Memorandum

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21 April 2017

To Aaron Clifton
From Carolina Sardella

Subject Camden Gas Project- FY17 Six-monthly monitoring update – April 2017

Dear Aaron,

This memo presents the updated hydrographs for the Menangle Park and Glenlee groundwater monitoring bores to April 2017, and the water quality results for the April 2017 sampling event. The Denham Court monitoring bores were decommissioned in October 2016, as such no data has been collected during this monitoring event.

Key observations for this monitoring period (October to April 2017) are as follows:

- water levels at the Menangle Park monitoring bores declined to seasonal lows over the summer and show a response to the rainfall events in March 2017; this response decreases with depth; and
- the VWP sensors at GLMB01 and GLMB02, have not stabilised during this monitoring period. As such, the data has not been presented in this report as it is considered unreliable.

The groundwater quality results will be analysed and discussed in the next annual monitoring report.

Figures A.1 – A.4: Individual hydrographs for the Menangle Park and Glenlee sites

Figures A.5: Nested hydrographs for the Menangle Park and Glenlee sites

Table A.1: Water quality results for April 2017

Yours sincerely

Carolina Sardella
Senior Hydrogeologist
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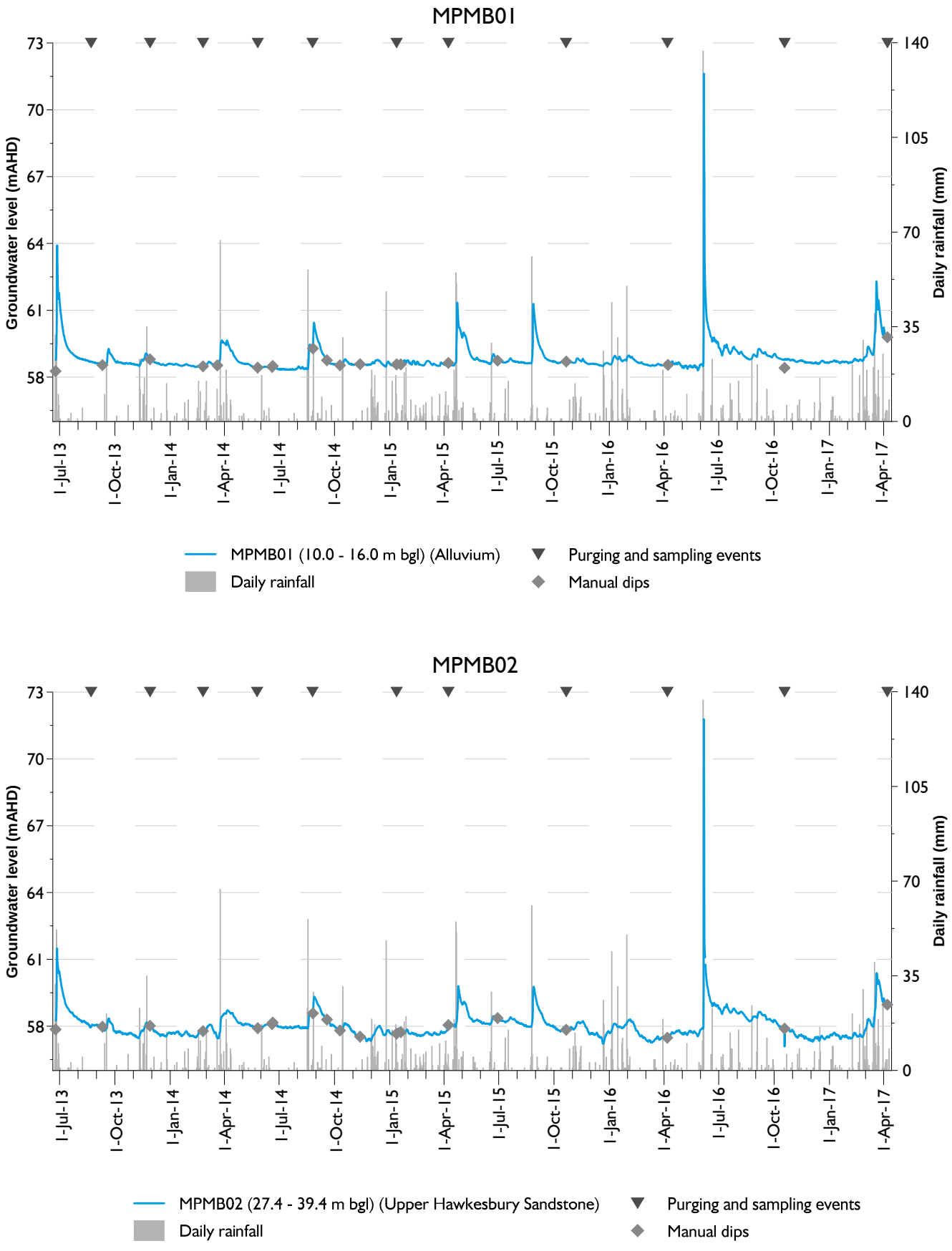
Reviewed: JCD



MPMB01 and MPMB02 hydrographs

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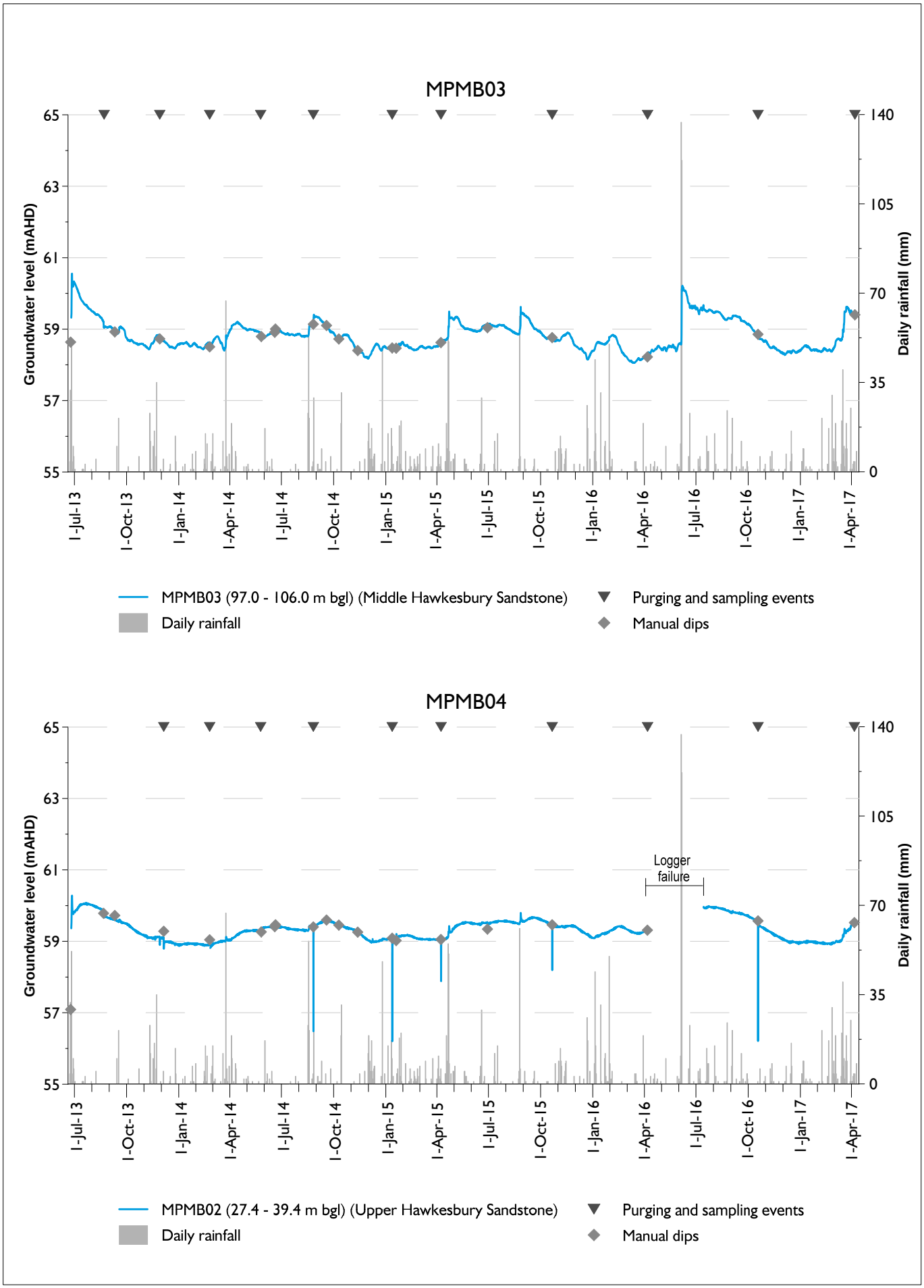
Figure A.1



MPMB03 and MPMB04 hydrographs

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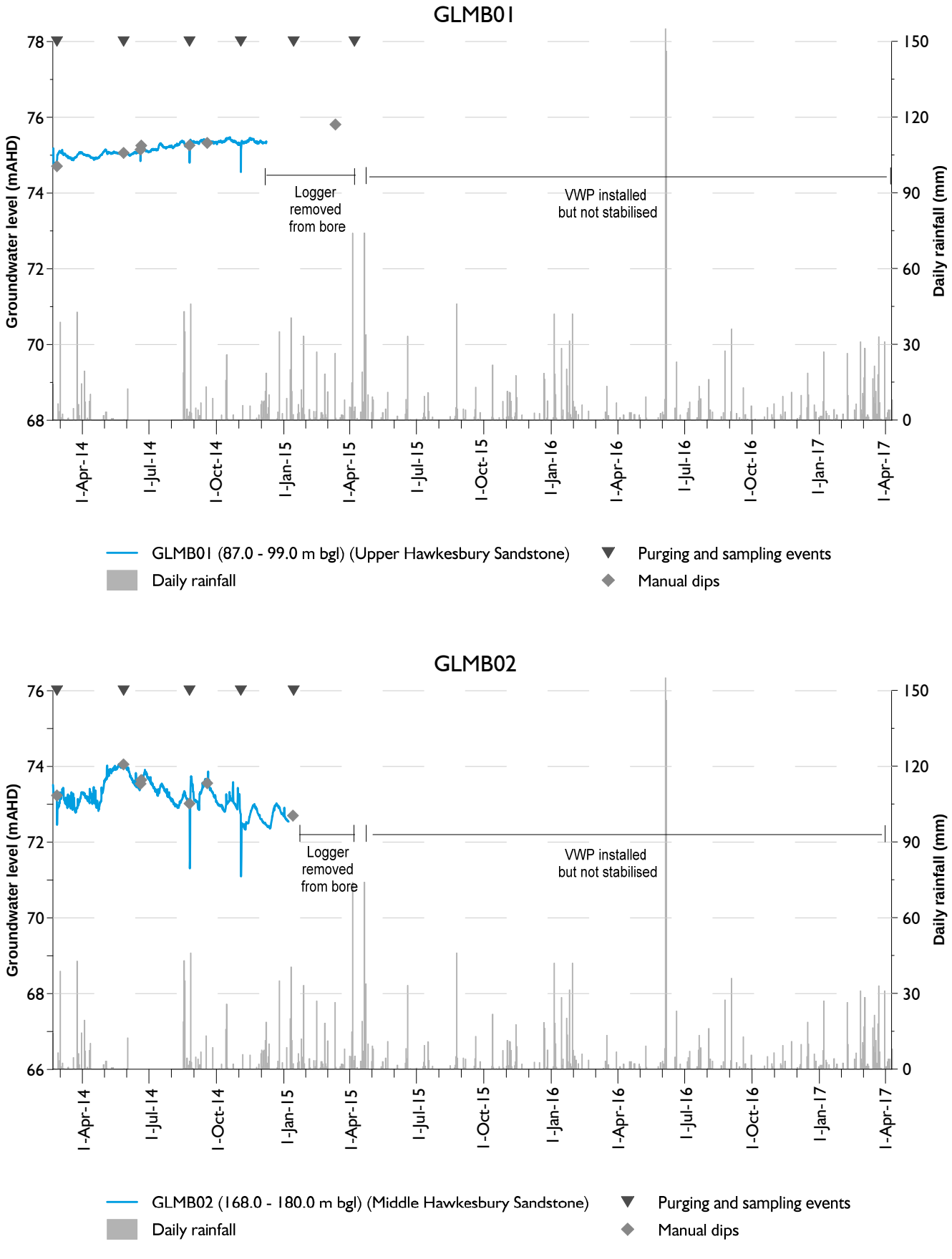
Figure A.2



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GLMB01 and GLMB02 hydrographs

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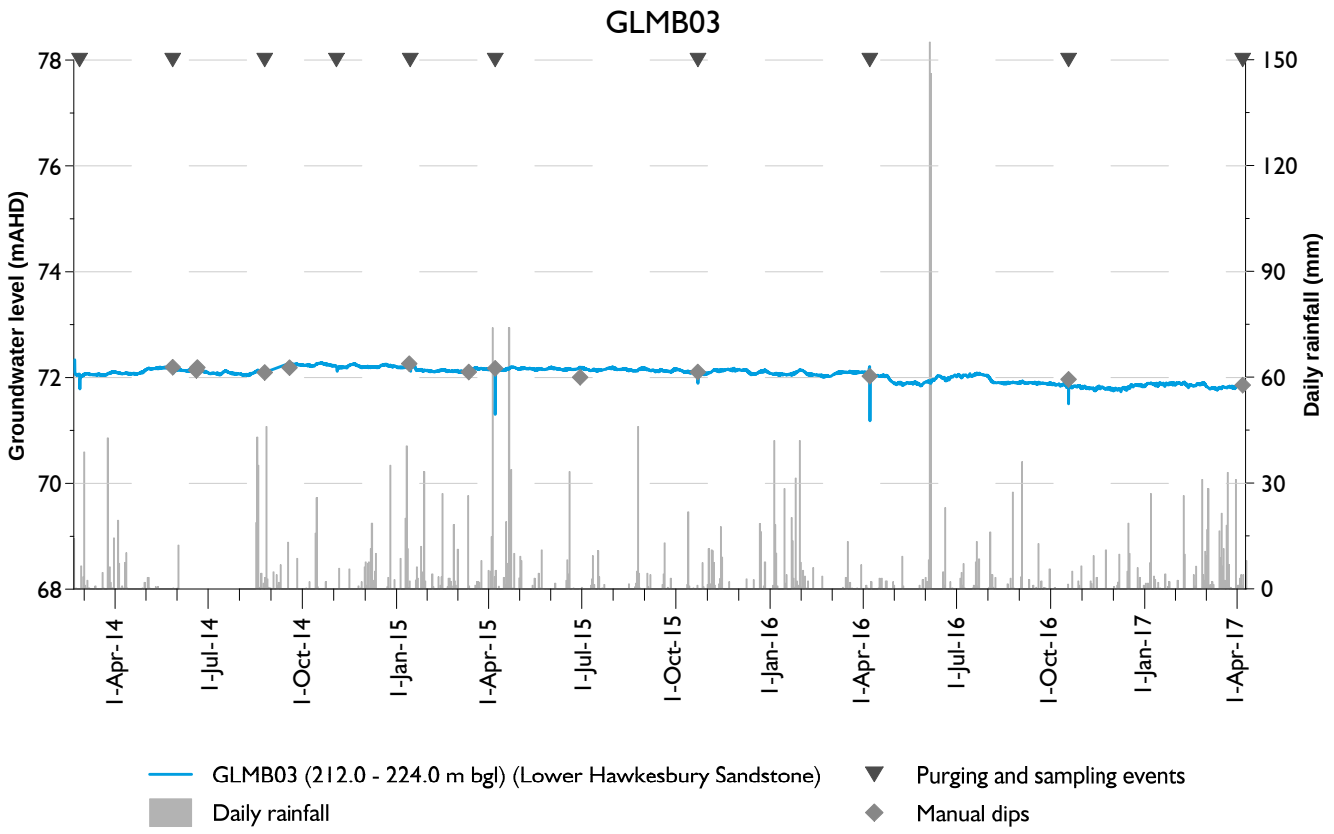
Figure A.3



GLMB03 hydrograph

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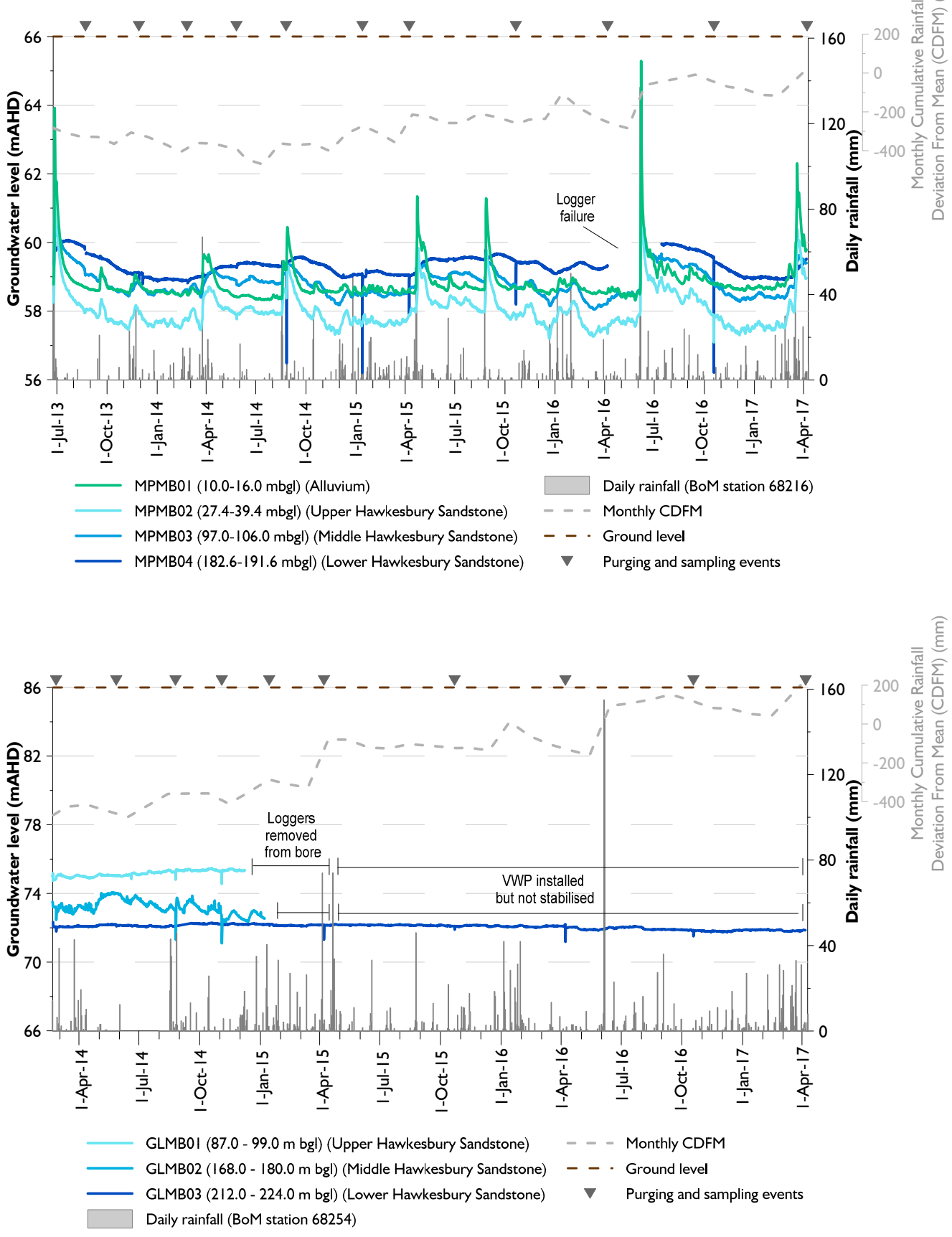
Figure A.4



MPMB and GLMB hydrographs

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Figure A.5

Table A.1 - Water quality results April 2017

		Site ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
	Units	LOR	6/04/2017	7/04/2017	7/04/2017	7/04/2017	6/04/2017
Field							
pH (field)	pH units		8.15	5.28	6.37	6.96	9.9
Electrical conductivity (field)	uS/cm		5,100	924	833	1,087	626
Electrical conductivity (lab)	µS/cm	1	5,430	916	828	1,070	623
Temp (Field)	°C		20.9	20.5	20.3	21.2	19
Dissolved Oxygen	mg/L		0.78	0.49	0.51	0.8	0.91
Dissolved oxygen (field)	%		8.9	5.5	5.6	9	10.5
Total dissolved solids (field)	mg/L		3,315	598	539.5	708.5	409.5
Total dissolved solids (lab)	mg/L	10	3,130	560	456	610	374
Suspended solids	mg/L	5	<5	24	20	25	12
Redox (field)	mV		-77.5	115.4	-76.6	-153.7	-8.5
Laboratory analytes							
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1	<1	<1	<1
Carbonate Alkalinity-mg CaCO3/L	mg/L	1	<1	<1	<1	<1	115
Bicarbonate Alkalinity-mg CaCO3/L	mg/L	1	1,810	19	164	487	46
Alkalinity (total) as CaCO3	mg/L	1	1,810	19	164	487	161
Sulfate as SO4 - Turbidimetric	mg/L	1	<1	3	5	<1	<1
Chloride	mg/L	1	631	276	167	66	81
Calcium	mg/L	1	118	13	29	85	3
Magnesium	mg/L	1	75	24	31	23	<1
Sodium	mg/L	1	930	116	83	109	118
Potassium	mg/L	1	36	1	3	13	7
Reactive Silica	mg/L	0.05	18.1	15.7	11.7	9	6.88
Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	0.5
Bromide	mg/L	0.01	1.28	0.507	0.292	0.125	0.168
Cyanide Total	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved metals							
Aluminium	mg/L	0.01	<0.01	<0.01	<0.01	0.02	<0.01
Antimony	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.001	0.046	<0.001	0.006	0.015	0.003
Barium	mg/L	0.001	19.7	0.634	0.506	3.11	0.393
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bromine	mg/L	0.1	1.4	0.6	0.4	0.2	0.2
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	<0.001	0.041	<0.001	0.002	<0.001
Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.05	0.64	0.19	4.2	4.06	<0.05
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.018	0.481	0.162	0.113	0.002
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.01
Nickel	mg/L	0.001	<0.001	0.015	<0.001	<0.001	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.001	4.87	0.155	0.353	0.931	0.094
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	0.195	0.042	0.015	0.011	0.05
Nutrients							
Ammonia (as N)	mg/L	0.01	3.3	0.01	0.13	1.11	0.97
Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate (as N)	mg/L	0.01	<0.01	0.28	<0.01	0.07	<0.01
Nitrite + Nitrate as N	mg/L	0.01	<0.01	0.28	<0.01	0.07	<0.01
Total phosphorus	mg/L	0.01	<0.05	<0.01	0.01	0.01	<0.01
Reactive phosphorus (as P)	mg/L	0.01	<0.05	<0.01	<0.01	<0.01	<0.01
Total organic carbon	mg/L	1	5	<1	<1	<1	5
Dissolved gases							
Methane	mg/L	0.01	13.8	0.012	0.249	28.9	41.7
Ethane	mg/L	0.01	0.117	<0.01	<0.01	<0.01	<0.01
Ethene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propane	mg/L	0.01	0.027	<0.01	<0.01	<0.01	<0.01
Propene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenolic compounds							
Phenol	µg/L	1	<1	<1	<1	<1	1.9
2-chlorophenol	µg/L	1	<1	<1	<1	<1	<1
2-methylphenol	µg/L	1	<1	<1	<1	<1	<1
3-&4-methylphenol	µg/L	2	<2	<2	<2	<2	<2
2-nitrophenol	µg/L	1	<1	<1	<1	<1	<1
2,4-dimethylphenol	µg/L	1	<1	<1	<1	<1	<1
2,4-dichlorophenol	µg/L	1	<1	<1	<1	<1	<1
2,6-dichlorophenol	µg/L	1	<1	<1	<1	<1	<1
4-chloro-3-methylphenol	µg/L	1	<1	<1	<1	<1	<1
2,4,6-trichlorophenol	µg/L	1	<1	<1	<1	<1	<1
2,4,5-trichlorophenol	µg/L	1	<1	<1	<1	<1	<1
Pentachlorophenol	µg/L	2	<2	<2	<2	<2	<2
Polycyclic aromatic hydrocarb							
Acenaphthene	µg/L	1	<1	<1	<1	<1	<1
Acenaphthylene	µg/L	1	<1	<1	<1	<1	<1
Fluorene	µg/L	1	<1	<1	<1	<1	<1
Phenanthrene	µg/L	1	<1	<1	<1	<1	<1
Anthracene	µg/L	1	<1	<1	<1	<1	<1
Fluoranthene	µg/L	1	<1	<1	<1	<1	<1
Pyrene	µg/L	1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	<1	<1	<1	<1	<1
Chrysene	µg/L	1	<1	<1	<1	<1	<1
Benzo(k)fluoranthene	µg/L	1	<1	<1	<1	<1	<1
Benzo(b&j)fluoranthene	µg/L	1	<1	<1	<1	<1	<1
Benzo(a) pyrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc (Zero)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	µg/L	1	<1	<1	<1	<1	<1
Dibenz(a,h)anthracene	µg/L	1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	1	<1	<1	<1	<1	<1
Polycylic aromatic hydrocarbons EPA448	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total petroleum hydrocarbons							
C 6 - C 9 Fraction	µg/L	20	210	<20	<20	<20	50
C10 - C14 Fraction	µg/L	50	<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	100	<100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	50	<50	<50	<50	<50	<50
TPH+C10 - C36 (Sum of total)	µg/L	50	<50	<50	<50	<50	<50
Total recoverable hydrocarbons							
C6-C10 fraction	µg/L	20	220	<20	<20	<20	60
C6 - C10 fraction minus BTEX	µg/L	20	90	<20	<20	<20	<20
C10 - C16 fraction	µg/L	100	<100	<100	<100	<100	<100
TRH >C10-C16 less Naphthalene (F2)	µg/L	100	<100	<100	<100	<100	<100
C16 - C34 fraction	µg/L	100	<100	<100	<100	<100	<100
C34 - C40 fraction	µg/L	100	<100	<100	<100	<100	<100
C10 - C40 fraction (Sum)	µg/L	100	<100	<100	<100	<100	<100
Aromatic hydrocarbons							
Benzene	µg/L	1	<1	<1	<1	<1	<1
Toluene	µg/L	2	126	<2	<2	<2	41
Ethylbenzene	µg/L	2	<2	<2	<2	<2	<2
Xylene (m & p)	µg/L	2	2	<2	<2	<2	<2
Xylene (o)	µg/L	2	<2	<2	<2	<2	<2
Xylene Total	µg/L	2	2	<2	<2	<2	<2
Total BTEX	µg/L	1	128	<1	<1	<1	41
Naphthalene	µg/L	1	<1	<1	<1	<1	<1

Note: LOR - Laboratory limit of reporting