2.5
EvaporationKimmage	9/29/11	01:00	2.3
EvaporationKimmage	9/30/11	01:00	1.4
EvaporationKimmage	10/1/11	01:00	0.5

EvaporationKimmage	10/2/11	01:00	0.8
EvaporationKimmage	10/3/11	01:00	1.6
EvaporationKimmage	10/4/11	01:00	1.1
EvaporationKimmage	10/5/11	01:00	1.6
EvaporationKimmage	10/6/11	01:00	1.5
EvaporationKimmage	10/7/11	01:00	1.2
EvaporationKimmage	10/8/11	01:00	1.3
EvaporationKimmage	10/9/11	01:00	1.2
EvaporationKimmage	10/10/11	01:00	1
EvaporationKimmage	10/11/11	01:00	0.8
EvaporationKimmage	10/12/11	01:00	0.8
EvaporationKimmage	10/13/11	01:00	0.9
EvaporationKimmage	10/14/11	01:00	0.6
EvaporationKimmage	10/15/11	01:00	0.8
EvaporationKimmage	10/16/11	01:00	1.2
EvaporationKimmage	10/17/11	01:00	1.1
EvaporationKimmage	10/18/11	01:00	1.1
EvaporationKimmage	10/19/11	01:00	0.8
EvaporationKimmage	10/20/11	01:00	0.6
EvaporationKimmage	10/21/11	01:00	1.3
EvaporationKimmage	10/22/11	01:00	0.8
EvaporationKimmage	10/23/11	01:00	0.9
EvaporationKimmage	10/24/11	01:00	0.7
EvaporationKimmage	10/25/11	01:00	0.6
EvaporationKimmage	10/26/11	01:00	0.8
EvaporationKimmage	10/27/11	01:00	0.6
EvaporationKimmage	10/28/11	01:00	0.9
EvaporationKimmage	10/29/11	01:00	0.7
EvaporationKimmage	10/30/11	01:00	0.8
EvaporationKimmage	10/31/11	01:00	0.8
EvaporationKimmage	11/1/11	01:00	0.6
EvaporationKimmage	11/2/11	01:00	1.3
EvaporationKimmage	11/3/11	01:00	0.8
EvaporationKimmage	11/4/11	01:00	0.4
EvaporationKimmage	11/5/11	01:00	0.3
EvaporationKimmage	11/6/11	01:00	0.3
EvaporationKimmage	11/7/11	01:00	0.2
EvaporationKimmage	11/8/11	01:00	0.6
EvaporationKimmage	11/9/11	01:00	0.8
EvaporationKimmage	11/10/11	01:00	0.5
EvaporationKimmage	11/11/11	01:00	1.2
EvaporationKimmage	11/12/11	01:00	0.4
EvaporationKimmage	11/13/11	01:00	1
EvaporationKimmage	11/14/11	01:00	0.5
EvaporationKimmage	11/15/11	01:00	0.4
EvaporationKimmage	11/16/11	01:00	0.5
EvaporationKimmage	11/17/11	01:00	0.5
EvaporationKimmage	11/18/11	01:00	1.1
EvaporationKimmage	11/19/11	01:00	0.8
EvaporationKimmage	11/20/11	01:00	0.4
EvaporationKimmage	11/21/11	01:00	0.4
EvaporationKimmage	11/22/11	01:00	0.3
EvaporationKimmage	11/23/11	01:00	0.7
EvaporationKimmage	11/24/11	01:00	0.6
EvaporationKimmage	11/25/11	01:00	0.6
EvaporationKimmage	11/26/11	01:00	0.9
EvaporationKimmage	11/27/11	01:00	0.5
EvaporationKimmage	11/28/11	01:00	0.8
EvaporationKimmage	11/29/11	01:00	0.7
EvaporationKimmage	11/30/11	01:00	0.9
EvaporationKimmage	12/1/11	01:00	0.1

EvaporationKimmage	12/2/11	01:00	0.4
EvaporationKimmage	12/3/11	01:00	0.5
EvaporationKimmage	12/4/11	01:00	0.4
EvaporationKimmage	12/5/11	01:00	0.4
EvaporationKimmage	12/6/11	01:00	0.4
EvaporationKimmage	12/7/11	01:00	0.3
EvaporationKimmage	12/8/11	01:00	0.6
EvaporationKimmage	12/9/11	01:00	0.1
EvaporationKimmage	12/10/11	01:00	0.5
EvaporationKimmage	12/11/11	01:00	0.4
EvaporationKimmage	12/12/11	01:00	0.6
EvaporationKimmage	12/13/11	01:00	0.6
EvaporationKimmage	12/14/11	01:00	0.6
EvaporationKimmage	12/15/11	01:00	0.3
EvaporationKimmage	12/16/11	01:00	0.2
EvaporationKimmage	12/17/11	01:00	0.2
EvaporationKimmage	12/18/11	01:00	0.2
EvaporationKimmage	12/19/11	01:00	0.4
EvaporationKimmage	12/20/11	01:00	0.3
EvaporationKimmage	12/21/11	01:00	0.5
EvaporationKimmage	12/22/11	01:00	0.8
EvaporationKimmage	12/23/11	01:00	0.3
EvaporationKimmage	12/24/11	01:00	0.3
EvaporationKimmage	12/25/11	01:00	0.4
EvaporationKimmage	12/26/11	01:00	0.9
EvaporationKimmage	12/27/11	01:00	0.8
EvaporationKimmage	12/28/11	01:00	0.6
EvaporationKimmage	12/29/11	01:00	0.5
EvaporationKimmage	12/30/11	01:00	0.5
EvaporationKimmage	12/31/11	01:00	0.6
EvaporationKimmage	1/1/12	01:00	0.6
EvaporationKimmage	1/2/12	01:00	0.5
EvaporationKimmage	1/3/12	01:00	0.6
EvaporationKimmage	1/4/12	01:00	0.7
EvaporationKimmage	1/5/12	01:00	0.3
EvaporationKimmage	1/6/12	01:00	0.3
EvaporationKimmage	1/7/12	01:00	0.5
EvaporationKimmage	1/8/12	01:00	0.4
EvaporationKimmage	1/9/12	01:00	0.4
EvaporationKimmage	1/10/12	01:00	0.6
EvaporationKimmage	1/11/12	01:00	0.4
EvaporationKimmage	1/12/12	01:00	0.2
EvaporationKimmage	1/13/12	01:00	0
EvaporationKimmage	1/14/12	01:00	0.4
EvaporationKimmage	1/15/12	01:00	0.8
EvaporationKimmage	1/16/12	01:00	0.3
EvaporationKimmage	1/17/12	01:00	0.5
EvaporationKimmage	1/18/12	01:00	0.2
EvaporationKimmage	1/19/12	01:00	0.5
EvaporationKimmage	1/20/12	01:00	0.5
EvaporationKimmage	1/21/12	01:00	0.6
EvaporationKimmage	1/22/12	01:00	0.7
EvaporationKimmage	1/23/12	01:00	0.4
EvaporationKimmage	1/24/12	01:00	0.5
EvaporationKimmage	1/25/12	01:00	0.8
EvaporationKimmage	1/26/12	01:00	0.5
EvaporationKimmage	1/27/12	01:00	0.5
EvaporationKimmage	1/28/12	01:00	0.3
EvaporationKimmage	1/29/12	01:00	0.4
EvaporationKimmage	1/30/12	01:00	0.6
EvaporationKimmage	1/31/12	01:00	0.7

EvaporationKimmage	2/1/12	01:00	0.4
EvaporationKimmage	2/2/12	01:00	0.5
EvaporationKimmage	2/3/12	01:00	0.5
EvaporationKimmage	2/4/12	01:00	0.4
EvaporationKimmage	2/5/12	01:00	0.4
EvaporationKimmage	2/6/12	01:00	0.3
EvaporationKimmage	2/7/12	01:00	0.4
EvaporationKimmage	2/8/12	01:00	0.7
EvaporationKimmage	2/9/12	01:00	0.6
EvaporationKimmage	2/10/12	01:00	0.4
EvaporationKimmage	2/11/12	01:00	0.5
EvaporationKimmage	2/12/12	01:00	0.3
EvaporationKimmage	2/13/12	01:00	0.5
EvaporationKimmage	2/14/12	01:00	0.7
EvaporationKimmage	2/15/12	01:00	1
EvaporationKimmage	2/16/12	01:00	0.5
EvaporationKimmage	2/17/12	01:00	0.6
EvaporationKimmage	2/18/12	01:00	0.6
EvaporationKimmage	2/19/12	01:00	0.8
EvaporationKimmage	2/20/12	01:00	0.7
EvaporationKimmage	2/21/12	01:00	1
EvaporationKimmage	2/22/12	01:00	0.7
EvaporationKimmage	2/23/12	01:00	0.9
EvaporationKimmage	2/24/12	01:00	0.6
EvaporationKimmage	2/25/12	01:00	0.6
EvaporationKimmage	2/26/12	01:00	0.9
EvaporationKimmage	2/27/12	01:00	0.6
EvaporationKimmage	2/28/12	01:00	0.7
EvaporationKimmage	2/29/12	01:00	1.2
EvaporationKimmage	3/1/12	01:00	1.1
EvaporationKimmage	3/2/12	01:00	1.3
EvaporationKimmage	3/3/12	01:00	1
EvaporationKimmage	3/4/12	01:00	1.1
EvaporationKimmage	3/5/12	01:00	1
EvaporationKimmage	3/6/12	01:00	0.7
EvaporationKimmage	3/7/12	01:00	1.1
EvaporationKimmage	3/8/12	01:00	1.4
EvaporationKimmage	3/9/12	01:00	1.2
EvaporationKimmage	3/10/12	01:00	0.9
EvaporationKimmage	3/11/12	01:00	0.7
EvaporationKimmage	3/12/12	01:00	1
EvaporationKimmage	3/13/12	01:00	0.6
EvaporationKimmage	3/14/12	01:00	0.9
EvaporationKimmage	3/15/12	01:00	1.1
EvaporationKimmage	3/16/12	01:00	0.7
EvaporationKimmage	3/17/12	01:00	0.7
EvaporationKimmage	3/18/12	01:00	1.5
EvaporationKimmage	3/19/12	01:00	1.4
EvaporationKimmage	3/20/12	01:00	1.5
EvaporationKimmage	3/21/12	01:00	1
EvaporationKimmage	3/22/12	01:00	1.3
EvaporationKimmage	3/23/12	01:00	1.4
EvaporationKimmage	3/24/12	01:00	2.6
EvaporationKimmage	3/25/12	01:00	2.7
EvaporationKimmage	3/26/12	01:00	2.2
EvaporationKimmage	3/27/12	01:00	2.2
EvaporationKimmage	3/28/12	01:00	2.2
EvaporationKimmage	3/29/12	01:00	2.2
EvaporationKimmage	3/30/12	01:00	1.4
EvaporationKimmage	3/31/12	01:00	1.1
EvaporationKimmage	4/1/12	01:00	1.4

EvaporationKimmage	4/2/12	01:00	0.8
EvaporationKimmage	4/3/12	01:00	1.1
EvaporationKimmage	4/4/12	01:00	1.5
EvaporationKimmage	4/5/12	01:00	2
EvaporationKimmage	4/6/12	01:00	1
EvaporationKimmage	4/7/12	01:00	1.2
EvaporationKimmage	4/8/12	01:00	1.1
EvaporationKimmage	4/9/12	01:00	1.1
EvaporationKimmage	4/10/12	01:00	1.9
EvaporationKimmage	4/11/12	01:00	1.9
EvaporationKimmage	4/12/12	01:00	1.7
EvaporationKimmage	4/13/12	01:00	1.8
EvaporationKimmage	4/14/12	01:00	1.9
EvaporationKimmage	4/15/12	01:00	1.5
EvaporationKimmage	4/16/12	01:00	1.4
EvaporationKimmage	4/17/12	01:00	1.5
EvaporationKimmage	4/18/12	01:00	1.5
EvaporationKimmage	4/19/12	01:00	2
EvaporationKimmage	4/20/12	01:00	1.9
EvaporationKimmage	4/21/12	01:00	2.4
EvaporationKimmage	4/22/12	01:00	1.7
EvaporationKimmage	4/23/12	01:00	1.6
EvaporationKimmage	4/24/12	01:00	1.7
EvaporationKimmage	4/25/12	01:00	0.8
EvaporationKimmage	4/26/12	01:00	1.1
EvaporationKimmage	4/27/12	01:00	1.5
EvaporationKimmage	4/28/12	01:00	1.9
EvaporationKimmage	4/29/12	01:00	1.3
EvaporationKimmage	4/30/12	01:00	1.5
EvaporationKimmage	5/1/12	01:00	0.9
EvaporationKimmage	5/2/12	01:00	1.4
EvaporationKimmage	5/3/12	01:00	1.6
EvaporationKimmage	5/4/12	01:00	1.3
EvaporationKimmage	5/5/12	01:00	2
EvaporationKimmage	5/6/12	01:00	1.6
EvaporationKimmage	5/7/12	01:00	2.1
EvaporationKimmage	5/8/12	01:00	1.6
EvaporationKimmage	5/9/12	01:00	1.3
EvaporationKimmage	5/10/12	01:00	0.9
EvaporationKimmage	5/11/12	01:00	1.2
EvaporationKimmage	5/12/12	01:00	2.6
EvaporationKimmage	5/13/12	01:00	3.3
EvaporationKimmage	5/14/12	01:00	2.5
EvaporationKimmage	5/15/12	01:00	2.7
EvaporationKimmage	5/16/12	01:00	1.8
EvaporationKimmage	5/17/12	01:00	1.4
EvaporationKimmage	5/18/12	01:00	1.7
EvaporationKimmage	5/19/12	01:00	1.1
EvaporationKimmage	5/20/12	01:00	1.9
EvaporationKimmage	5/21/12	01:00	2.5
EvaporationKimmage	5/22/12	01:00	2.6
EvaporationKimmage	5/23/12	01:00	3.6
EvaporationKimmage	5/24/12	01:00	3.8
EvaporationKimmage	5/25/12	01:00	2.2
EvaporationKimmage	5/26/12	01:00	4.2
EvaporationKimmage	5/27/12	01:00	4.2
EvaporationKimmage	5/28/12	01:00	4
EvaporationKimmage	5/29/12	01:00	1.9
EvaporationKimmage	5/30/12	01:00	2.1
EvaporationKimmage	5/31/12	01:00	1.5
EvaporationKimmage	6/1/12	01:00	2.7

EvaporationKimmage	6/2/12	01:00	2.2
EvaporationKimmage	6/3/12	01:00	0.8
EvaporationKimmage	6/4/12	01:00	3.4
EvaporationKimmage	6/5/12	01:00	1.3
EvaporationKimmage	6/6/12	01:00	2.6
EvaporationKimmage	6/7/12	01:00	0.9
EvaporationKimmage	6/8/12	01:00	0.9
EvaporationKimmage	6/9/12	01:00	3.1
EvaporationKimmage	6/10/12	01:00	2.8
EvaporationKimmage	6/11/12	01:00	3.4
EvaporationKimmage	6/12/12	01:00	1.9
EvaporationKimmage	6/13/12	01:00	1.9
EvaporationKimmage	6/14/12	01:00	1.7
EvaporationKimmage	6/15/12	01:00	1.3
EvaporationKimmage	6/16/12	01:00	1
EvaporationKimmage	6/17/12	01:00	1.5
EvaporationKimmage	6/18/12	01:00	2.5
EvaporationKimmage	6/19/12	01:00	3.5
EvaporationKimmage	6/20/12	01:00	3
EvaporationKimmage	6/21/12	01:00	1.5
EvaporationKimmage	6/22/12	01:00	2.2
EvaporationKimmage	6/23/12	01:00	2.2
EvaporationKimmage	6/24/12	01:00	2.8
EvaporationKimmage	6/25/12	01:00	2.7
EvaporationKimmage	6/26/12	01:00	2.8
EvaporationKimmage	6/27/12	01:00	3.1
EvaporationKimmage	6/28/12	01:00	3.5
EvaporationKimmage	6/29/12	01:00	3.2
EvaporationKimmage	6/30/12	01:00	2.2
EvaporationKimmage	7/1/12	01:00	2.3
EvaporationKimmage	7/2/12	01:00	2.5
EvaporationKimmage	7/3/12	01:00	1.5
EvaporationKimmage	7/4/12	01:00	2.9
EvaporationKimmage	7/5/12	01:00	2.7
EvaporationKimmage	7/6/12	01:00	0.9
EvaporationKimmage	7/7/12	01:00	3.2
EvaporationKimmage	7/8/12	01:00	1
EvaporationKimmage	7/9/12	01:00	1.6
EvaporationKimmage	7/10/12	01:00	2.8
EvaporationKimmage	7/11/12	01:00	2.6
EvaporationKimmage	7/12/12	01:00	2.4
EvaporationKimmage	7/13/12	01:00	2.1
EvaporationKimmage	7/14/12	01:00	2.1
EvaporationKimmage	7/15/12	01:00	2.7
EvaporationKimmage	7/16/12	01:00	2
EvaporationKimmage	7/17/12	01:00	3.4
EvaporationKimmage	7/18/12	01:00	2.5
EvaporationKimmage	7/19/12	01:00	2.3
EvaporationKimmage	7/20/12	01:00	2.5
EvaporationKimmage	7/21/12	01:00	2.9
EvaporationKimmage	7/22/12	01:00	3.3
EvaporationKimmage	7/23/12	01:00	3.3
EvaporationKimmage	7/24/12	01:00	1.5
EvaporationKimmage	7/25/12	01:00	2.8
EvaporationKimmage	7/26/12	01:00	3.9
EvaporationKimmage	7/27/12	01:00	2.8
EvaporationKimmage	7/28/12	01:00	2.4
EvaporationKimmage	7/29/12	01:00	2.6
EvaporationKimmage	7/30/12	01:00	3.2
EvaporationKimmage	7/31/12	01:00	1.5
EvaporationKimmage	8/1/12	01:00	2.7

EvaporationKimage	8/2/12	01:00	3.3
EvaporationKimage	8/3/12	01:00	1.7
EvaporationKimage	8/4/12	01:00	1.3
EvaporationKimage	8/5/12	01:00	1.2
EvaporationKimage	8/6/12	01:00	2.2
EvaporationKimage	8/7/12	01:00	1.8
EvaporationKimage	8/8/12	01:00	2.5
EvaporationKimage	8/9/12	01:00	3
EvaporationKimage	8/10/12	01:00	3.5
EvaporationKimage	8/11/12	01:00	2.6
EvaporationKimage	8/12/12	01:00	2
EvaporationKimage	8/13/12	01:00	1.9
EvaporationKimage	8/14/12	01:00	2
EvaporationKimage	8/15/12	01:00	1.7

```

[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS NONE
NODES NONE
LINKS C17
[TAGS]
[MAP]
DIMENSIONS 313096.218 229879.828 315220.783 232178.843
Units      Meters

```

```

[COORDINATES]
;;Node      X-Coord      Y-Coord
;;-----
J1           314011.626    230939.266
J2           314068.974    231031.846
J3           314031.975    231043.745
J4           314029.411    231139.647
J5           314030.209    231196.154
J6           314184.684    231209.159
J7           313999.808    230859.789
J8           314104.623    230948.663
J9           314161.055    231020.659
J10          314200.070    231073.246
J11          314266.281    231162.977
J12          314349.736    231181.870
J13          314331.423    231206.393
J14          314268.733    231165.676
J15          314235.030    231216.583
J16          314286.653    231250.659
J17          314292.158    231254.563
OF1          314298.781    231259.237

```

```

[VERTICES]
;;Link      X-Coord      Y-Coord
;;-----

```

```

[Polygons]
;;Subcatchment X-Coord      Y-Coord
;;-----

```

```

[SYMBOLS]
;;Gage      X-Coord      Y-Coord
;;-----
RG1         314137.949    231105.380

```

Appendix E: Matlab code for build-up and washoff model

```

% Function runGlobalSearch sets up solver, calls myfunc at each iteration

problem
createOptimProblem('fmincon','x0',[0.4;1.85;10],'lb',[0;1.1;1],'ub',[5;2.
6;50000],'objective',@myfunc);

gs
GlobalSearch('Display','iter','NumTrialPoints',64,'NumStageOnePoints',10)
;

tic; [x,f] = run(gs,problem);toc

% Function myfunc allows multiple parameters to be optimized by
% GlobalSearch, calls washoff function at each solver iteration

function f = myfunc(x)

buildup = x(1);
n = x(2);
Rc = x(3);

f = washoff(buildup,n,Rc);

end

% function washoff calculates suspended solids washoff

function y = washoff(daily_buildup,n,Rc,Ie)

load 'rain.txt';
load 'obs_flow.txt';
load 'event_ref_ssc.txt';
load 'obs_ssc.txt';
load 'obsTM.txt';
load 'cal_events.txt';
load 'ver_events.txt';

% inputs-----

% daily_buildup.....kg/day
% n.....washoff exponent
% Rc.....washoff coefficient
% Ie.....intensity exponent

%-----

av_runoff = zeros(404333,1);
expw = zeros(404333,1);

Pt = zeros(404333,1); % Pt mass on surface (kg)
Poff = zeros(404333,1); % Poff mass washed off at time t (mg)
modSSC = zeros(404333,1); % SSC (mg/l)
modTM = zeros(19,1); % Event total mass (kg)
Pi = zeros(19,1); % Initial event mass (kg)

```

```

% calculate Ic .... I_10 t - 360 sec

I_10 = zeros(404333,1);

Ic = zeros(404333,1);

for i = 61:404333

    I_10(i,1) = sum(rain(i-4:i));

    Ic(i,1) = (1 + I_10(i))^Ie;

end

%washoff exponent expw-----

flow = obs_flow./14200; % average subcatchment runoff (mm/sec)

for i = 2:404333

    av_runoff(i) = 0.5*((flow(i))^n + (flow(i-1))^n);

end

for i = 1:404333

    expw(i) = exp(-Rc*Ic(i)*av_runoff(i)*120);

end

% fill first two hours buildup-----

Pt(1) = daily_buildup/720;

for i = 2:60

    Pt(i) = (Pt(i-1)) + daily_buildup/720;

end

% calculate mass on surface Pt-----

for i = 61:404333

    if (sum(rain(i-59:i))>0) && (obs_flow(i-1)>0.1)

        Pt(i) = Pt(i-1)*expw(i);

    else

        Pt(i) = Pt(i-1) + daily_buildup/720;

    end

end

end

```



```

% calculate Poff-----
for i = 2:404333
    if Pt(i) < Pt(i-1)
        Poff(i) = (Pt(i-1) - Pt(i))*1e6; % Poff mg/l
    end
end

% calculate SSC-----
for i = 2:404333
    if ((obs_flow(i) + obs_flow(i-1))/2)>0)
        modSSC(i) = Poff(i)/(((obs_flow(i) + obs_flow(i-1))/2)*120);
    end
end

% Calc event total mass (#19) in ModTM (kg)-----
for i = 1:19
    modTM(i) = Pt(event_ref_ssc(i,2)) - Pt(event_ref_ssc(i,3));
end

% Save initial mass each event
for i = 1:19
    Pi(i) = Pt(event_ref_ssc(i,2));
end

% fill modSSCo *all events* where obs values exist-----
-----
k = 1;

obsSSCo = zeros(226,1);
modSSCo = zeros(226,1);

for i = 1:404333
    if obs_ssc(i)>0
        obsSSCo(k) = obs_ssc(i);
        modSSCo(k) = modSSC(i);
    end
end

```

```

        k = k + 1;

    end

end

% calculate NSE-----

meanSSCobs = mean(obsSSCo);

SSR = zeros(226,1);
SSE = zeros(226,1);

for i = 1:226

    SSR(i) = (obsSSCo(i) - modSSCo(i))^2;

    SSE(i) = (obsSSCo(i) - meanSSCobs)^2;

end

SumSSR = sum(SSR);
SumSSE = sum(SSE);

NSE19 = SumSSR/SumSSE;

% obs&mod SSC for SSC>0-----

c = 1;

for i = 1:13

    k = event_ref_ssc(cal_events(i),2);

    for j = 1:event_ref_ssc(cal_events(i),4)

        if obs_ssc(k) > 0

            obs_SSC_cal(c,1) = obs_ssc(k);

            mod_SSC_cal(c,1) = modSSC(k);

            c = c + 1;

        end

        k = k + 1;

    end

end

end

% calculate NSE cal-----

```

```

mean_obs_SSC_cal = mean(obs_SSC_cal);

SSR_cal = zeros(156,1);
SSE_cal = zeros(156,1);

for i = 1:156

    SSR_cal(i) = (obs_SSC_cal(i) - mod_SSC_cal(i))^2;

    SSE_cal(i) = (obs_SSC_cal(i) - mean_obs_SSC_cal)^2;

end

SumSSR_cal = sum(SSR_cal);
SumSSE_cal = sum(SSE_cal);

NSE_cal = SumSSR_cal/SumSSE_cal;

% Separate TM into cal and ver-----

obsTM_cal = zeros(13,1);
obsTM_ver = zeros(6,1);

for i = 1:13

    obsTM_cal(i) = obsTM(cal_events(i));

end

for i = 1:6

    obsTM_ver(i) = obsTM(ver_events(i));

end

modTM_cal = zeros(13,1);
modTM_ver = zeros(6,1);

for i = 1:13

    modTM_cal(i) = modTM(cal_events(i));

end

for i = 1:6

    modTM_ver(i) = modTM(ver_events(i));

end

% peak SSC

create_events;

peak_obs = zeros(19,1);

```

```

peak_mod = zeros(19,1);

for i = 1:19

peak_obs(i,1) = max(obs_events(:,i));

peak_mod(i,1) = max(mod_events(:,i));

end

% Separate Peak Mass into cal and ver

obsPM_cal = zeros(13,1);
obsPM_ver = zeros(6,1);

for i = 1:13

    obsPM_cal(i) = peak_obs(cal_events(i));

end

for i = 1:6

    obsPM_ver(i) = peak_obs(ver_events(i));

end

modPM_cal = zeros(13,1);
modPM_ver = zeros(6,1);

for i = 1:13

    modPM_cal(i) = peak_mod(cal_events(i));

end

for i = 1:6

    modPM_ver(i) = peak_mod(ver_events(i));

end

% Error function for total mass and peak SSC

Err_mass_cal = zeros(12,1);

mean_obsTM_cal = mean(obsTM_cal);

for i = 1:13

    Err_mass_cal(i,1) = (abs(obsTM_cal(i) -
modTM_cal(i))/mean_obsTM_cal);

end

Sum_Err_mass_cal = sum(Err_mass_cal);

```



```

Err_peak_cal = zeros(12,1);

mean_obsPM_cal = mean(obsPM_cal);

for i = 1:13

    Err_peak_cal(i,1) = (abs(obsPM_cal(i) -
modPM_cal(i))/mean_obsPM_cal);

end

Sum_Err_peak_cal = sum(Err_peak_cal);

y = Sum_Err_mass_cal + Sum_Err_peak_cal;

end

```