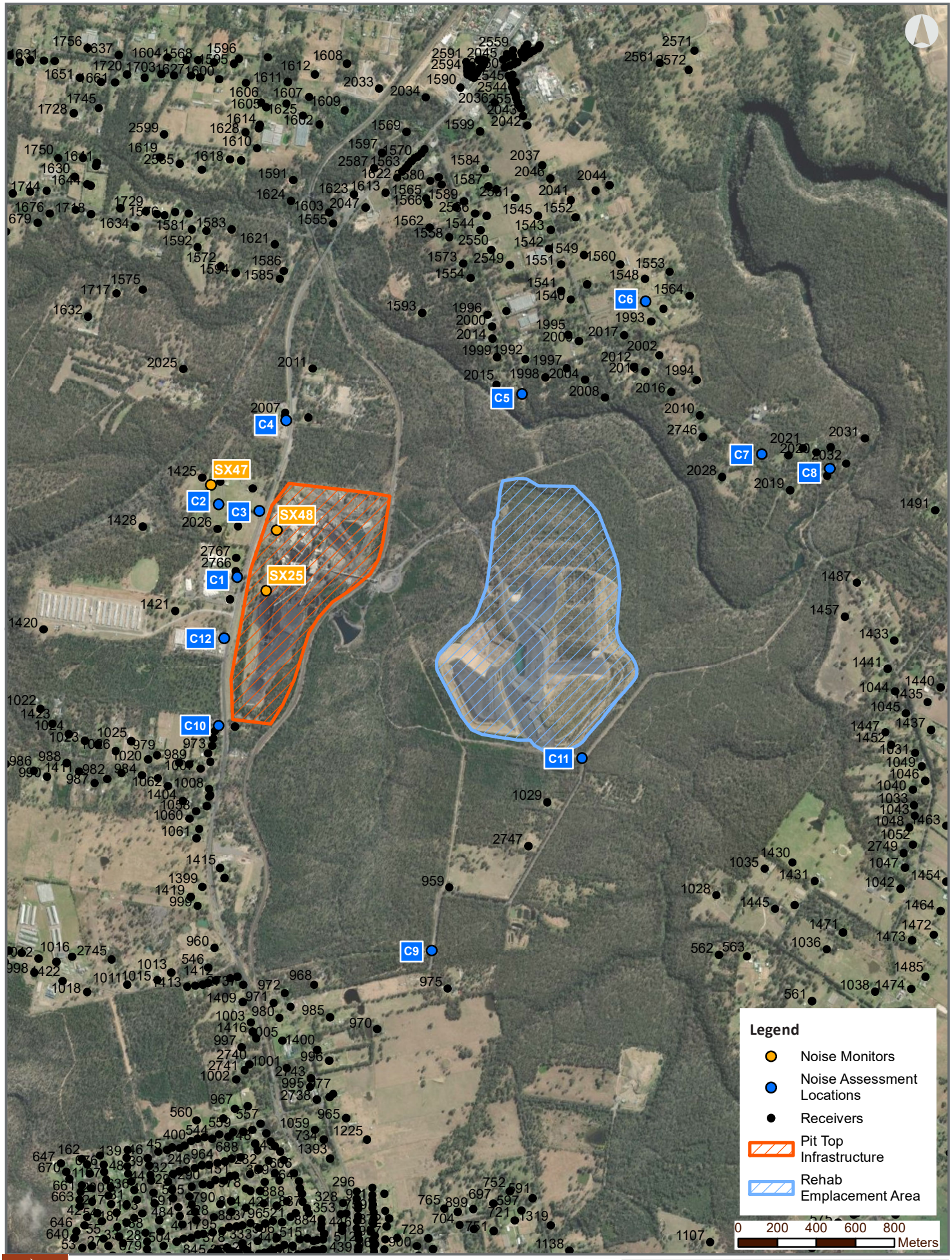
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APPENDIX 1

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W:\ArcGIS\SA NSW Responses

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Tahmoor South
Noise Monitoring Locations

Date: 11/01/2023

Data Sources:
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Year	Site	EIS Site Name	Assessment Goal L10	Estimated contribution Q1 (L10)	Estimated contribution Q2 (L10)	Estimated contribution Q3 (L10)	Estimated contribution Q4 (L10)	Description	Residential Property
2014	M1	C12		<45/6	<48	<48	<48	Remembrance Driveway (Service Station)	No
2015				<52	<50	<46	54/5		
2016				<50	<50	<55	<45		
2017				53/4	50/1	54/5	53/4		
2018				48/9	50/1	<45	<45		
2019				<49	<52	<56	<45		
2020				<48	<46	<46	<44		
2021				<47	<56	<47	<58***		
2022				<50***	<50***	<50**	<50**		
2014	M2	C1		46/7	47	<60	47	Remembrance Driveway (School Entrance Road)	No
2015				<53	<54	<47	55/6		
2016				<50	<50	<50	<46		
2017				53/4	55/7	56/7	53/3		
2018				48/9	50/1	<45	<46		
2019				<53	<56	<56	<48		
2020				<48	<46	<48	<45		
2021				<49	<56	<48	<60***		
2022				<52***	<53***	<50***	<50***		
2014	M3	C2	45	<44	<47	<45	<42	Olive Lane (End of Cul-de-sac)	Yes
2015				<48**	<47	<42	44/5		
2016				44/5	<40	<45	<45*		
2017				<45**	<47**	<47	<45*		
2018				<47***	<47**	<44	<47***		
2019				<46***	<47***	<42**	<44		
2020				<46***	<44**	<46**	<45**		
2021				<45**	<45**	<45**	<51***		
2022				<47***	<50***	<45***	<44***		
2014	M4	C3		<45	<49	<47	<45	Olive Lane/Remembrance Driveway Intersection	No
2015				<48	<53	<47	47/8		
2016				<45	<40	<45	<46		
2017				<48	<50	<50	<50		
2018				<45	<50	<50	<48		
2019				<50	<46	<46	<50		
2020				<48	<47	<47	<46		
2021				<50	<52	<50	<60***		
2022				<52***	<55***	<50***	<50***		
2014	M5	C4	45	<40	<40	<47	<40	Remembrance Driveway (Service Station)	Yes
2015				<40	<46	<42	<42		
2016				<40	<40	<45	<45*		
2017				<45**	<45**	<45	<40		
2018				<35	<35	<45	<40		
2019				<43**	<45**	<40**	<40		
2020				<44**	<45**	<35	<40		
2021				<45**	<45**	<42**	<48***		
2022				<45**	<45**	<44**	<40**		
2014	M6	C5	45 (37)	<35 (<35)	<43 (<35)	<38 (<35)	<30	Stratford Road	Yes
2015				<30	40/1 (-)	40/1 (-)	39/40 (-)		
2016				<35 (<35)	<50	<55	<45		
2017				<40** (<35)	<40** (<35)	<40 (<35)	<40 (<35)		
2018				<35	<37	<40	<40**		
2019				<35**	<37**	<39**	<39		
2020				<35	<39	<35	<40		
2021				<44**(<35)	<42(<35)	<40 (<35)	<42** (<35)		
2022				<40**(<35)	<43**(<35)	<44***	<40 (<35)		
2014	M7	C6	45 (37)	<35	<35	<35	<30	Hodgson Grove (End of Cul-de-sac)	Yes
2015				<30	35/6(-)	<35	<30 (-)		
2016				<30 (-)	<30 (-)	<30 (-)	<35*(-)		
2017				<35**(<35)	<35**(<35)	<35**(<35)	<35**(<35)		
2018				<35	<35	<35	<35		
2019				<35	<35	<35	<35		
2020				<35	<35	<35	<35		
2021				<35(<35)	<35 (<35)	<35 (<35)	<42** (<35)		
2022				<40(<35)	<40(<35)	<40**	<40 (<35)		
2014	M8	C7	45 (37)	<35	<35	<35	<32	Rockford Road	Yes
2015				<33	32/3(-)	<34	<35 (-)		
2016				<33 (-)	<30 (-)	<30 (-)	<40* (<35)		
2017				<35**(<35)	<35**(<35)	<37**(<35)	<37**(<35)		
2018				<35	<35	<35	<40		
2019				<35	<35	<35	<35		
2020				<35	<35	<35	<37**		
2021				<37 (<35)	<35 (<35)	<35 (<35)	<42 (<35)		
2022				<40**(<35)	<40**(<35)	<40**	<42** (<35)		
2014	M9	C8	45 (37)	<35	<35	<35	<30	Kammer Place (End of Cul-de-sac)	Yes
2015				<30	<30 (-)	<30 (-)	<30 (-)		
2016				<30 (-)	<30 (-)	<30 (-)	<35* (<35)		
2017				<35* (<35)	<35* (<35)	<35* (<35)	<35* (<35)		
2018				<35	<35	<35	<35		
2019				<35	<35	<35	<35		
2020				<35	<35	<35	<35		
2021				<35 (<35)	<35 (<35)	<35 (<35)	<35 (<35)		
2022				<40**(<35)	<40 (<35)	<40**(<35)	<40 (<35)		
2014	M10	C11		<35 (<35)	<36 (<35)	<32 (<35)	<30	Charlies Point Road	No
2015				<30	<30	<6	<35		
2016				<30	<35	<35	<35		
2017				<45	<45	<35	<35		
2018				<35	<35	<35	<35		
2019				<35	<35	<35	<35		
2020				<35	<35	<30	<30		
2021				<35	<35	<35	<35		
2022				<35	<35	<35	<45***		

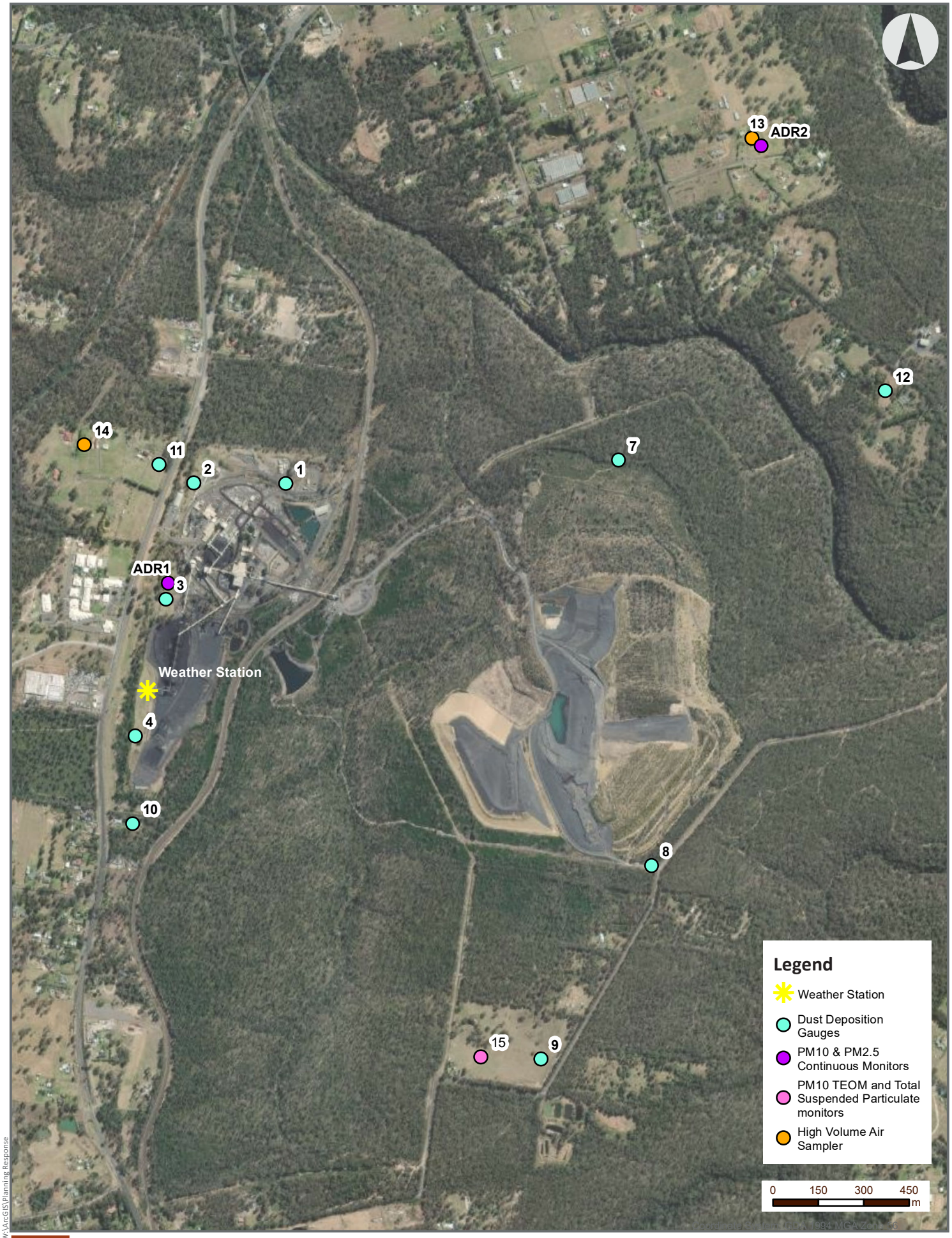
NOTES: # Ambient noise controlled by insects (2-5kHz)
* Includes DECC INP +2dB(A) allowance (INP Section 11.1.3)
** Includes +2dB correction for low frequency noise (NPfl Table C.1)
*** Includes +5dB correction for low frequency noise (NPfl Table C.1)
() Noise Assessment Goal for REA

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APPENDIX 3

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Tahmoor South
Air Quality Monitoring Locations

Date: 13/01/2023

Data Sources:
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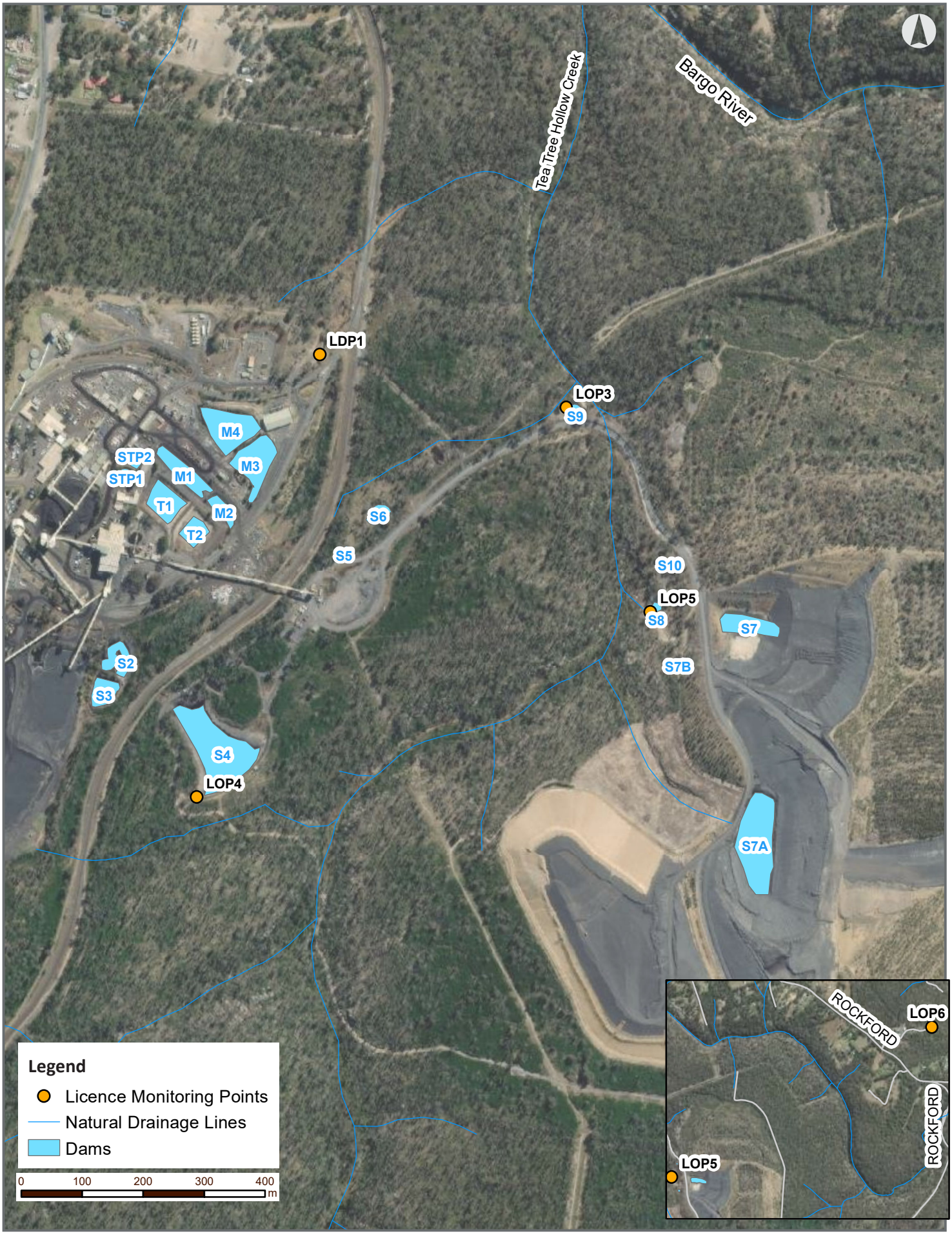
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DOCUMENT FILE PATH

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Tahmoor Coal
EPL Discharge and Overflow points

Coordinate System: GDA 1994 MGA Zone 56

Date: 13/01/2023

Data Sources:
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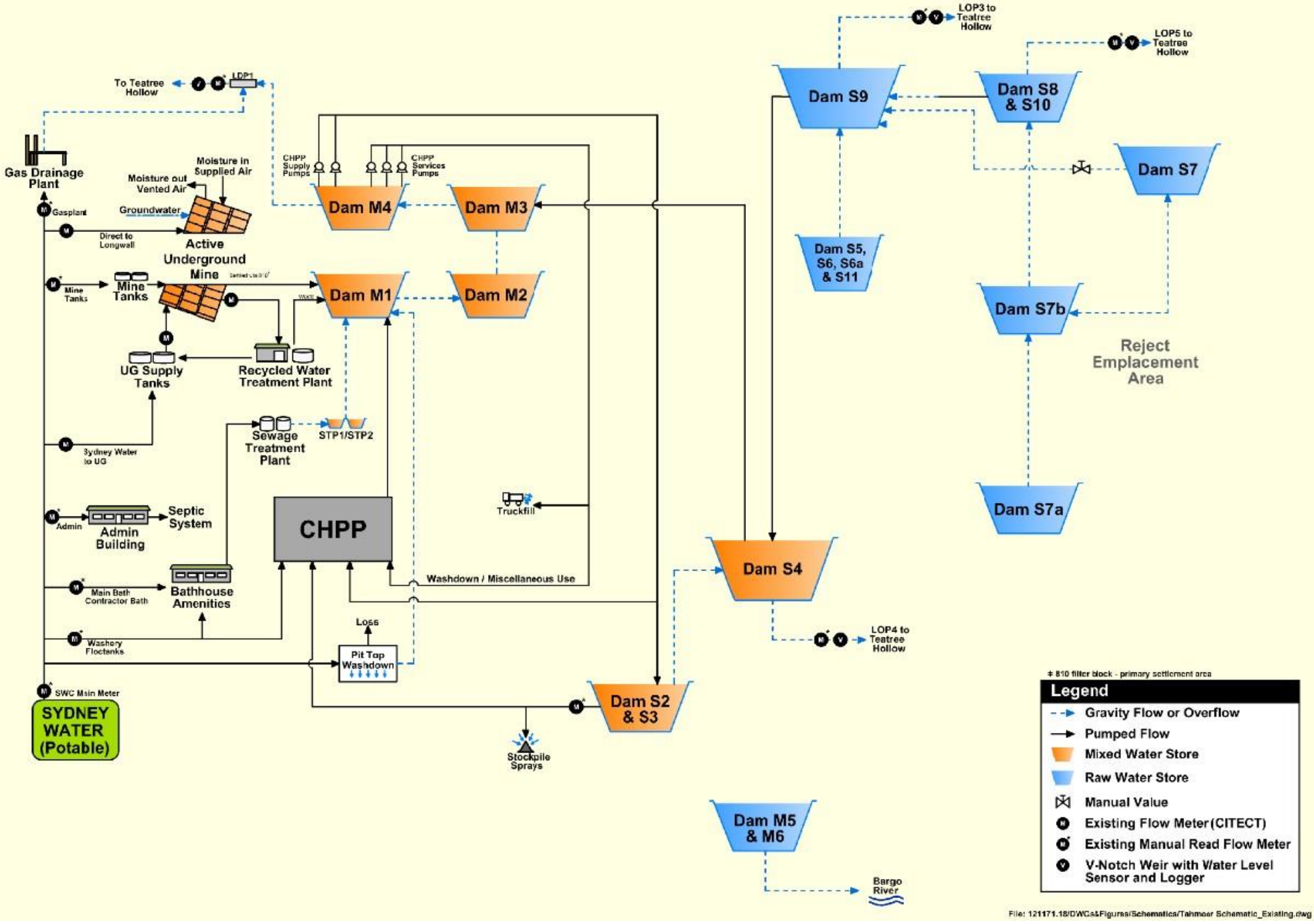
Estimated Water Volume				
Water Storage Name	**Beginning 2022**	**End 2022**	**Capacity**	**Comments**
M1	1.8ML	1.8ML	1.8ML	M series Dams act together to treat mine water pumped from Underground and stormwater which is then discharged via Licenced Discharge Point One (LDP1).
M2	0.5ML	0.5ML	0.5ML	
M3	9.0ML	9.0ML	9.0ML	
M4	8.0ML	8.0ML	8.0ML	
M5	1.5ML	1.0ML	3.0ML	First settling Dam for No.2 Shaft Site area (stormwater).
M6	4ML	2ML	4.5ML	Second settling Dam for No.2 Shaft Site area (stormwater).
S1	0ML	0ML	14.5ML	The coking coal stockpile acts as a retention basin during major storms (refered to as S1). Discharges to S2 Dam. Stockpile Dams S2 and S3 are kept full and are used to supply water used for Dust suppression. Discharges via overflow to S4 Dam.
S2/S3	8.3ML	8.3ML	8.3ML	
S4	1.8ML	10ML	36.9ML	The Dam is designed to act as a retention basin with a controlled outlet. Discharges via Licenced Overflow Point 4 (LOP4).
S5	0.3ML	0.2ML	0.5ML	This Sediment Dam is designed to act as a retention basin and discharges to S6.
S6	1ML	0.75ML	1.5ML	This Sediment Dam is designed to act as a retention basin with a controlled outlet.
S7	2ML	1ML	41.5ML	This is the main catchment for runoff from the REA. The dam is a retention basin during peak rainfall events. All water is pumped to S9 then onto S4.
S7a	10ML	8ML	12.0ML	These Dams are designed to act as retention basins with a controlled outlet to S7 Dam.
S7b	0.8ML	0.5ML	1.0ML	
S8	2ML	2.5ML	4.5ML	Dam retains overflow from S7b. Pumps to Dam S9. Overflow discharge via LOP5.
S9	0.2ML	0.15ML	0.4ML	Silt trap only for sealed Haul road. Wet werll pumps to Dam S4. Overflow discharges via LOP3.
STP1	590KL	590KL	590KL	Treated effluent overflows to M1 Dam.
STP2	590KL	590KL	590KL	
Tank No.1	250KL	250KL	250KL	Underground potable water supply
Tank No.2	250KL	250KL	250KL	Underground potable water supply

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LOP3 to Teatree Hollow
LOP5 to Teatree Hollow
To Teatree Hollow
LDP1
Dam S9
Dam S8 & S10
Dam S7
Gas Drainage Plant
Moisture out Vented Air
Moisture in Supplied Air
Groundwater
Gasplant
Direct to Longwall
Active Underground Mine
CHPP Supply Pumps
CHPP Services Pumps
Dam M4
Dam M3
Dam S5, S6, S6a & S11
Mine Tanks
Mine Tanks
Dam M1
Dam M2
Dam S7b
Reject Emplacement Area
UG Supply Tanks
Recycled Water Treatment Plant
Sydney Water to UG
Sewage Treatment Plant
STP1/STP2
Dam S7a
Truckfill
CHPP
Admin
Admin Building
Septic System
Dam S4
Main Bath Contractor Bath
Bathhouse Amenities
Washdown / Miscellaneous Use
Loss
Washery Floctanks
Pit Top Washdown
LOP4 to Teatree Hollow
SWC Main Meter
SYDNEY WATER (Potable)
Dam S2 & S3
Stockpile Sprays
Dam M5 & M6
Bargo River
* 810 filter block - primary settlement area
Legend
Gravity Flow or Overflow
Pumped Flow
Mixed Water Store
Raw Water Store
Manual Value
Existing Flow Meter (CITECT)
Existing Manual Read Flow Meter
V-Notch Weir with Water Level Sensor and Logger
File: 121171.18/DWGs&Figures/Schematics/Tahmoor Schematic_Existing.dwg

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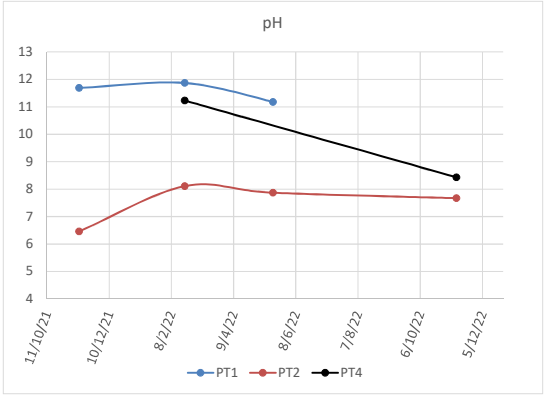
pH	PT1	PT2	PT4
5/9/19	5.88	5.68	5.69
14/11/19	9.5	5.9	4.46
20/2/20	10	6.9	5.38
18/8/20	10.81	6.15	5.8
17/11/20	10.79	7.87	6.15
1/2/21	11.21	6.26	8.93
24/5/21	10.98	6.05	5.8
27/8/21	11.14	6.38	
11/11/21	11.69	6.46	
21/2/22	11.87	8.11	11.23
17/5/22	11.18	7.87	
10/11/22		7.67	8.43
Min	5.88	5.68	4.46
Max	11.87	8.11	11.23
Median	10.98	6.42	5.8

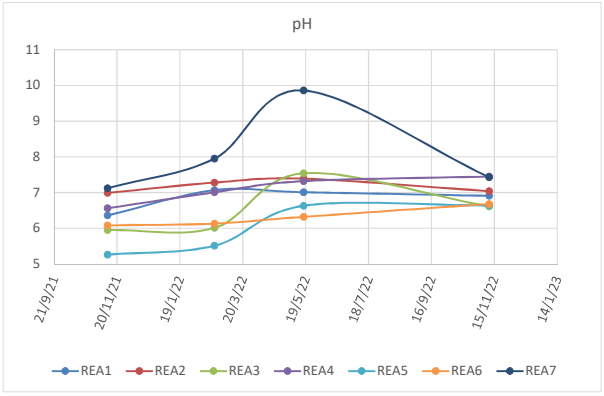
wellhead flooded - no access

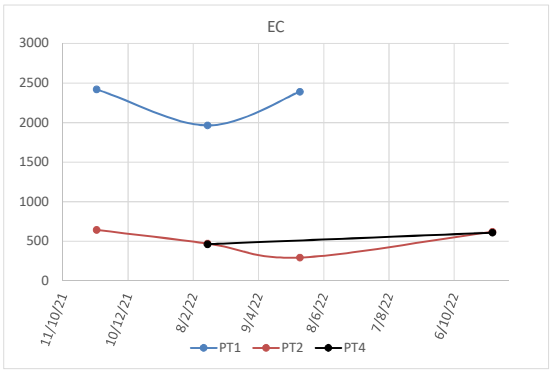
EC	PT1	PT2	PT4
5/9/19	1542	758	3290
14/11/19	1490	632	3190
20/2/20	1605	977	3000
18/8/20	1560	257	1250
17/11/20	1176	633	240
1/2/21	1395	572	298
24/5/21	1855	765	312
27/8/21	1921	356	
11/11/21	2420	644	
21/2/22	1965	472	463
17/5/22	2390	295	
10/11/22		621	609
Min	1176	257	240
Max	2420	977	3290
Median	1605	626.5	609

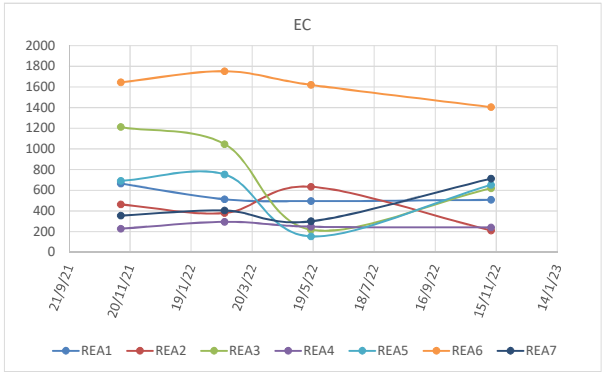
pH	REA1	REA2	REA3	REA4	REA5	REA6	REA7
9/8/19	7.49	7.7	5.04	5.86	7.88	7.89	6.65
11/10/19	6.25	5.55	5.48	5.72	5.89	6.22	6.59
14/11/19	5.91	5.62	5.4	5.87	5.33	5.9	5.99
20/2/20	5.94	5.99	5.44	5.84	6.1	5.88	6.54
18/8/20	5.19	5.58	5.16	5.2	5.4	5.38	6.21
17/11/20	6.24	6.6	6.66	6.12	6.72	6.13	6.77
1/2/21	5.99	6.32	5.61	5.54	5.41	6.03	6.28
24/5/21	5.58	6.6	5.66	5.31	5.1	5.41	6.06
27/8/21	6.2	6.7	6.11	5.95	5.12	5.93	6.89
11/11/21	6.36	6.99	5.95	6.56	5.26	6.08	7.12
21/2/22	7.07	7.28	6.01	7.01	5.51	6.13	7.95
17/5/22	7.01	7.39	7.54	7.32	6.63	6.32	9.86
10/11/22	6.91	7.04	6.61	7.45	6.64	6.68	7.43
Min	5.19	5.55	5.04	5.2	5.1	5.38	5.99
Max	7.49	7.7	7.54	7.45	7.88	7.89	9.86
Median	6.2	6.6	5.61	5.86	5.41	6.03	6.59

EC	REA1	REA2	REA3	REA4	REA5	REA6	REA7
9/8/19	477	2940	1030	958	750	1780	1084
11/10/19	583	4200	1000	747	608	1450	672
14/11/19	519	3400	1270	930	634	1377	787
20/2/20	563	1992	976	936	309	1358	744
18/8/20	570	623	1050	1024	380	1218	653
17/11/20	515	262	956	790	323	1215	568
1/2/21	502	333	1055	754	490	1193	632
24/5/21	430	423	323	145	606	1426	309
27/8/21	509	386	489	222	489	1146	312
11/11/21	665	463	1212	228	691	1645	355
21/2/22	513	380	1046	295	753	1752	404
17/5/22	495	634	218	248	154	1620	300
10/11/22	507.6	210.6	620	240	652	1404	713
Min	430	210.6	218	145	154	1146	300
Max	665	4200	1270	1024	753	1780	1084
Median	515	463	1030	754	606	1377	632









		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		TDS	Na	Ca	K	Mg	Cl	F	HCO3	SO4	TP	TN	Fe T	Fe	Mn T	Mn	Cu	Pb	Zn	Cd	Ni	Al	As	Sr	Li	Ba	Se	DOC
REA3	**16/07/19**	595	125	48	5.8	31	285	0.11	125	19	0.37	1.4	8.6	3.7	2.5	2.2	<0.001	<0.001	0.46		0.04	0.01	<0.01	0.10	0.017	0.17		2
REA4	**16/07/19**	480	115	22	15	20	235	0.15	63	28	0.28	1.8	19	12	2.4	2.3	<0.001	<0.001	0.50	_	0.03	<0.01	<0.01	0.089	0.022	0.16	_	2
REA5	**16/07/19**	390	84	28	4.6	18	190	0.13	65	17	0.26	1.0	20	6.5	2.1	2.1	<0.001	<0.001	0.66	_	0.03	0.03	<0.01	0.056	0.010	0.12	_	<1
REA6	**16/07/19**	1220	340	62	4.9	27	445	0.20	280	170	0.50	0.7	43	11	2.5	2.3	<0.001	<0.001	0.28	_	0.04	0.01	<0.01	0.29	0.026	0.10	_	9
REA7	**16/07/19**	680	215	21	16	15	50	0.19	635	26	0.07	0.9	6.5	5.5	0.22	0.17	<0.001	<0.001	0.20	_	0.04	0.01	<0.01	0.24	0.28	0.73	_	4
REA2	**09/08/19**	1740	445	67	8.9	91	995	0.18	92	58	0.08	0.5	27	20	3.2	3.0	<0.001	<0.001	0.68	_	0.06	<0.01	<0.01	0.19	0.039	0.13	_	1
REA1	**12/09/19**	260	78	3.2	2.5	8.2	81	0.14	130	2	<0.01	0.6	9.5	8.6	0.71	0.66	<0.001	<0.001	0.18	_	0.04	<0.01	<0.01	0.013	0.084	0.062	_	
REA1	**10/10/19**	250	73	4.1	2.1	8.2	79	0.14	135	2	0.06	0.7	16	16	0.95	0.90	<0.001	<0.001	0.017	_	0.05	0.04	<0.01	0.021	0.11	0.083	_	4
REA2	**10/10/19**	1690	430	62	8.8	86	960	0.18	92	64	0.06	0.7	41	38	3.4	3.4	<0.001	<0.001	0.16	_	0.06	0.03	<0.01	0.23	0.048	0.17	_	2
REA3	**10/10/19**	550	115	24	4.7	29	305	<0.1	37	15	0.13	0.9	40	39	2.8	2.8	<0.001	<0.001	0.19	_	0.03	0.05	<0.01	0.081	0.017	0.26	_	<1
REA4	**10/10/19**	495	110	31	10	20	230	0.12	72	42	0.06	2.5	21	21	2.5	2.5	<0.001	<0.001	0.072	_	0.02	0.05	<0.01	0.066	0.018	0.13	_	10
REA5	**10/10/19**	370	81	24	3.2	17	185	<0.1	61	14	0.09	0.5	17	15	2.3	2.3	<0.001	<0.001	0.77	_	0.03	0.02	<0.01	0.084	0.014	0.19	_	2
REA6	**10/10/19**	1120	285	65	5.2	26	385	0.25	315	120	0.16	1.7	65	33	3.3	3.0	<0.001	<0.001	0.035	_	<0.01	0.01	<0.01	0.27	0.025	0.10	_	5
REA7	**10/10/19**	465	150	20	13	12	43	0.21	410	33	0.08	1.1	3.0	1.6	0.50	0.50	<0.001	<0.001	0.016	_	0.02	<0.01	<0.01	0.11	0.21	0.35	_	3
REA1	**14/11/19**	265	84	3.5	1.3	6.4	87	0.21	125	6	0.08	0.7	15	15	1.0	0.91	<0.001	<0.001	0.021	_	0.06	0.03	<0.01	0.018	0.14	0.079	_	2
REA2	**14/11/19**	1770	450	60	10	82	985	0.22	120	61	0.17	1.9	52	49	3.5	3.3	<0.001	<0.001	0.20	_	0.05	0.02	<0.01	0.29	0.072	0.18	_	3
REA3	**14/11/19**	500	120	7.2	3.2	30	300	<0.1	5	13	0.15	1.1	39	38	2.8	2.8	<0.001	<0.001	0.23	_	0.03	0.04	<0.01	0.067	0.020	0.27	_	<1
REA4	**14/11/19**	510	115	27	8.4	21	245	0.13	85	27	0.15	3.6	21	18	2.6	2.4	<0.001	<0.001	0.078	_	0.01	0.03	<0.01	0.090	0.034	0.067	_	16
REA5	**14/11/19**	355	86	8.5	2.2	14	195	0.11	8	11	0.11	0.6	33	32	2.3	2.3	<0.001	<0.001	1.8	_	0.06	0.03	<0.01	0.10	0.013	0.16	_	1
REA6	**14/11/19**	970	260	58	4.1	23	380	0.27	225	110	0.40	1.0	42	31	2.7	2.4	<0.001	<0.001	0.019	_	<0.01	0.04	<0.01	0.26	0.037	0.088	_	6
REA7	**14/11/19**	470	140	18	10	11	45	0.20	385	39	0.09	1.1	3.4	1.2	0.48	0.44	<0.001	<0.001	0.027	_	0.02	0.03	<0.01	0.15	0.23	0.28	_	6
REA1	**20/02/20**	275	82	5.6	2.5	6.7	88	0.23	125	8	0.04	0.3	11	9.2	0.72	0.71	<0.001	<0.001	0.036	_	0.06	0.04	<0.01	0.027	0.11	0.077	<0.01	2
REA2	**20/02/20**	1220	275	77	14	51	550	0.21	225	105	0.13	1.8	18	14	2.2	1.8	<0.001	<0.001	0.090	_	0.02	0.03	<0.01	0.53	0.029	0.13	<0.01	13
REA3	**20/02/20**	485	125	8.4	5.3	26	285	0.11	4	15	0.10	0.5	23	18	2.3	2.3	<0.001	<0.001	0.26	_	0.03	0.05	<0.01	0.063	0.015	0.19	<0.01	1
REA4	**20/02/20**	490	115	22	8.5	19	235	0.12	85	19	0.06	1.7	20	18	2.3	2.2	<0.001	<0.001	0.095	_	0.01	0.03	<0.01	0.082	0.019	0.082	<0.01	9
REA5	**20/02/20**	150	24	12	4.1	6.9	49	<0.1	37	24	0.12	1.9	3.4	2.7	0.35	0.35	<0.001	<0.001	0.13	_	0.01	0.04	<0.01	0.057	0.011	0.048	<0.01	8
REA6	**20/02/20**	820	220	42	5.2	20	345	0.24	160	84	0.28	0.7	31	27	2.1	2.0	<0.001	<0.001	0.087	_	0.04	0.02	<0.01	0.30	0.020	0.10	<0.01	7
REA7	**20/02/20**	425	125	15	11	10	43	0.21	340	35	0.09	0.8	0.80	0.76	0.23	0.21	<0.001	<0.001	0.023	_	0.01	0.03	<0.01	0.12	0.19	0.11	<0.01	5
REA1	**17/11/20**	245	88	5.1	1.8	6.7	83	0.16	120	11	0.10	0.6	19	13	0.85	0.74	<0.001	<0.001	0.056	_	0.05	0.04	<0.01	0.021	0.10	0.081	<0.01	2
REA2	**17/11/20**	380	43	64	20	9.0	43	0.14	225	77	0.10	0.9	3.6	2.6	0.10	0.10	<0.001	<0.001	0.049	_	<0.01	0.04	<0.01	0.44	0.003	0.026	<0.01	19
REA3	**17/11/20**	485	110	10	3.3	29	280	<0.1	<1	16	0.07	0.4	39	34	2.6	2.2	<0.001	<0.001	0.10	_	0.03	0.02	<0.01	0.051	0.010	0.23	<0.01	<1
REA4	**17/11/20**	500	115	31	7.2	23	240	0.11	105	13	0.10	1.6	18	16	2.4	2.1	<0.001	<0.001	0.047	_	<0.01	0.01	<0.01	0.11	0.023	0.067	<0.01	3
REA5	**17/11/20**	195	43	12	4.1	10	95	<0.1	23	24	0.08	0.9	4.0	3.7	0.28	0.25	<0.001	<0.001	0.94	_	0.02	<0.01	<0.01	0.064	0.004	0.073	<0.01	2
REA6	**17/11/20**	790	235	36	4.2	25	355	0.26	140	70	0.41	1.2	60	27	2.3	2.0	<0.001	<0.001	0.066	_	0.04	0.02	<0.01	0.29	0.019	0.13	<0.01	4
REA7	**17/11/20**	395	130	13	10	9.4	43	0.17	315	30	0.08	0.7	4.9	1.5	0.31	0.29	<0.001	<0.001	0.059	_	0.01	0.02	<0.01	0.085	0.14	0.085	<0.01	3
REA1	**20/2/21**	250	79	3.4	1.2	6.4	82	0.20	115	10	0.04	0.5	12	12	0.90	0.85	<0.001	<0.001	0.024	_	0.05	0.01	<0.01	0.019	0.10	0.085	<0.01	2
REA2	**20/2/21**	315	31	63	14	7.2	36	0.13	215	48	0.12	1.2	3.1	1.6	0.07	0.06	<0.001	<0.001	0.026	_	<0.01	0.05	<0.01	0.41	0.004	0.054	<0.01	19
REA3	**20/2/21**	470	110	10	2.5	29	280	<0.1	<1	19	0.11	0.4	33	30	2.9	2.3	<0.001	<0.001	0.14	_	0.03	0.04	<0.01	0.053	0.011	0.22	<0.01	1
REA4	**20/2/21**	440	105	20	6.1	19	235	<0.1	43	14	<0.01	0.3	30	23	2.5	2.2	<0.001	<0.001	0.036	_	<0.01	0.02	<0.01	0.18	0.015	0.18	<0.01	2
REA5	**20/2/21**	295	76	7.9	2.9	15	165	0.11	7	23	0.06	0.4	15	13	1.9	1.7	<0.001	<0.001	1.1	_	0.03	0.03	<0.01	0.060	0.007	0.11	<0.01	2
REA6	**20/2/21**	815	225	32	3.5	24	390	0.30	140	66	0.33	1.0	53	24	2.4	2.2	<0.001	<0.001	0.047	_	0.04	0.02	<0.01	0.28	0.021	0.12	<0.01	3
REA7	**20/2/21**	390	125	13	10	8.8	39	0.21	320	29	0.04	0.4	1.4	1.2	0.15	0.11	<0.001	<0.001	0.050	_	0.01	0.02	<0.01	0.081	0.16	0.14	<0.01	4
REA1	**24/5/21**	0	88	5.1	1.9	7.7	88	0.16	120	11	0.03	0.3	13	11	0.88	0.82	<0.001	<0.001	0.030	<0.0002	0.05	0.02	<0.01	0.018	0.10	0.082	<0.01	2
REA2	**24/5/21**	250	19	58	8.3	5.5	20	0.10	180	39	0.08	1.0	2.3	1.4	0.06	0.06	0.004	0.002	0.11	<0.0002	<0.01	0.05	<0.01	0.26	0.006	0.037	<0.01	15
REA3	**24/5/21**	175	27	26	6.2	3.1	17	<0.1	135	16	0.14	1.4	12	4.2	0.22	0.15	0.006	0.003	0.93	<0.0002	0.01	0.04	<0.01	0.12	0.014	0.035	<0.01	5
REA4	**24/5/21**	76	13	10	3.4	1.9	11	<0.1	41	13	0.06	0.5	2.2	0.28	0.03	0.03	0.002	0.002	0.24	<0.0002	<0.01	0.05	<0.01	0.069	0.008	0.031	<0.01	4
REA5	**24/5/21**	285	90	4.1	2.2	11	160	0.11	8	21	0.05	0.2	26	25	2.0	1.6	0.003	0.004	0.82	<0.0002	0.02	0.03	<0.01	0.045	0.007	0.11	<0.01	1
REA6	**24/5/21**	770	240	24	4.5	26	370	0.26	100	62	0.31	1.2	39	28	1.9	1.9	0.001	<0.001	0.16	<0.0002	0.05	0.03	<0.01	0.29	0.018	0.10	<0.01	3
REA7	**24/5/21**	165	47	3.6	16	2.4	15	<0.1	105	25	0.05	0.2	1.6	0.72	0.09	0.07	<0.001	<0.001	0.057	<0.0002	<0.01	0.05	<0.01	0.043	0.015	0.025	<0.01	2
REA1	**27/8/21**	265	84	5.8	2.2	7.2	88	0.17	125	11	0.25	1.4	22	12	0.93	0.85	0.002	<0.001	0.053	<0.0002	0.06	<0.01	<0.01	0.10	0.074	0.016	<0.01	<1
REA2	**27/8/21**	235	18	55	10	4.5	20	0.13	180	33	0.19	2.0	10	4.6	0.24	0.23	0.002	<0.001	0.049	<0.0002	<0.01	0.05	<0.01	0.004	0.037	0.26	<0.01	14
REA3	**27/8/21**	320	67	32	8.2	12	145	<0.1	82	18	0.09	0.6	17	9.3	1.4	1.1	<0.001	<0.001	0.48	<0.0002	0.02	0.02	<0.01	0.012	0.10	0.11	<0.01	<1
REA4	**27/8/21**	82	13	12	4.8	2.0	11	<0.1	55	12	<0.01	0.8	1.8	0.61	0.15	0.15	0.001	<0.001	0.21	<0.0002	<0.01	0.02	<0.01	0.005	0.047	0.081	<0.01	3
REA5	**27/8/21**	325	71	19	3.9	12	175	<0.1	8	19	0.04	0.3	20	17	2.3	2.1	0.002	0.001	1.1	<0.0002	0.03	0.04	<0.01	0.008	0.13	0.026	<0.01	<1
REA6	**27/8/21**	780	225	22	4.2	24	375	0.27	97	54	0.14	0.3	36	30	2.3	2.2	<0.001	<0.001	0.062	<0.0002	0.04	0.01	<0.01	0.021	0.082	0.37	<0.01	<1
REA7	**27/8/21**	160	37	5.5	21	1.7	17	<0.1	110	21	0.04	0.6	2.0	1.2	0.11	0.10	<0.001	<0.001	0.019	<0.0002	<0.01	0.03	<0.01	0.018	0.031	0.047	<0.01	1
REA1	**11/11/21**	275	81	7.9	3.5	6.4	91	0.15	125	11	0.09	0.5	12	12	0.84	0.79	<0.001	<0.001	0.019	<0.0002	0.05	0.01	<0.01	0.10	0.079	0.015	<0.01	<1
REA2	**11/11/21**	230	17	55	11	4.6	19	0.10	195	24	0.04	0.7	1.9	1.6	0.08	0.07	<0.001	<0.001	0.030	<0.0002	<0.01	0.04	<0.01	0.002	0.037	0.26	<0.01	14
REA3	**11/11/21**	475	110	20	5.4	25	280	<0.1	2	19	0.08	0.2	26	19	2.4	2.3	<0.001	<0.001	0.17	<0.0002	0.03	0.03	<0.01	0.008	0.21	0.076	<0.01	<1
REA4	**11/11/21**	91	15	11	5.9	3.1	12	<0.1	59	13	0.03	0.5	3.9	3.5	0.19	0.17	<0.001	<0.001	0.061	<0.0002	<0.01	0.03	<0.01	0.003	0.050	0.091	<0.01	3
REA5	**11/11/21**	315	81	12	2.8	14	180	<0.1	5	15	0.03	0.4	5.2	4.6	2.2	2.2	0.003	<0.001	0.89	<0.0002	0.04	0.01	<0.01	0.010	0.13	0.027	<0.01	<1
REA6	**11/11/21**	715	210	19	3.5	22	345	0.22	91	51	0.13	0.3	27	23	2.2	2.1	<0.001	<0.001	0.047	<0.0002	0.03	0.02	<0.01	0.017	0.081	0.33	<0.01	<1
REA7	**11/11/21**	170	40	5.1	26	1.8	19	<0.1	120	19	0.06	0.6	2.2	1.7	0.16	0.13	<0.001	<0.001	0.032	<0.0002	<0.01	<0.01	<0.01	0.018	0.078	0.064	<0.01	<1
REA1	**11/11/21**	275	81	7.9	3.5	6.4	91	0.15	125	11	0.09	0.5	12	12	0.84	0.79	<0.001	<0.001	0.019	<0.0002	0.05	0.01	<0.01	0.10	0.079	0.015	<0.01	<1
REA2	**11/11/21**	230	17	55	11	4.6	19	0.10	195	24	0.04	0.7	1.9	1.6	0.08	0.07	<0.001	<0.001	0.030	<0.0002	<0.01	0.04	<0.01	0.002	0.037	0.26	<0.01	14
REA3	**11/11/21**	475	110	20	5.4	25	280	<0.1	2	19	0.08	0.2	26	19	2.4	2.3	<0.001	<0.001	0.17	<0.0002	0.03	0.03	<0.01	0.008	0.21	0.076	<0.01	<1
REA4	**11/11/21**	91	15	11	5.9	3.1	12	<0.1	59	13	0.03	0.5	3.9	3.5	0.19	0.17	<0.001	<0.001	0.061	<0.0002	<0.01	0.03	<0.01	0.003	0.050	0.091	<0.01	3
REA5	**11/11/21**	315	81	12	2.8	14	180	<0.1	5	15	0.03	0.4	5.2	4.6	2.2	2.2	0.003	<0.001	0.89	<0.0002	0.04	0.01	<0.01	0.010	0.13	0.027	<0.01	<1
REA6	**11/11/21**	715	210	19	3.5	22	345	0.22	91	51	0.13	0.3	27	23	2.2	2.1	<0.001	<0.001	0.047	<0.0002	0.03	0.02	<0.01	0.017	0.081	0.33	<0.01	<1
REA7	**11/11/21**	170	40	5.1	26	1.8	19	<0.1	120	19	0.06	0.6	2.2	1.7	0.16	0.13	<0.001	<0.001	0.032	<0.0002	<0.01	<0.01	<0.01	0.018	0.078	0.064	<0.01	<1

REA1	**21/02/2022**	260	83	8.2	2.1	7.1	85	0.16	120	11	<0.01	0.7	15	11	0.72	0.67	<0.001	<0.001	0.016	<0.0002	0.06	0.04	<0.01	0.1	0.091	0.036	<0.01	1
REA2	**21/02/2022**	235	17	55	12	4.9	19	0.11	200	18	<0.01	0.7	1.2	1	0.05	0.03	<0.001	<0.001	0.047	<0.0002	<0.01	0.05	<0.01	0.007	0.05	0.26	<0.01	14
REA3	**21/02/2022**	460	115	14	6.1	28	265	<0.1	11	16	0.15	0.5	2	1.9	2.3	2	<0.001	<0.001	0.12	<0.0002	0.03	0.03	<0.01	0.012	0.22	0.066	<0.01	<1
REA4	**21/02/2022**	145	25	19	5.3	2.7	12	<0.1	115	14	0.11	0.9	2.5	1	0.25	0.2	<0.001	<0.001	0.056	<0.0002	<0.01	0.02	<0.01	0.024	0.059	0.077	<0.01	4
REA5	**21/02/2022**	320	80	16	2.7	14	180	<0.1	6	16	0.09	0.8	1.5	0.76	2.1	1.9	<0.001	<0.001	0.95	<0.0002	0.02	0.04	<0.01	0.01	0.16	0.17	<0.01	<1
REA6	**21/02/2022**	765	245	20	4.1	23	375	0.25	100	50	0.05	0.6	20	15	2.2	2	<0.001	<0.001	0.081	<0.0002	0.03	0.04	<0.01	0.021	0.1	0.35	<0.01	1
REA7	**21/02/2022**	230	53	6.4	35	1.5	19	0.11	170	23	0.02	1.1	0.86	0.77	0.08	0.07	<0.001	<0.001	0.007	<0.0002	<0.01	0.05	<0.01	0.032	0.049	0.073	<0.01	2

REA1	**10/11/2022**	330.2	73	2	1	6.2	77	0.2	120	9	0.08	0.2	25	16	0.94	0.78	<0.001	<0.001	0.004	_	0.045	<0.001	<0.001	0.016	0.13	0.088	<0.001	7
REA2	**10/11/2022**	136.5	13	49	5.5	4	8	0.1	160	6	0.1	1.4	3.5	0.19	0.33	0.011	0.003	<0.001	0.007	_	0.001	0.03	<0.001	0.18	0.001	0.036	<0.001	16
REA3	**10/11/2022**	403	8.4	24	4	3	85	<0.1	36	7	0.08	0.5	11	0.07	1.2	0.09	0.004	<0.001	0.082	_	0.001	0.06	<0.001	0.082	0.001	0.027	<0.001	7
REA4	**10/11/2022**	156	8.8	31	11	1	5	<0.1	110	4	<0.05	0.3	2.4	0.03	0.051	<.001	0.003	<0.001	0.085	_	0.005	0.02	<0.001	0.14	0.008	0.018	<0.001	6
REA5	**10/11/2022**	422.5	38	5.4	3	8.6	100	0.1	15	9	0.1	0.2	30	2.3	1.3	0.41	0.003	<0.001	2.1	_	0.013	0.05	<0.001	0.021	0.005	0.065	<0.001	5
REA6	**10/11/2022**	910	190	18	4	18	300	0.3	130	38	0.2	0.1	38	25	2.2	1.9	<0.001	<0.001	0.012	_	0.012	0.02	<0.001	0.28	0.03	0.1	<0.001	9
REA7	**10/11/2022**	461.5	72	6	27	5	29	0.2	230	29	<0.05	0.1	2.6	2.7	0.13	0.15	<0.001	<0.001	0.002	_	0.007	0.02	0.001	0.043	0.12	0.11	<0.001	3

		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Site	**Date**	**TDS**	**Na**	**Ca**	**K**	**Mg**	**Cl**	**F**	**HCO3**	**SO4**	**TP**	**TN**	**Fe T**	**Fe**	**Mn T**	**Mn**	**Cu**	**Pb**	**Zn**	**Cd**	**Ni**	**Al**	**As**	**Sr**	**Li**	**Ba**	**Se**	**DOC**
PIT TOP 1	**5/09/2019**	970	300	14	86	14	260	0.23	495	51	0.18	2.2	4.6	0.14	0.36	0.33	0.003	<0.001	0.052	_	0.03	0.04	<0.01	0.10	0.15	0.047	_	7
PIT TOP 2	**5/09/2019**	520	72	83	12	33	30	0.14	560	6	0.12	1.0	8.1	2.5	0.23	0.18	0.001	<0.001	0.012	_	<0.01	<0.01	<0.01	0.82	0.021	1.2	_	6
PIT TOP 4	**5/09/2019**	1750	570	40	7.3	69	1060	0.40	62	36	0.19	1.5	3.4	0.56	4.3	4.2	0.004	<0.001	1.2	_	0.07	0.05	<0.01	0.11	0.025	0.17	_	3
PIT TOP1	**14/11/19**	800	265	8.2	66	7.5	230	0.25	165	37	0.08	1.8	1.0	0.95	0.05	0.03	0.001	<0.001	0.006	_	0.03	0.05	<0.01	0.14	0.22	0.023	140	11
PIT TOP2	**14/11/19**	425	76	43	9.5	21	34	0.11	385	20	5.5	6.0	110	8.5	0.46	0.14	<0.001	<0.001	0.008	_	<0.01	0.03	<0.01	0.60	0.013	0.74	_	4
PIT TOP4	**14/11/19**	1710	530	29	5.7	70	1020	0.51	<1	42	0.11	1.7	5.4	1.8	4.4	4.3	0.005	0.003	0.56	_	0.07	0.11	<0.01	0.14	0.046	0.17	_	4
PIT TOP 1	**20/02/20**	680	245	1.6	64	1.4	200	0.22	10	32	3.7	2.4	1.5	1.4	0.06	0.04	<0.001	<0.001	0.016	_	0.03	0.05	<0.01	0.11	0.21	0.016	<0.01	9
PIT TOP 2	**20/02/20**	560	43	105	18	36	34	0.13	570	21	0.05	4.0	1.2	0.55	0.08	0.05	<0.001	<0.001	0.085	_	<0.01	0.01	<0.01	1.1	0.12	0.95	<0.01	5
PIT TOP 4	**20/02/20**	1700	500	23	11	72	1020	0.45	<1	47	0.05	0.9	1.7	1.3	3.8	3.8	0.009	0.011	0.62	_	0.09	1.3	<0.01	0.18	0.037	0.19	<0.01	3

PIT TOP 1	**17/11/20**	620	260	0.8	59	0.9	185	0.21	<1	29	0.10	1.3	4.7	0.52	0.06	0.05	<0.001	<0.001	0.032	_	0.02	0.28	<0.01	0.12	0.14	0.012	<0.01	12
PIT TOP 2	**17/11/20**	370	43	64	13	20	19	<0.1	365	20	0.08	0.7	10	3.2	0.13	0.13	<0.001	<0.001	0.017	_	<0.01	0.03	<0.01	0.74	0.025	1.3	<0.01	3
PIT TOP 4	**17/11/20**	155	26	19	7.3	6.1	11	<0.1	115	23	0.12	1.4	1.6	1.3	0.09	0.08	<0.001	<0.001	0.34	_	<0.01	0.05	<0.01	0.17	0.013	0.11	<0.01	11

PIT TOP 1	**20/2/21**	630	250	0.5	59	0.6	195	0.23	<1	28	0.05	1.4	190	16	0.10	0.08	<0.001	<0.001	0.030	_	0.02	0.31	<0.01	0.12	0.14	0.015	<0.01	13
PIT TOP 2	**20/2/21**	360	38	66	14	21	15	<0.1	385	17	0.03	0.7	5.1	3.8	0.14	0.11	<0.001	<0.001	0.015	_	<0.01	0.05	<0.01	0.74	0.027	1.3	<0.01	4
PIT TOP 4	**20/2/21**	140	27	12	6.8	4.5	17	0.11	98	16	0.15	3.0	3.1	1.2	0.06	0.04	<0.001	<0.001	0.10	_	<0.01	0.03	<0.01	0.47	0.034	0.068	<0.01	15

PIT TOP 1	**24/5/21**	620	245	0.7	63	0.5	190	0.22	<1	29	0.05	1.2	2.2	0.47	0.03	0.02	<0.001	<0.001	0.017	<0.0002	0.02	0.32	<0.01	0.12	0.13	0.016	<0.01	14
PIT TOP 2	**24/5/21**	580	61	98	15	39	20	<0.1	635	15	0.07	0.5	7.0	5.3	0.12	0.10	<0.001	<0.001	0.010	<0.0002	<0.01	0.03	<0.01	0.98	0.059	1.3	<0.01	3
PIT TOP 4	**24/5/21**	185	39	19	13	5.7	18	0.11	155	14	0.07	1.4	1.7	0.72	0.05	0.05	<0.001	<0.001	0.062	<0.0002	<0.01	0.05	<0.01	0.36	0.019	0.092	<0.01	15

PIT TOP 1	**27/8/21**	605	260	0.8	56	0.4	190	0.19	<1	27	0.17	2.3	8.1	1.7	0.12	0.09	<0.001	<0.001	0.025	<0.0002	0.02	0.36	<0.01	0.13	0.010	0.10	<0.01	16
PIT TOP 2	**27/8/21**	225	24	39	9.6	10	17	<0.1	200	12	0.03	0.6	12	5.3	0.13	0.09	<0.001	<0.001	0.016	<0.0002	<0.01	0.02	<0.01	0.015	0.66	0.36	<0.01	1

PIT TOP 2	**11/11/21**	260	32	44	10	11	15	<0.1	260	7	0.03	0.6	0.66	0.49	0.07	0.06	<0.001	<0.001	0.022	<0.0002	<0.01	0.02	<0.01	0.012	0.82	0.45	<0.01	3
PIT TOP 4	**11/11/21**	600	260	0.6	52	0.5	185	0.18	<1	25	0.07	2.8	1.5	1.4	0.26	0.23	<0.001	<0.001	0.006	<0.0002	<0.01	0.05	<0.01	0.12	0.032	0.12	<0.01	15

PIT TOP 1	**21/02/2022**	595	255	0.5	58	0.2	190	0.18	<1	27	0.2	1.9	0.62	0.43	0.13	0.1	<0.001	<0.001	0.016	<0.0002	0.02	0.47	<0.01	0.12	0.017	0.11	<0.01	13
PIT TOP 2	**21/02/2022**	210	23	36	11	9.3	10	<0.1	205	8	0.24	0.7	2	1.2	0.02	0.01	<0.001	<0.001	0.017	<0.0002	<0.01	0.04	<0.01	0.033	0.69	0.37	<0.01	2
PIT TOP 4	**21/02/2022**	155	44	3.6	42	0.5	10	<0.1	<1	16	0.01	2.7	1.5	0.35	0.02	0.02	<0.001	<0.001	0.01	<0.0002	<0.01	1.1	<0.01	0.069	0.085	0.59	<0.01	13

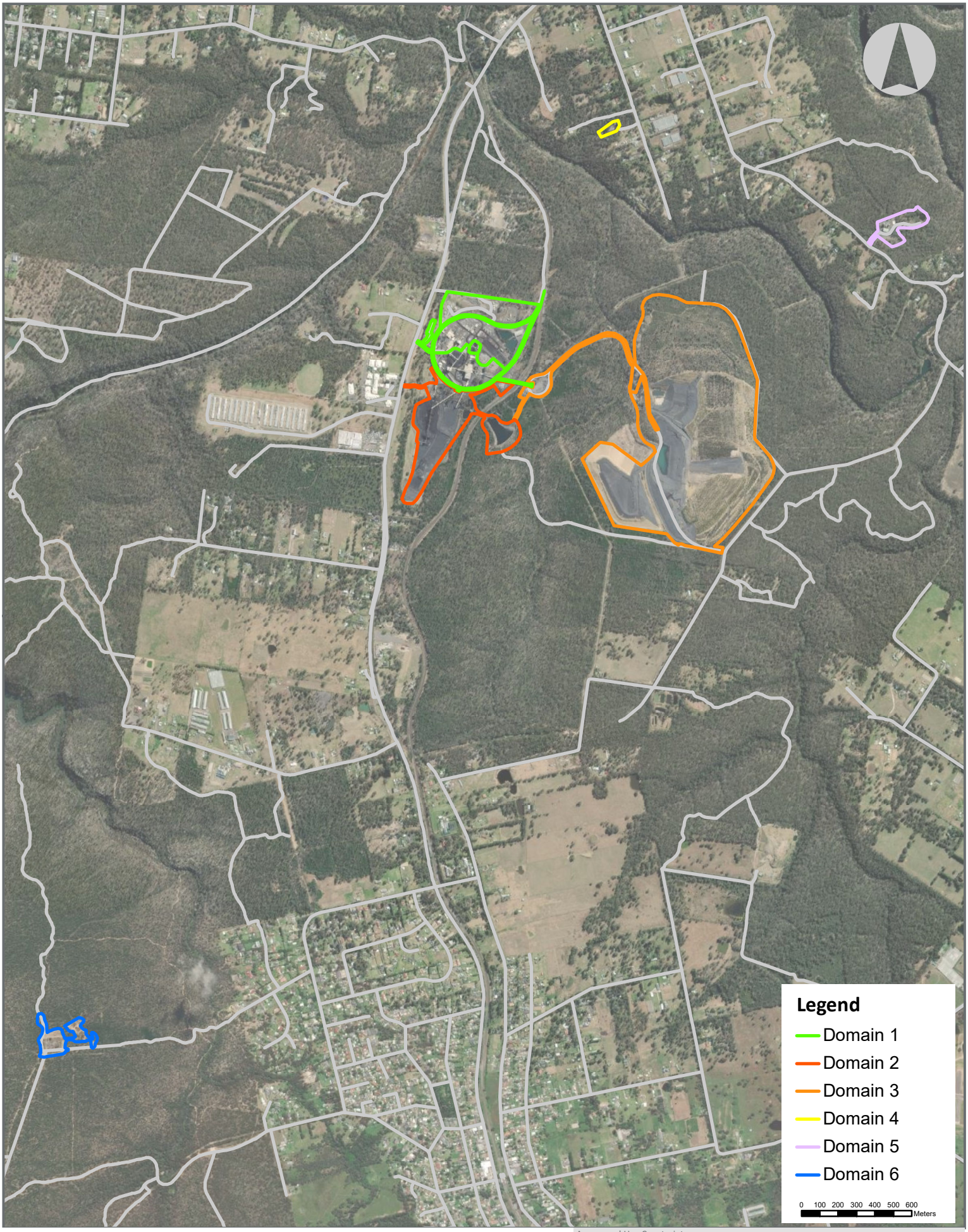
PIT TOP 1	**10/11/2022**																										Not tested
PIT TOP 2	**10/11/2022**	403	60	93	13	34	12	<0.1	460	14	<0.05	0.4	16	6.9	0.19	0.13	<0.001	<0.001	<0.001	-	<0.001	<0.001	<0.001	0.93	0.09	1.1	<0.001	4.00
PIT TOP 4	**10/11/2022**	396.5	42	32	4	28	8	0.2	270	31	1.8	1.8	9.2	0.98	2.1	0.64	<0.001	<0.001	0.01	-	<0.001	<0.001	<0.001	0.22	<0.001	0.07	<0.001	29

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APPENDIX 8

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Closure Domains

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APPENDIX 9

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Tahmoor Coal Pty Ltd. Rehabilitation Monitoring 2022

Tahmoor Coal Pty Ltd.

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Template 2.8.1

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Abbreviations

Abbreviation	Description
ELA	Eco Logical Australia Pty Ltd
OGM	Organic Growth Medium
REA	Refuse Emplacement Area

1. Introduction

In 2022, rehabilitation monitoring was carried out by Eco Logical Australia Pty Ltd (ELA) in accordance with the Tahmoor Coal's Rehabilitation Management Plan - TAH-HSEC-402 and Rehabilitation Strategy TAH-HSEC-401 and Rehabilitation Monitoring procedure which require both:

- an annual walkover inspection of all areas within the Refuse Emplacement Area (REA) where rehabilitation activities have been completed including newly established revegetation
- monitoring of permanent monitoring sites within each mine closure Domain. Within the REA (closure Domain 3) permanent plots have been established in each development stage to assess revegetation progress.

These guidelines state:

"The objective of this monitoring is to evaluate progress of rehabilitation towards fulfilling long term land use objectives, such as the development towards a self-sustaining ecosystem."

Rehabilitation of vegetation within the REA has been carried out since 1993 as each stage of the refuse emplacement was constructed. The permanent monitoring sites program began in 2010 with the establishment of two permanent plots within each existing section of the REA and two reference site plots within relatively undisturbed native vegetation nearby. As each Stage of the REA was completed permanent plots have been established following revegetation. In addition, further plots were established in areas greater than four hectares to address the recommendations for native vegetation monitoring provided in the Rehabilitation Strategy. In future, in accordance with monitoring guidelines, additional permanent plots will be installed as each area of revegetation within the REA reaches an age of 5 years from planting.

Monitoring of permanent sites in the rehabilitation areas provides information regarding changes in both vegetation growth, senescence, colonisation, and species diversity. In addition, indication of the success of the rehabilitation is gained through comparison of both vegetation structure and species composition with the reference sites monitored in nearby bushland. Methods for measuring these values include detailed species counts and cover within 2 m x 2 m nested quadrats and species diversity, canopy cover, growth rates, reproductive potential, and progress within a 20 m x 10 m plot. Photographic monitoring of plots is also implemented.

The walkover inspection records details across each stage and includes information on the following factors:

- evidence of soil profile development and visual assessment of surface materials
- evidence of erosion and stability, and function of erosion and sediment control structures
- growth rates and evidence of plant mortality or dieback
- species diversity including identification of target species
- presence of over-storey, mid-storey and understorey species
- evidence of reproductive potential
- evidence of biological nutrient cycling
- occurrence of potholing or slumping and evidence of spontaneous combustion

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- evidence of contamination or other limitations to vegetative establishment.

Native grass species have been trialled in areas where the existing vegetation within established revegetation areas was sparse. These grass planting trials were monitored to review the survival and growth of planted species.

More detailed presentation of the monitoring results is included in the appendices:

- **Appendix A - Monitoring 2021 – Mine Closure Domains 1 – 5 Permanent Sites** and
- **Appendix B - Monitoring 2021 - Annual Walkover – Refuse Emplacement Area and No. 2 Shaft Power Corridor.**

These appendices include collated details of the recorded monitoring results, the collected field data sheets, and monitoring photographs.

2. Results

2.1 Monitoring results prior to 2022

Revegetation across the REA was highly variable with some sections approximately 20 years old and others newly established with seeding carried out 24 months prior to monitoring. The native species included in the revegetation mix also varies, in both diversity and structural representation, between those areas revegetated prior to 2006 and those revegetated more recently.

Characteristics of sections revegetated prior to 2006 include:

- canopy species including *Eucalyptus* species, *Angophora* species and *Allocasuarina littoralis* providing cover ranging from good to limited, heights up to 10 m and exhibiting good growth. Second generation *Allocasuarina littoralis* were common near mature plants, with other canopy species second generation plants beginning to appear.
- smaller tree species including *Acacia decurrens and Acacia binervia* were also regenerating with second generation individuals present
- a midstorey that varied from dense stands of *Kunzea ambigua* (Tick Bush) or the non-local species *Leptospermum laevigatum* (Coast Teatree) to scattered *Acacia* species interspersed with other less abundant native species.
- highly effective weed control actions reduced weed cover where extensive stands of the weed *Andropogon virginicus* (Whiskey Grass) and smaller populations of *Eragrostis curvula* (African Lovegrass) were present and excluded all other species. Weed cover was generally low with weed control providing good on-going results.
- increasing colonisation by native grasses with cover increasing annually in most areas, including where exotic grasses have been controlled.
- vegetation was dominated by *Acacia* species, many of which are senescent or in some sections mixed native vegetation that is not representative of the local native plant communities. Senescent Acacias becoming less common.
- good species diversity including target species; however, many species had a low abundance.
- all species exhibited signs of good reproduction potential including the threatened species, *Persoonia bargoensis* and *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea).

Characteristics of sections revegetated in 2007 (Stage 8):

- originally planted with pasture species as a stabiliser, and was still dominated by exotic grasses in 2016
- trial of reseeding using the soil amelioration product OGM proved not suitable for the REA
- very limited cover by native species, both target and non-target
- scattered patches of native grasses with good cover prior to 2017.

Characteristics of sections revegetated post 2010 are:

- generally good germination rates on level areas with species from all strata represented
- germination more variable on slopes but still adequate
- growth rates moderate to very good

- limited weed populations.

2.2 Monitoring results in 2022

Erosion control structures which were implemented in 2019 remain in good condition and no major erosion was recorded along the slopes of the REA. An area in Stage 1 where seepage affected vegetation growth was rehabilitated with the ripping of the soil surface and mulching in 2018. This area continues to be in a good condition with no seepage evident in 2022. Nearby the seepage area, minor erosion has been recorded, this should continue to be monitored and minor works required to rectify the erosion if required.

Monitoring of grass trials was undertaken, the grass trials have previously shown that with adequate fencing, herbivory is somewhat controlled and have shown good growth rates of grasses. In 2022 grass trial monitoring was undertaken. Most of the fencing around the trials as been damaged, likely by macropods. Regardless, native grass diversity and cover were recorded as well as midstorey shrubs and come regenerating canopy species such as *Allocasuarina littoralis* and eucalypt species. This was particular evident within Stages 1, 2 and 3 which are likely to be naturally recruiting from the maturing plantings across those Stages.

The reference plots and permanent monitoring plots which were burnt by fire in 2019 showed good signs of recovery with epicormic growth evident of canopy species, high levels of seedings and saplings of canopy species noted, and a high level of species cover and diversity of grasses and forbs. There is also evident of nutrient recycling with termite mounds, ants and scats noted in those burnt plots. Litter cover had significantly improved in these plots with grass, leaf litter and twigs recorded in all plots.

Over the past 12 months there has been above average rainfall attributed to the current La Nina event. It is advised that all erosion control measures, and gully erosion are carefully monitored to prevent significant erosion developing.

The non-burnt plots in the REA showed slight decrease overall. However, most plots recorded an increased percentage of understorey cover which was attributed to the higher cover of non-grass species including midstorey species and recruitment of canopy species. It is likely that above average rainfall over the year had a positive impact on understorey species cover and across the REA.

Superficially, the result of the species diversity shows that species diversity across the REA has declined, however, this is due to the Reference plots being previously burnt and therefore the species diversity within the reference plots generally does not match the monitoring plots. Prior to the Reference sites being burnt, there were many target species recorded in the permanent monitoring plots. It is expected that as the Reference plots continue to regenerate, the results of species diversity of the reference plots against the monitoring plots will better align.

Some plots also recorded a higher percentage cover of weed cover which is expected considering the high rainfall coverage over the past 12 months.

Additional characteristics and changes that were noted include:

- adequate growth of the diameter at breast height (DBH) in all canopy species including juveniles and seedlings

- consistent senescence of *Acacia* spp.
- increase of weed cover over the last 12 months in stage 10 and 12A of the REA, in particular the cover of *Eragrostis curvula* (African Love Grass), increased weed management is required in this area.
- signs of a rabbit population observed
- herbivory of planted grasses in grass trials reducing reproductive potential of grass species.

Table 1 provides further details of the monitoring results from 2022 in comparison with results from earlier years and recommendations.

Table 1: Key monitoring results

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
Soil profile development	Highly variable and developing in the older stages of rehabilitation around leaf and grass litter, fallen timber, native grass clumps, and newer revegetation in rip lines. <u>2020</u> Development recorded in rip lines and areas with high leaf litter. Cover with grass litter low due to drought conditions	Soil profile continues to develop across all areas of the REA and litter cover has generally improved or remained consistent across all monitoring plots.	Nil.
Evidence of erosion	Isolated areas of minor gully erosion, rill and sheet wash have been recorded. Remediation works carried out at several locations. Additional drains installed to direct stormwater and addressing erosion in new rehabilitation area. Stormwater drains in some sections were rock lined to provide better erosion control. <u>2020</u> Limited, minor gully erosion present across the REA.	Limited, some erosion noted past the seepage area to the north of Stage 1 which should be monitored.	Repair areas of minor gully erosion with minor works (i.e., filling with rocks, branches, logs etc.) Monitor minor and major gully erosion.
Native plant species diversity	Species diversity has increased since monitoring began, with an increase in groundcover species seen in areas of weed control within the early revegetation areas. Native herbs and forbs are more abundant in areas where native grasses are colonising. The midstorey is dominated by *Acacia* spp., but also includes *Dodonaea* spp., *Persoonia* spp., *Kunzea ambigua and Cassinia* sp. Groundcover species diversity is good with herbs, sedges, lilies, and grasses all represented; however, many species have low abundance.	<u>Previously burnt vegetation</u> Continued evidence of epicormic growth in canopy species. Regeneration of Acacia spp. is high and many seedlings and saplings of *Eucalyptus* spp. and *Allocasuarina littoralis* noted within and around plots. Grass and forb cover in the understorey is regenerating and generally includes good species diversity and cover and includes target species. Leaf and twig litter significantly increased.	Maintain weed control program with attention to avoiding off-target damage

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
	2020 Burnt vegetation Reference sites and stages 6 and 9 results were consumed by fire in 2019. These areas show evidence of epicormic growth in canopy species. Midstorey species consumed by fire and have not begun to regenerate yet. Grass and forb cover in the understorey is regenerating and generally includes good species diversity and cover and include target species. Leaf and twig litter slowly accumulating. Non-burnt vegetation Native species diversity remains consistent overall allowing for a dry season and a decrease in species diversity in undisturbed bushland. *Acacia* diversity reduced with senescence in some shrub species. Senescence of *Hakea* species also noted across stages 1 and 2. The number of target species (i.e., those consistent with reference sites and nearby native vegetation) within each monitoring plot remains adequate to good despite earlier drought conditions. Species diversity in canopy species adequate on average in most REA stages, however some sections have more limited diversity. Midstorey species diversity more limited. Forb species diversity limited.	Non-burnt vegetation Most plots recorded increased percentage of understorey cover including shrubs and non-grasses Native grass cover tended to decline overall Good diversity of species noted across the REA. Expected that target species in non-burnt plots will better align with the Reference sites as they continue to regenerate	

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
Native plant cover (overstorey, midstorey, groundcover)	Native cover is highly variable within all strata across the REA and, with some small areas devoid of vegetation. Canopy cover varies from good to very low, with much of the revegetation too young to provide a meaningful measurement. Sub-shrub cover is more limited with a number of species failing to reach maturity. Groundcover varies within the established revegetation areas from 100% to 0%. Colonisation by grasses and groundcover species is patchy but improving slowly. <u>2020</u> Native plant cover remains variable across the REA, with groundcover varying greatly and some areas devoid of groundcover species. Otherwise, native plant cover is increasing at a slow rate. Colonisation by groundcover species including grasses and sedges delayed by earlier drought conditions In more recent revegetation areas, native cover is consistent with high numbers of juvenile canopy species. <u>2021</u> Native plant cover has generally increased across the REA with most plots recording increase in cover of understorey stratum. Areas which have the least groundcover are within I1 and I2. Continue to monitor native plant cover in these plots and consider infilling with native grass tubestock.	Notable recruitment in midstorey stratum, as permanent plots continue to progress. Overstorey species second generation recruitment evident and consistent across the REA. Previously noted that plots I1 and I2 (Stage 12b) lacked groundcover species; result from 2022 monitoring recorded increase in understorey live cover and increase in total number of native species.	Continue to monitor groundcover diversity of Stage 12b.

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
Native plant growth rates and regeneration	Canopy species growth is adequate and is consistent with the growth rates determined in the undisturbed nearby native vegetation. Second generation canopy species are prevalent in the earlier revegetation areas. Many *Acacia parramattensis* are senescent or have died and fallen. Some species (particularly sub shrubs) failing to thrive to maturity, possibly due to selective herbivory by rabbits. Native grasses are regenerating and spreading in some sections strongly. <u>2020</u> For those monitoring plots burnt in the 2019 bushfires the following characteristics were noted: • all strata consumed by fire • canopy species showing epicormic growth • midstorey is absent, *Allocasuarina* and *Acacia* species did not survive hot fire • groundcover has recolonised following fire, generally low cover however, some monitoring plots have higher diversity of species post fire. • leaf litter and woody material largely consumed by fire, reduced cover of grass, twig litter is available. Growth rates are variable in newly established revegetation areas. Growth rates are generally better in those areas with low slope, indicating that moisture availability is limiting growth on steeper sections.	The growth rate in canopy species remains consistent and small increases recorded in all plots across the REA.	Nil.

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
	The growth rate in canopy species remains consistent. Senescent *Acacia* midstorey species are present across the REA. Growth rates, other than that of sub-shrubs, are adequate but variable. Second generation recruitment in this stratum is greatest in *Acacia* species, with recruitment in other species increasing slowly. Native grasses have increased in some monitoring plots despite drought conditions. 2021 The growth rate in canopy species remains consistent and small increases recorded in all plots across the REA.		
Threatened flora	Two threatened species have been observed within the rehabilitation areas, *Grevillea parviflora* subsp. *parviflora* and *Persoonia bargoensis* 2020 The population of *Grevillea parviflora* subsp. *parviflora* within Stage 6 has significantly decreased as a result of fire in late 2019. One individual seeding was found within this area during 2020 monitoring. The population of *Persoonia bargoensis* is increasing within areas of early revegetation. It is unknown if the plants previous recorded within the No 2 shaft 11kV power line were lost to fire in late 2019. 2021 Stable populations of *Grevillea parviflora* subsp. *parviflora* and *Persoonia bargoensis.*	Stable populations of *Grevillea parviflora* subsp. *parviflora* and *Persoonia bargoensis* in Stages 6 and 9. *Persoonia bargoensis* also recorded in some permanent monitoring plots in Stages 3, 4, & 5 and Stage 10 where it has not been recorded previously.	Continue to monitor threatened species populations. Weed control in the vicinity of these species to be carried out by hand.

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Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
Weed occurrences and cover	Weed densities were highly variable across the REA. Heavy infestations of *Andropogon virginicus* (Whiskey Grass) and smaller populations of *Eragrostis curvula* (African Lovegrass), *Sisymbrium officinale* (Hedge Mustard) and *Nassella trichotoma* (Serrated Tussock) were observed within the early rehabilitated areas in the north of the REA prior to 2010. Weed control programs were instigated with strong results. *Andropogon virginicus* and *Eragrostis curvula* continued to be present in isolated patches within the REA. *Cenchrus setaceus* (Fountain Grass) colonised the slopes of Stage 5 in 2017. <u>2020</u> Weed cover is generally low across the REA, however there is increased cover by *Eragrostis curvula* in several stages - the upper benches of Stages 14 and 16 and Stage 12, and the western section of stage 10. Patches of this weed are increasing across the REA. *Cenchrus setaceus* (Fountain Grass) continues to spread on the slopes of Stage 5. The population of *Sisymbrium officinale* has increased over the last 12 months. The small population of *Gomphocarpus fruticosus* (Narrow-leaved Cotton Bush) has increased over the last 12 months. <u>2021</u> The population of *Gomphocarpus fruticosus* was significantly lower than previous year.	*Gomphocarpus fruticosus* not recorded across REA *Cenchrus setaceus* not recorded across REA Populations of *Sisymbrium officinale* and *Eragrostis curvula* continue to spread across Stage 5 and parts of Stage 1. Large area of *Eragrostis curvula* present on top of upper benches of Stages 14 and 16 and Stage 12	Increase weed monitoring and weed control program overall, targeting key areas of weed infestations. Take care to avoid off-target damage during weed control works is to be considered. *Eragrostis curvula - control* mature plants year-round, with extra effort in spring before flowering look for flushes of seedlings after rain when temperatures are over 10°C (most seeds germinate in autumn and spring) and target the seedlings before they are six weeks old (DPI, 2023)

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
	Populations of *Sisymbrium officinale* and *Cenchrus setaceus* continue to spread across Stage 5 and parts of Stage 1. Large area of *Eragrostis curvula* present on top of upper benches of Stages 14 and 16 and Stage 12		
Non-local native species	Non-local native species are common within those sections of the REA which were revegetated prior to 2000 and are uncommon elsewhere. *Leptospermum laevigatum* is the most abundant non-local native species and is colonising strongly outside the original area of planting. *Acacia saligna* (Western Australian golden wattle) was recorded as both mature trees and juveniles. This species was controlled across the REA prior to November 2016. Most other species within this category are present in limited numbers and populations are not increasing. <u>2020</u> *Leptospermum laevigatum* remains abundant within the oldest revegetation area with scattered individuals beyond stages 1 and 2. These species have not been included in more recent seedings for revegetation within the REA. Limited *Acacia saligna* seedlings were located across the REA. <u>2021</u> *Leptospermum laevigatum* remains abundant. Acacia saligna is limited.	*Leptospermum laevigatum* remains abundant. *Acacia saligna* is limited.	Control the spread of *Leptospermum laevigatum* by controlling seedlings outside stages 1 and 2. Maintain monitoring for *Acacia saligna* and control opportunistically during weed control activities.
Feral fauna	Evidence of significant rabbit population. Herbivory by this species was considered to be impacting on the	Rabbits noted during field surveys	Rabbit monitoring to continue and control programme in conjunction

Key Characteristics	Summary - Results from Permanent Plot surveys 2010 – 2017 and Walkover surveys 2008 - 2012	Results from survey 2022	Recommendations
	success of revegetation by the selective removal of some species. Rabbit population controlled in 2017. 2020 A small rabbit population remains. 2021 A small rabbit population remains.		with neighbouring properties if required. Consultation with Local Land Services advisable.

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SIX MONTHLY SUBSIDENCE IMPACT REPORT

Western Domain Longwalls West 1 – West 4

1 January 2022 – 31 December 2022

Report 7 – March 2023

simecgfg.com

Document Control

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Executive Summary

This report is the seventh six-monthly report to be submitted since the commencement of extraction in the Western Domain, in accordance with the requirements of the Longwall West 1 and West 2 (LW W1-W2) Extraction Plan and the Longwall West 3 and West 4 (LW W3-W4) Extraction Plan. The reporting period of this report is a full calendar year from 1 January 2022 to 31 December 2022 to support the Annual Review (2022).

Extraction of coal from Longwalls West 1 to West 3 were completed on 6 November 2020, 17 June 2021 and 21 March 2022, respectively. Longwall West 4 (LW W4) commenced on 16 May 2022 and was completed on 13 September 2022. Subsidence impacts discussed in this report are for those observed during and after the extraction of LW W3 and LW W4.

The maximum observed vertical subsidence relating to the extraction of LW W4 was 897 mm recorded along the LW W1-W4 crossline survey.

There were ten (10) environmental aspects that were associated with Trigger Action Response Plans (TARPs) triggers. All triggers have been reviewed by the Environmental Response Group / Structural Response Group / specialists to determine if any further action is required. These TARP triggers included:

- Pool Water Level TARP – Level 3 triggered due to pool water level reduction in Cedar Creek (pool CR14) between 9 and 20 December 2022. During the periods of water level decline the water level remained above the previously recorded minimum and did not decline atypically. This TARP was resolved on 31 December 2022 and no further actions other than ongoing monitoring are required. Tahmoor Coal is reporting on pool water level on a 3-monthly basis to DPE;
- Natural Drainage Behaviour TARP – Level 3 triggered due to laminar fracturing at SR17 Rockbar from November 2021 onwards, and fracturing at SR20 Rockbar from August 2022 onwards. A Level 3 TARP trigger was associated for both locations as the rockbar fracturing was formed during mining (was not present during baseline inspections), and there was no reduction in pool water level, drainage or overland connected flow (taking into account climatic conditions and observations during the baseline monitoring period). No further actions other than ongoing monitoring are required;
- Surface Water Quality TARP – Level 2 triggered due to elevated dissolved aluminium at various pools throughout the reporting period, and variable pH levels at monitoring site SD in August and September 2022. These elevated aluminium concentrations were attributed to prevailing climatic conditions, while the variable pH levels were attributed to instrumentation or field measurement issues. No further actions other than ongoing monitoring are required;
- Groundwater Bore Level TARP – Levels 2 and 3 triggered during the reporting period, however a trend in groundwater recovery was evident. Groundwater bore level will continue to be monitored in accordance with the LW W3-W4 Water Management Plan, and Tahmoor Coal will continue to provide 3-monthly reports to DPE for surface water and groundwater;
- Shallow Groundwater Pressures TARP – Levels 2, 3 and 4 triggered during the reporting period, however a trend in groundwater recovery was evident. Groundwater bore level will continue to be monitored in accordance with the LW W3-W4 Water Management Plan, and Tahmoor Coal will continue to provide 3-monthly reports to DPE for surface water and groundwater;
- Deep Groundwater Pressures TARP – Level 2 triggered during the reporting period. Groundwater monitoring will continue under the existing monitoring program;

- Groundwater Quality TARP – Levels 2 and 3 and potential Level 4 were triggered due to water quality results during the reporting period. Potential Level 4 triggers were identified for pH at P12B, and strontium at P15A, and EC and Barium at GW115860. All potential Level 4 triggers were resolved during this reporting period. A Level 3 TARP trigger was noted for elevated zinc concentration at P16C. Groundwater monitoring will continue under the existing monitoring program, and no actions are required;
- Stonequarry Creek Rockbar TARP – Blue Triggers for extension of High Resolution Closure Lines and measured strains across the SR17 Rockbar, and a Yellow Trigger for fractures on the SR17 Rockbar. These triggers have been investigated, and no impacts were noted at the Aboriginal heritage items located on the SR17 Rockbar. Monitoring of the rockbar has now finished as mining in the Western Domain has been completed;
- Historical Heritage TARP – Level 3 Trigger for impacts to sandstone culverts at 88.400 km and 88.980 km. These impacts included cracking and minor spalling on the portal sides and cracking in the barrel of the culvert at 88.400 km. This Level 3 TARP trigger is a continuation of the TARP notification to DPE on 21 September 2021. Tahmoor Coal is undertaking remediation now that the full effects of LW W3-W4 have been complete; and
- Main Southern Railway TARP – Blue Triggers at Ballast Top Subways (88.133 km and 86.838 km) and Picton Tunnel, which were attributed to impacts from rainfall rather than mining impacts. As these triggers have been resolved, ongoing monitoring is required.

During the reporting period, there was one exceedance of environmental performance measures or indicators, as adopted from DA 67/98 Modification 5 or the LW W1-W2 Extraction Plan Approval conditions. Cracking on sandstone culverts at 88.400 km and 88.980 km resulted in an exceedance of subsidence performance indicator for 'other Aboriginal and heritage sites', which was defined as 'negligible subsidence impacts or environmental consequences'. Tahmoor Coal notified DPE and Heritage NSW of the trigger via the NSW Major Projects Planning Portal on 21 September 2021. A site visit with DPE was completed on 12 April 2022. A warning letter from DPE was received on 16 May 2022 regarding the breach against Section 4.2(1)(b) of the *Environmental Planning and Assessment Act 1979.* Tahmoor Coal has committed to complete remediation by 30 June 2023.

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1 Introduction

1.1 Background

Tahmoor Coal Mine (Tahmoor Mine) is an underground coal mine located approximately 80 kilometres (km) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (NSW) (refer to **Figure 1-1**). Tahmoor Mine produces up to three million tonnes of Run of Mine coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla for Australian domestic customers and export customers.

Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (Tahmoor Coal) since Tahmoor Mine commenced in 1979 using bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group.

Tahmoor Coal has mined 36 longwalls to the north and west of Tahmoor Mine's current pit top location. The 'Western Domain' is a mining area located north-west of the Main Southern Rail between the townships of Thirlmere and Picton (**Figure 1-1**). The Western Domain is within the Tahmoor North mining area and is within Mining Lease (ML) 1376 and ML 1539.

Extraction Plan approval for the third and fourth longwalls in the Western Domain (LW W3-W4) was granted by DPIE (now DPE) on 13 September 2021. A copy of this Project Approval is available on the Tahmoor Coal website (http://www.simec.com/mining/tahmoor-coking-coal-operations/). The Study Area for this extraction plan is provided in **Figure 1-2**.

Extraction of coal from Longwalls West 1 to West 3 were completed on 6 November 2020, 17 June 2021 and 21 March 2022, respectively. Longwall West 4 (LW W4) commenced on 16 May 2022 and was completed on 13 September 2022.

Extraction Plan approval for Tahmoor South Domain A Series was granted on 20 September 2022, and extraction of LW S1A commenced 18 October 2022. Subsidence Impact Reporting for Tahmoor South Domain is reported separately to that of the Western Domain.

1.2 Purpose

1.2.1 Six-Monthly Subsidence Impact Report Requirements

The purpose of this report is to address the requirements for six-monthly reporting on impacts and environmental monitoring results associated with the extraction of LW W3-W4. These requirements are outlined in Section 6.1.4 of the LW W3-W4 Extraction Plan, which are derived from the Section 6 of the DPE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). It is noted that an updated version of the Guidelines was published in October 2022.

This report provides with a summary of subsidence and environment monitoring results, subsidence impacts and management actions undertaken during the reporting period. The reporting period for this report is defined in **Section 1.3**.

In addition, a letter from DPE dated 19 December 2022 provided three additional reporting requirements for future Six-Monthly Subsidence Impact Reports for the Western Domain.

Reporting requirements are listed in **Table 1-1** below, together with the cross-reference where the requirements are addressed in this report.

Table 1-1 Six Monthly Subsidence Impact Report Requirements

Requirement No.	Requirement Description	Section Addressed
Reporting Requirements as per Section 6.1.2 of the LW W3-W4 Extraction Plan		
1	A comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);	Section 3.1
2	Any proposed actions resulting from triggers being met in the TARP, or other actions;	Section 3.2
3	An assessment of compliance with all relevant performance measures and indicators; and	Section 4
4	A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and level data, piezometer readings.	Section 2
Reporting Requirements as requested by DPE on 19 December 2022		
1	Continue to include an assessment against performance measures and performance indicators, and any recommendations in relation to ongoing monitoring or corrective actions;	Section 4, Section 3.2
2	Continue to include a review and update on the status of recommendations made in previous reports; and	Section 2.2.6 and Section 2.3.5
3	Include an update on the progress of remediation of the two sandstone culverts impacted by mining of LW W1-W4.	Section 3.2.9

This report will be distributed to the stakeholders listed in **Section 5.4**.

1.2.2 Three-monthly Reporting Requirements

This report forms part of three-monthly reporting for surface water and groundwater following an investigation of Level 4 TARP triggers relating to depressurisation of groundwater aquifers and water level at surface water monitoring site CB (Pool CR14). This reporting requirement was requested by NSW Department of Planning and Environment following the notification of these TARP triggers.

This report includes a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and a summary and progress of any recommendations in relation to ongoing monitoring or corrective actions (refer to **Section 2.2.6** and **Section 2.3.5, Appendix B,** and **Appendix D**).

1.2.3 Annual Review Requirements

An Annual Review for Tahmoor Mine operations during the previous calendar year is required in accordance with Condition E13 (SSD 8445) and Condition 45 of DA 67/98, and is submitted by 31 March annually to Department of Planning and Environment and other stakeholders, as well as upload to the Tahmoor Coal Website. This Six-Monthly Subsidence Impact Report assists with the completion of the 2022 Annual Review, and will be provided as an appendix to the Annual Review.

1.3 Scope

1.3.1 Reporting Period

This report is the seventh six-monthly report to be submitted since the commencement of extraction of LW W1, in accordance with the requirements of the LW W1-W2 Extraction Plan and LW W3-W4 Extraction Plan.

The reporting period of this report is from 1 January 2022 to 31 December 2022 (full calendar year for 2022). This report includes data previously reported in the fifth six-monthly report (reporting period 1 October 2021 to 15 May 2022) and the sixth six-monthly report (reporting period 25 March 2022 to 18 November 2022). The compilation of a full calendar year of monitoring data has been completed in this report to assist with the Annual Review of all operations at Tahmoor Mine for the full calendar year.

This reporting period covers subsidence impacts observed during and after the extraction of LW W3 and LW W4.

Table 1-2 summarises the monitoring and reporting completed during the reporting period, as well as the timeframe of data reviewed for each monitoring component.

1.3.2 LW W3-W4 Study Area

The Extraction Plan Study Area for LW W3-W4 is defined as the surface area that is likely to be affected by the extraction of LW W3-W4 from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (mm) subsidence contour resulting from the extraction of LW W3-W4; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW W3-W4.

The Study Area is illustrated in **Figure 1-2**.

1.3.3 LW W3-W4 Extraction Plan Context

The LW W3-W4 Extraction Plan is part of the Tahmoor Coal Environmental Management Structure, which is illustrated in **Figure 1-3**.

As part of the LW W3-W4 Extraction Plan, a set of management plans was prepared to manage particular environment or built features with the LW W3-W4 Study Area, which consisted of the following:

- Water Management Plan;
- Land Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Stonequarry Creek Rockbar Management Plan;
- Built Features Management Plan, with a number of sub-plans to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction; and
- Public Safety Management Plan.

The overall framework for subsidence monitoring and management of impacts of the LW W3-W4 Extraction Plan is provided in the relevant Subsidence Monitoring Programs. Monitoring of environmental and built features has been completed by Tahmoor Coal in accordance with management plans listed above.

It is noted that the management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan.

Monitoring of features from the LW W1-W2 Extraction Plan as part of post-mining monitoring has been either completed or incorporated into the LW W3-W4 Subsidence Monitoring Programs, with the exception of post-mining monitoring of cliffs and rock outcrops in the LW W1-W2 Study Area.

Subsidence monitoring results and any impacts for the Tahmoor South Domain will be reported separately to that of the Western Domain.

Table 1-2 Monitoring and Reports Reviewed for this Reporting Period

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Subsidence Monitoring Program	Subsidence	General subsidence	• SMEC • Building Inspection Service • Comms Network Solutions	• Mine Subsidence Engineering Consultants (MSEC)	• Weekly reports during mining • LW W3 and LW W4 end of panel reports	Appendix A (referenced reports only)
Water Management Plan	Surface Water	Stonequarry Creek flow	• WaterNSW	• ATC Williams	• 6-Monthly report for 1 October 2021 to 24 March 2022 • 6-Monthly report for 25 March 2022 to 7 September 2022 • Quarterly report for 1 September 2022 to 31 December 2022.	Appendix B
		Pool water level	• ALS			
		Stream water quality				
		Flooding	• SMEC	• WRM	• One report following completion of LW W4	Available on request
		Natural drainage behaviour	• Brienan Environment and Safety	• Brienan Environment and Safety	• Monthly reports during mining • Post-mining reports for October and November 2022 monitoring (monitoring required on a 3-monthly basis during the post-mining period)	Appendix C (referenced reports only)
	Groundwater	Groundwater quality	• GeoTerra • CES	• SLR	• 6-Monthly report for 1 November 2021 to 31 March 2022 • 6-Monthly report for 1 April 2022 to 30 September 2022 • Quarterly report for 1 October to 31 December 2022.	Appendix D
		Groundwater bore level	• GeoTerra • CES			
		Shallow groundwater pressures				
		Deep groundwater pressures	• Groundwater Exploration Services • SLR • CES			
		Groundwater Inflow	• Tahmoor Coal			

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Land Management Plan	Landscape	Cliff lines Steep Slopes Surface cracking (excluding railway corridor) Dams	• Douglas Partners	• Douglas Partners	• Monthly reports for all geotechnical features during mining • Fortnightly reports for selected dams during mining (as required) • Post-mining reports for October and December 2022 (monitoring required on a 3-monthly basis during post-mining period)	Available on request
		Dams	• Bloor Rail • Newcastle Geotechnical	• MSEC • Bloor Rail • Newcastle Geotechnical	• Picton-Mittagong Loop Line (PMLL) Weekly Detailed Reports during mining	Available on request
		Dams	• Building Inspection Service (BIS)	• BIS	• Weekly dam inspection reports during mining	Available on request
	Agricultural Land	Agricultural Land	• BIS	• BIS	• Monthly reporting during mining • One post-mining report for December 2022 (monitoring required on a 3-monthly basis during post-mining period)	Available on request
Biodiversity Management Plan	Aquatic Ecology	Macroinvertebrates	• Niche	• Niche	• Aquatic Ecology Monitoring Reports for Autumn 2022 (March 2022) and Spring 2022 (September 2022)	Available on request
	Terrestrial Ecology	Amphibians Riparian Vegetation	• Niche	• Niche	• Terrestrial Ecology Monitoring Reports for Autumn 2022 (March 2022) and Spring 2022 (September 2022)	Available on request
Heritage Management Plan and Stonequarry Creek Rockbar Management Plan	Aboriginal heritage	Grinding Grooves	• SMEC	• MSEC	• Weekly reports during mining • LW W3 and LW W4 end of panel reports • One post-mining report following completion of LW W4	Appendix A (referenced reports only)
			• EMM Consulting	• EMM Consulting	• LW W3 and LW W4 end of panel reports for Aboriginal heritage	Available on request

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Heritage Management Plan and Stonequarry Creek Rockbar Management Plan	Aboriginal heritage	SR17 Rockbar	• SMEC • Michael Nicholson Consulting • PSM	• MSEC	• Weekly and Monthly Stonequarry Creek Rockbar reports during mining of LW W3 and LW W4	Appendix F (referenced reports only)
	Historical heritage	Railway culverts	• Newcastle Geotechnical	• Newcastle Geotechnical	• Picton-Mittagong Loop Line (PMLL) Weekly Detailed Reports during mining to 2 November 2022	Available on request
			• EMM Consulting	• EMM Consulting	• LW W3 end of panel report for historical heritage • LW W4 end of panel reports for railway culverts and Weatherboard House	Appendix E (referenced reports only)
Built Features Management Plan	Built Features	Electricity Infrastructure	• SMEC • BIS • Comms Network Solutions •	• MSEC	• Weekly reports during mining • LW W3 and LW W4 end of panel reports	Appendix A (referenced reports only)
		Gas Infrastructure				
		Potable Water				
		Sewerage Infrastructure				
		Telecommunications				
		Local roads, bridges and culverts				
		Built Structures				
		Picton-Mittagong Loop Line	• Southern rail Services • Bloor Rail	• MSEC	• PMLL Weekly Status Reports during mining • Weekly post-mining reports following completion of LW W4 till 2 November 2022	Available on request

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Built Features Management Plan	Built Features	Transport for NSW (TfNSW) Infrastructure	• SMEC • Southern Rail Services • BIS	• MSEC	• Weekly Victoria Street Status Reports during mining and post-mining. Victoria Bridge Status Reports have been continued well beyond the extraction of LW4 due to a large rock mass movement towards the Stonequarry Creek incised valley. The rock mass anomalous movement was first observed in the mining of LW32 where relative survey ground movement vectors showed the ground moving towards the incised creek valley and away from the goaf. The rock mass only started to be seen at Victoria Bridge on the extraction of LW W3 and LW W4. Survey monitoring and status reports will continue to be provided on a monthly basis.	Available on request
		Main Southern Railway (MSR)	• SMEC • Southern rail Services • Bloor Rail • BIS • Comms Network Solutions • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction • Monthly MSR Status Reports during post-mining of LW W4	Appendix G (referenced reports only)

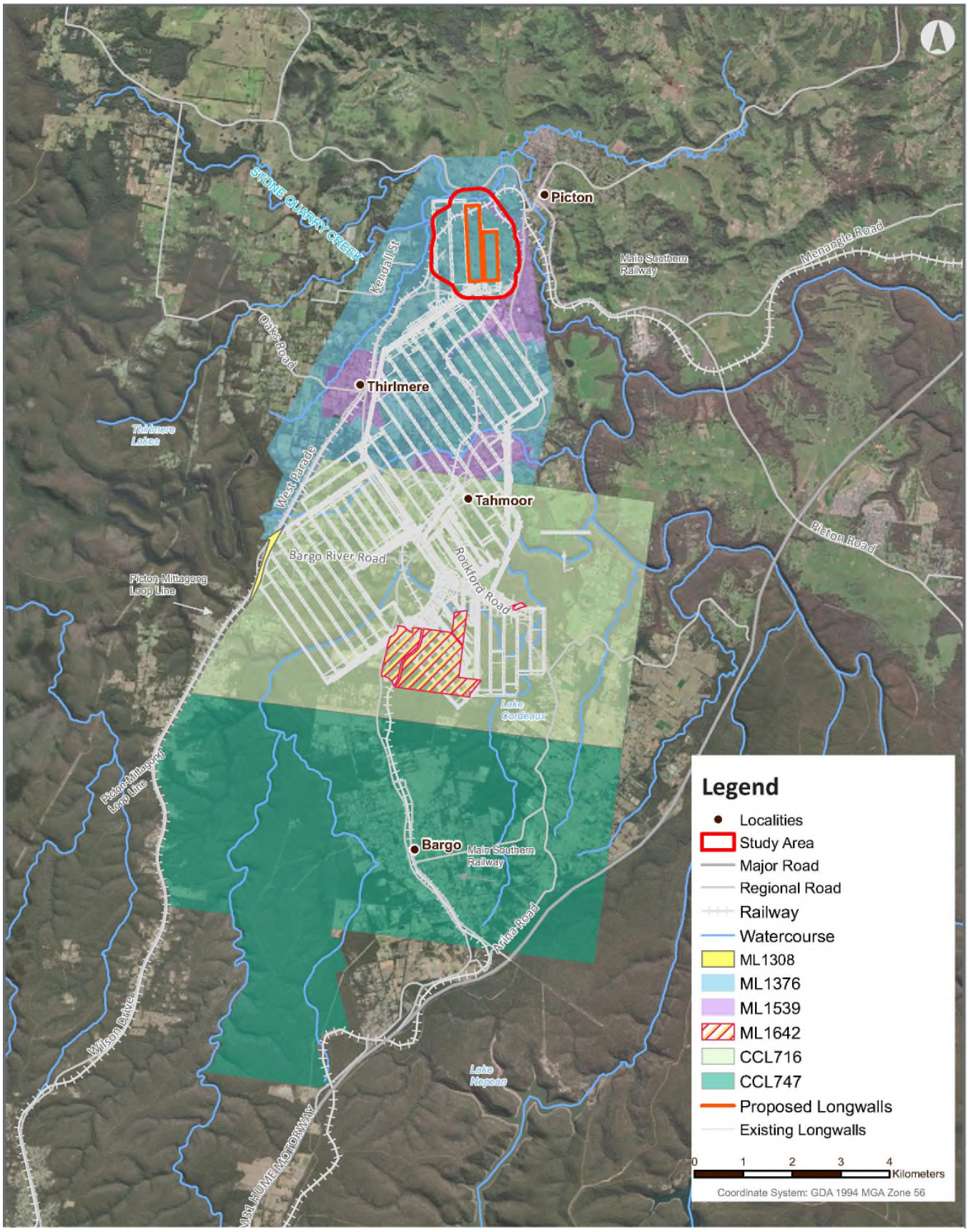


Figure 1-1 *Tahmoor Mine Area and Tenure (source: LW W3-W4 Extraction Plan)*

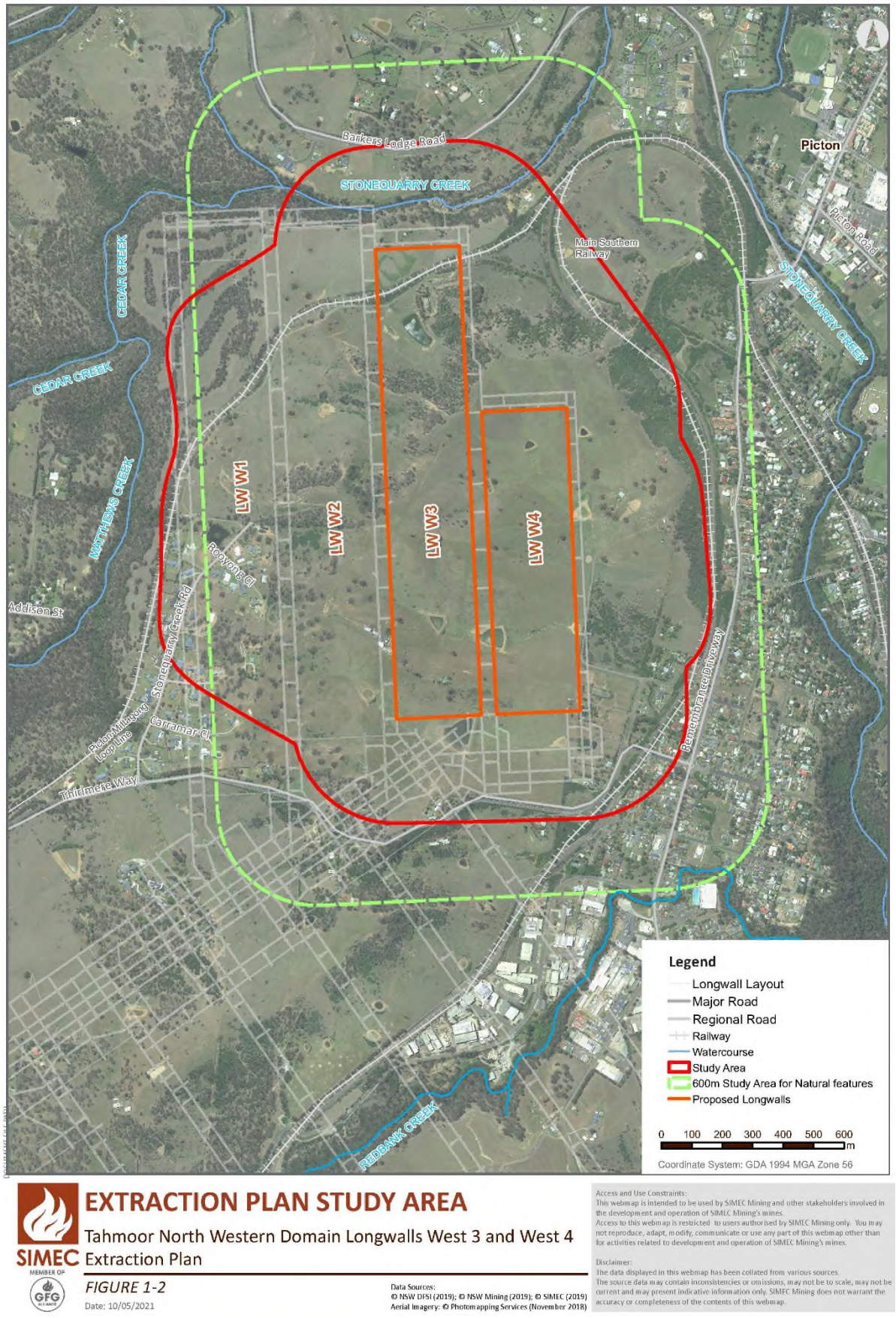


Figure 1-2 LW W3-W4 Extraction Plan Study Area (source: LW W3-W4 Extraction Plan)

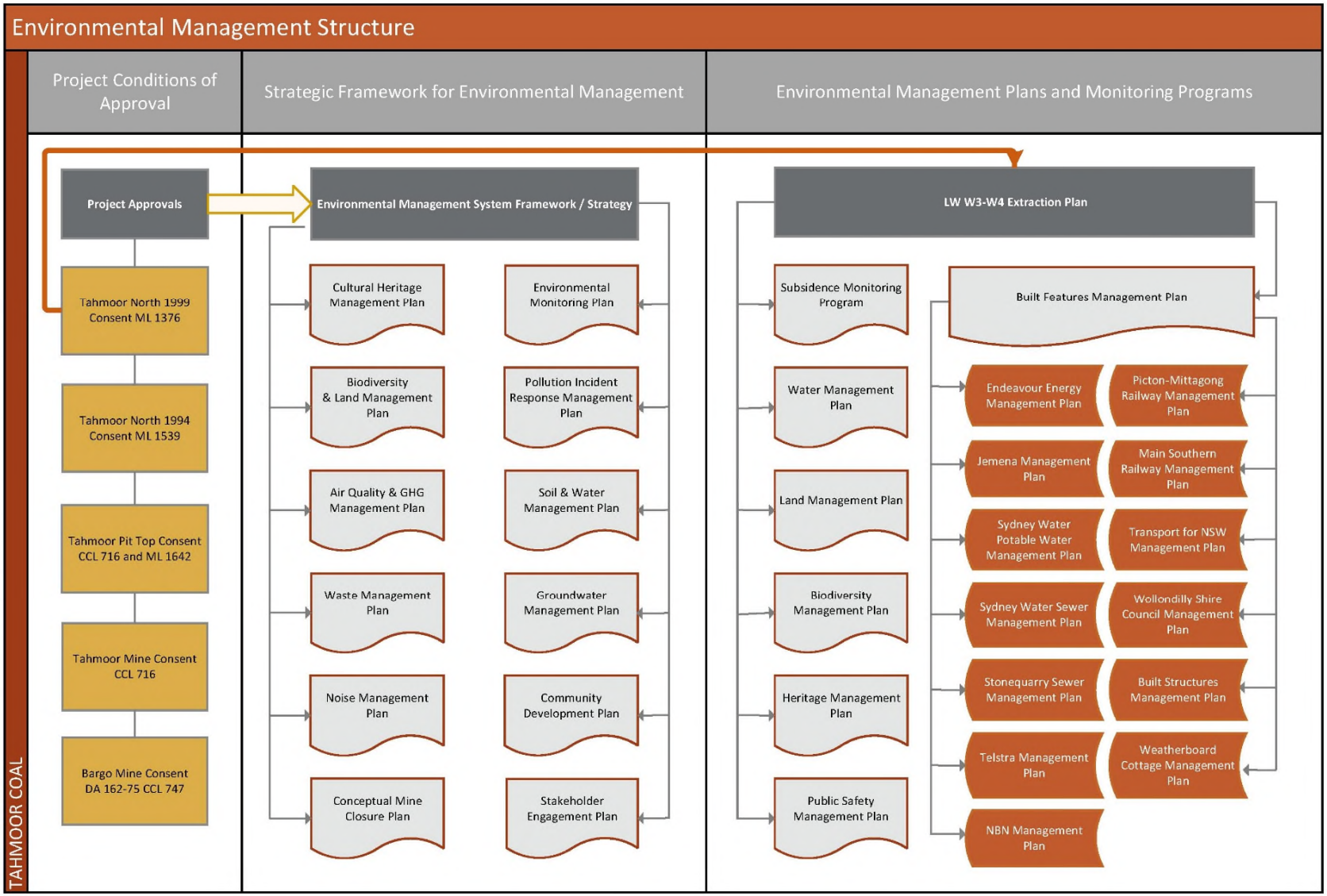


Figure 1-3 Overview of Environmental Management Structure for Tahmoor Coal (source: LW W3-W4 Extraction Plan)

2 Summary of Environmental Monitoring Results

2.1 Subsidence Monitoring

During the reporting period, the LW W3-W4 Subsidence Monitoring Program have been implemented to monitor subsidence impacts within the Study Area. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-4**. The Subsidence Monitoring Program includes eighteen (18) Global Navigation Satellite System (GNSS) units measuring absolute horizontal and vertical positions in real time installed directly above and adjacent to LW W3-W4.

A summary of all surveys and inspections completed during the reporting period is provided in MSEC1204 LW W3 Subsidence Monitoring Report 27 and MSEC1263 LW W4 Subsidence Monitoring Report 20 (refer **Appendix A**). A weekly review of the subsidence survey results was completed by Tahmoor Coal and MSEC during the extraction period.

Longwall West 3 (LW W3) commenced on 13 September 2021 and was completed on 21 March 2022. Longwall West 4 (LW W4) extraction commenced on 16 May 2022 was completed on 13 September 2022.

Table 2-1 summarises the maximum observed ground movements within the active subsidence zone at the start and end of this reporting period. During the reporting period, a maximum of 897 mm of vertical subsidence relating to the extraction of LW W4 was recorded along the LW W1-W4 crossline survey. Very minor subsidence movements have been observed during the post-mining period of LW W4.

Table 2-1 Subsidence Monitoring Observations at the end of LW W3 and LW W4 during this Reporting Period (source: MSEC reports included in Appendix A)

	Report 27 (MSEC1204) for LW W3		Report 20 (MSEC1263) for LW W4	
Monitoring Period	30/03/2022 – 15/05/2022		16/05/2022 – 18/11/2022	
Progress of extraction	LW W3 completed		LW W4 completed	
Observed Ground Movement Parameters	**Maximum Observed Total**	**Location**	**Maximum Observed Total**	**Location**
Subsidence (mm)	857	LW W1-W3 Crossline	897	LW W1-W4 Crossline
Tilt (mm/m)	3.8	Stonequarry Creek Road	9.8	LW W1-W4 Crossline
Hogging Curvature (km^{-1})	0.22	PMLL	0.35	LW W1-W4 Crossline
Sagging Curvature (km^{-1})	-0.29	LW W1-W3 Crossline	-0.33	LW W3 Centreline
Tensile Strain (mm/m)	1.4	PMLL	1.3	LW W2 Centreline
Compressive Strain (mm/m)	-5.0	PMLL	-5.6	LW W4 Centreline

2.1.1 Ground Survey Results

2.1.1.1 Longwalls West 3 Mining

The development of subsidence at pegs and GNSS units located on the LW W3 centreline that have been mined directly beneath by LW W3 are illustrated in **Figure 2-1**. This figure shows that subsidence observed along the centreline of LW W3, as well as that observed at GNSS Site 23 and 87.760 km on the Picton Mittagong Loop Line, was less than predicted.

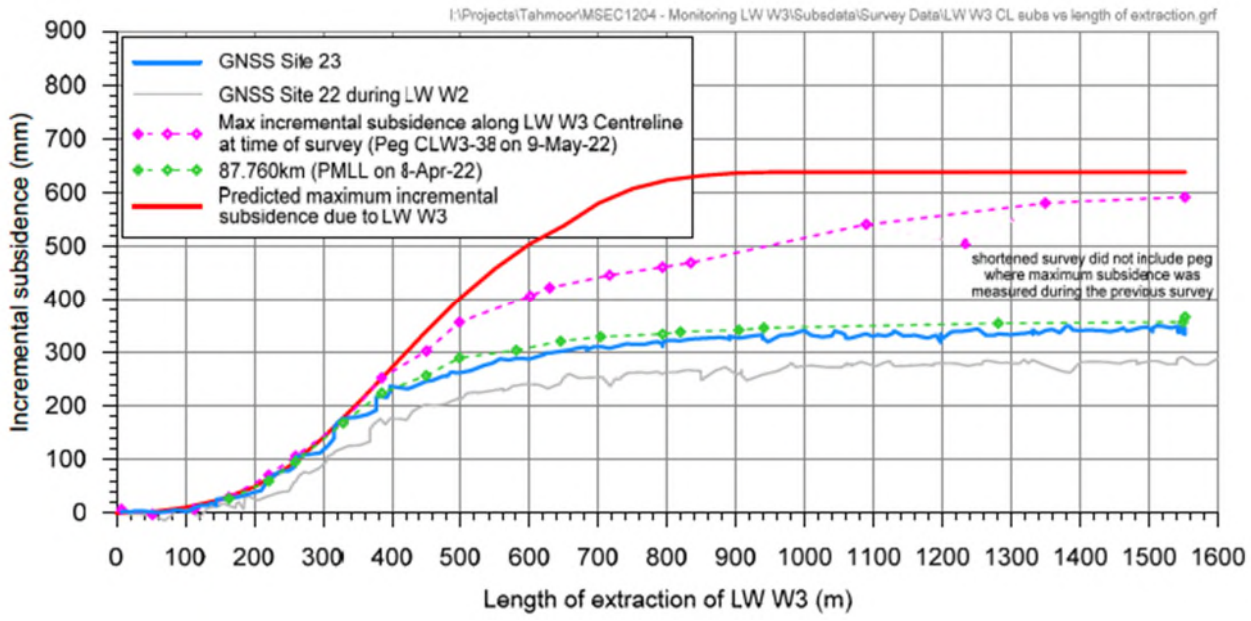


Figure 2-1 Development of subsidence along centreline of LW W3 (source: MSEC, Subsidence Monitoring Report 27, Appendix A)

Regular surveys were conducted along the Picton Mittagong Loop Line during the mining of LW W3. Compressive strains were noted above the centreline of LW W3 and across the creek crossing, however visual inspections did not identify any issues associated with mine subsidence.

Regular surveys were conducted along the Main Southern Railway during the mining of LW W3. All results were within survey tolerance during mining, and visual inspections did not identify any issues associated with mine subsidence.

Regular surveys were conducted at the Victoria Bridge over Stonequarry Creek during the mining of LW W3. Very small and gradual closure was observed across Stonequarry Creek. Visual inspections did not identify any impacts associated with mine subsidence but the gap between the deck and the eastern abutment was observed to almost close.

A comparison between assessed and observed impacts to surface features is summarised in Table 3 of the MSEC Subsidence Monitoring Report 27 (refer to **Appendix A**).

2.1.1.2 Longwall West 4 Mining

The development of subsidence at pegs and GNSS units located on the LW W4 centreline that have been mined directly beneath by LW W4 are illustrated in **Figure 2-2**. Observed subsidence exceeded predicted subsidence above the northern portion of LW W4, however returned to within predictions above the southern portion of LW W4. The subsidence observations above the northern portion of LW W4 is similar to previously observed increased subsidence above LWs 24A to 28 and LW 32, which were influenced by the Nepean Fault. The Nepean Fault is also located close to LW W4, and the potential for increased subsidence was raised in the subsidence prediction report for LW W3-W4 Extraction Plan.

GNSS unit 24 has experienced greater subsidence than predicted and greater subsidence than was previously experienced at equivalent locations during the mining of LW W2 and LW W3.

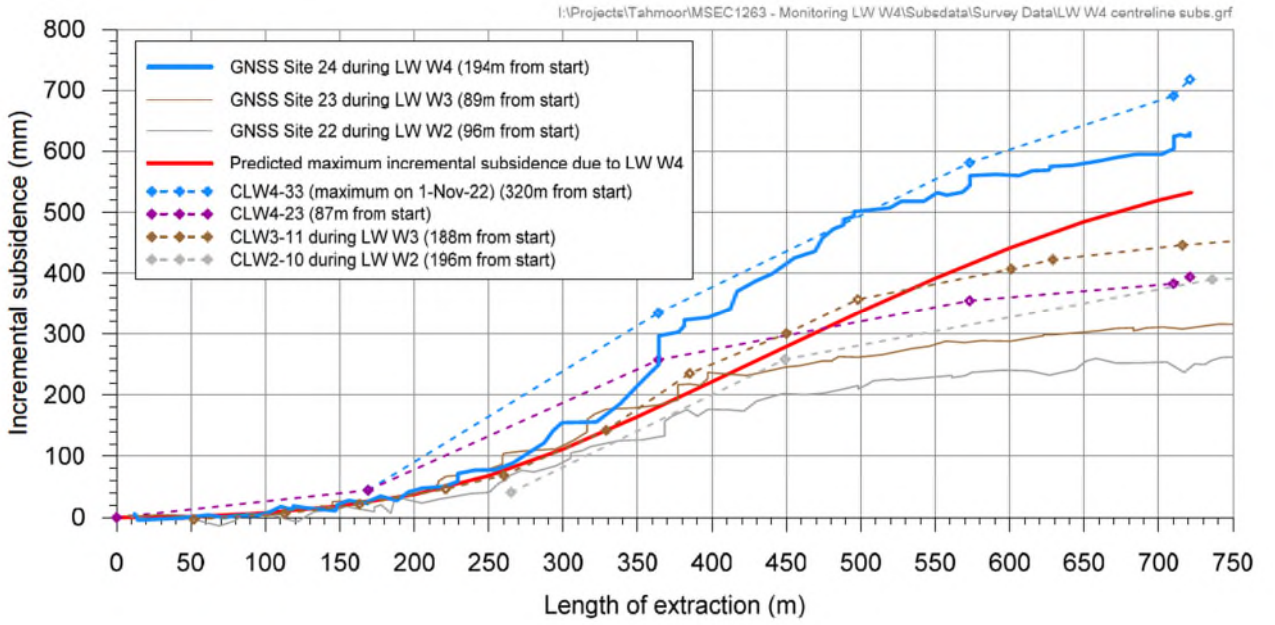


Figure 2-2 Development of subsidence along centreline of LW W4 (source: MSEC, Subsidence Monitoring Report 20, Appendix A)

Regular surveys were conducted along the Picton Mittagong Loop Line during the mining of LW W4, until the end of panel survey completed on 27 October 2022. Visual inspections did not identify any issues associated with mine subsidence.

Regular surveys were conducted along the Main Southern Railway during the mining of LW W4. All results were within survey tolerance during mining, and visual inspections did not identify any issues associated with mine subsidence.

Regular surveys were conducted at the Victoria Bridge over Stonequarry Creek during the mining of LW W4. Very small and gradual closure was observed across Stonequarry Creek. Visual inspections did not identify any impacts associated with mine subsidence but the gap between the deck and the eastern abutment was observed to almost close during the mining of LW W3. The buffer board was replaced on 7 June 2022 and the gap reinstated. A gap of 35 mm was measured between the structural cross beam and abutment on 10 June. The gap has gradually reduced over time to 19 mm. Rates of change showed a reduction throughout the remainder of and after LW W4 mining completion.

A comparison between assessed and observed impacts to surface features is summarised in Table 3 of the MSEC Subsidence Monitoring Report 20 (refer to **Appendix A**).

2.1.2 GNSS Monitoring Observations

Some trends can be seen in the results of the observed GNSS movements with the closest GNSS units generally moving towards the extracted panel as expected. Results from all GNSS units, including incremental horizontal movements, are presented in the MSEC Subsidence Monitoring Reports (refer **Appendix A**).

Changes in horizontal distances between GNSS units stationed near each other and on opposite sides of a waterway as a result of the extraction of LW W1-W4 are shown in **Figure 2-3**. During LW W4 extraction, only minor changes have been observed between the GNSS units.

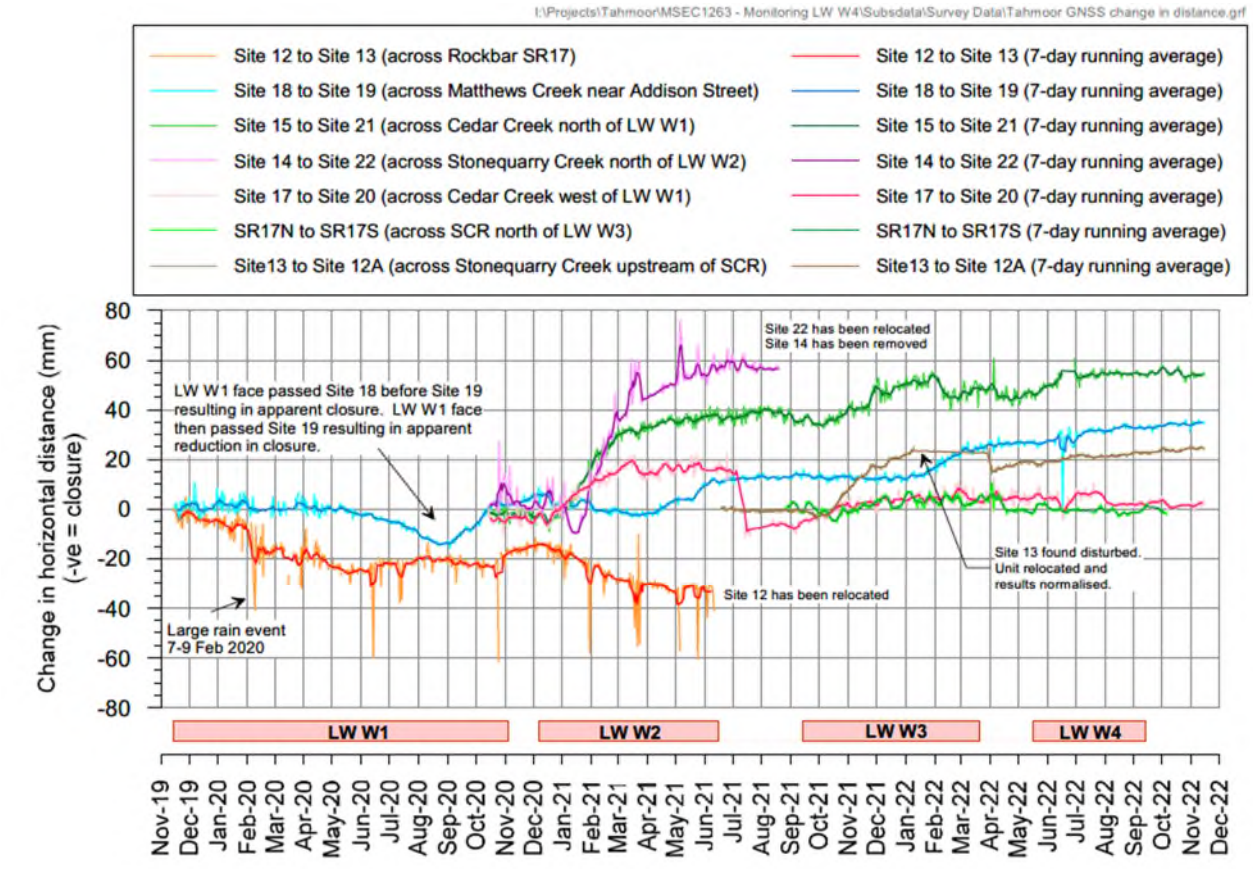


Figure 2-3 Observed changes in horizontal distances between GNSS units during LW W1-W4 extraction (source: MSEC, Subsidence Monitoring Report 20, Appendix A).

2.1.3 Valley Closure in Creeks

Survey marks installed across rockbars in Stonequarry Creek, Cedar Creek and Matthews Creek are illustrated in **Figure 2-4**.

During the extraction of LW W3, valley closure was measured to develop across Stonequarry Creek at SQ104 and SQ105, which are located near the confluence of Stonequarry Creek and Cedar Creek. Minor closure was developing across SQ104, SQ105, SQ106 and SQ107 up to 3 November 2021. The survey pegs for SQ101 to SQ109 were removed following the survey on 3 November, as requested by the landowner.

Survey completed at the end of LW W3 noted small changes in horizontal distances were observed both along and across the rockbar. Minor ground shortening was observed in the southeast corner of the rockbar, which is captured by measurements at Marks RBE11, RBF05 and RBF06. Survey completed at the end of LW W4 noted minor changes in horizontal distances both along and across Rockbar SR17. Minor ground shortening was also observed in the south-east corner of the rockbar.

Very little change in closure along Cedar Creek and Matthews Creek was observed during the mining of LW W3 and W4. The most recent survey was on 21 November 2022 for Cedar Creek and 28 November 2022 for Matthews Creek, with minor changes observed.

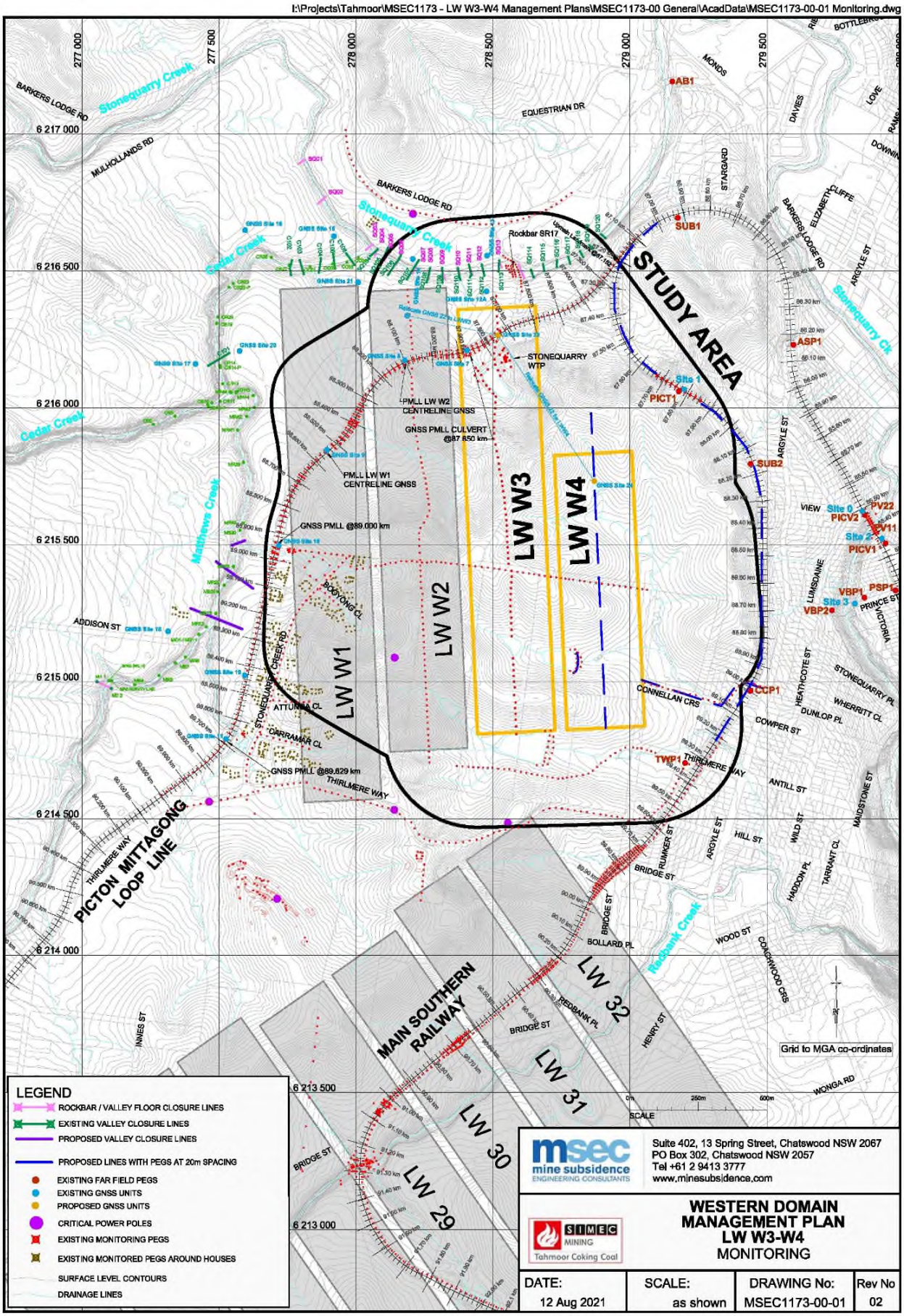


Figure 2-4 LW W3-W4 Subsidence Monitoring Program (source: LW W3-W4 Subsidence Monitoring Program)

2.2 Surface Water Monitoring

The LW W3-W4 Water Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on surface water in accordance with Condition 13H(vii)(c) of DA 67/98.

During this reporting period, the LW W3-W4 Water Management Plan have been implemented to monitor surface water:

- Flow, pool water level and surface water quality monitored for Stonequarry Creek, Cedar Creek and Matthews Creek – monthly monitoring data reviewed and reported by ATC Williams on a monthly (during mining and post-mining) basis (refer to **Appendix B**);
- Creek monitoring for natural drainage behaviour – visual inspections and reporting by Brienan Environment and Safety completed on a monthly (during mining) and quarterly (post-mining) frequency (refer to **Appendix C** for references report);

The following sections summarise the observations made during the reporting period for each surface water category. Performance against all Surface Water Management Plan TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2**.

2.2.1 Stonequarry Creek Flow

The assessment of downstream reduction in catchment flow rate recorded at the WaterNSW gauging station Stonequarry Creek at Picton (GS212053) relies on a calibrated streamflow model which enabled comparison of modelled and monitored streamflow rates. The locations of GS212053 is illustrated in **Figure 2-5**.

The rating curve for Stonequarry Creek at Picton (GS212053) was revised by WaterNSW in July and November 2020 and, as such, the streamflow records for the site have changed thereby invalidating the previous model calibration. Despite attempts to recalibrate the streamflow model, challenges were encountered due to the limitations of the gauging station at Stonequarry Creek at Picton (GS212053), the limitations of catchment rainfall records, water extraction from Stonequarry Creek catchment and the inability to adequately match the monitored and modelled flows. As such, the assessment method, and subsequently assessment of trigger exceedances in relation to catchment flow rate in Stonequarry Creek at Picton, have been discontinued.

2.2.2 Pool Water Level

Surface water level data has been recorded at the pool monitoring sites on Matthews Creek, Cedar Creek and Stonequarry Creek as shown in **Figure 2-5**. Continuous surface water level data has been recorded at three pool monitoring sites on Matthews Creek, seven monitoring sites on Cedar Creek and five monitoring sites on Stonequarry Creek. Manual water level measurements have also been undertaken monthly at the sites shown in **Figure 2-5**.

With the exception of monitoring site CB (discussed further below), water levels at monitoring sites on Matthews Creek, Stonequarry Creek, and Cedar Creek remained above minimum baseline levels and/or were consistent with baseline conditions during the reporting period.

Charts illustrating monitored pool water level hydrographs for pools on Matthews Creek, Cedar Creek and Stonequarry Creek are presented in the Surface Water Monitoring Reports (refer to **Appendix B**).

2.2.2.1 Monitoring Site CB (Pool CR14)

A Level 4 TARP significance was originally triggered in relation to surface water level decline for the period 19 to 29 January 2021 at monitoring site CB (pool CR14) in Cedar Creek. It is likely that mining induced subsidence had mobilised existing fractures resulting in changes in the water level recession rate of this site. In addition, it was likely that mining induced groundwater drawdown had resulted in the surface water system in the vicinity of pool CR14 transitioning from a gaining stream (baseflow discharge from the groundwater stream to the stream) to a weakly gaining or losing stream (surface water recharge to the groundwater system) (refer **Appendix B**).

From 9 to 30 December 2022, the water level recorded at monitoring site CB (pool CR14) declined below the baseline minimum by a maximum of 0.46 m. Similar water level decline was recorded at a number of monitoring sites during this period, although the water level did not decline below the baseline minimum at other water monitoring sites. The water level decline at monitoring site CB had negligible influence on the water level of downstream monitoring sites during the monitoring periods.

Groundwater levels recorded at groundwater monitoring site P40 (A, B, C and D) were recorded above the creek bed elevation from 9 to 30 December 2022. The decline in water level at monitoring site CB (pool CR14) from 9 to 30 December 2022 suggests that, although gaining conditions were prevailing in the vicinity of monitoring site CB, it is likely that fractures in the base of pool CR14 or in the subsurface, resulted in losing conditions occurring at monitoring site CB during this period.

The observations at monitoring site CB triggered a Level 3 TARP trigger. This trigger, as well as the actions and responses completed and proposed, are discussed further in **Section 3.2.1**.

2.2.3 Natural Drainage Behaviour

Visual and photographic surveys for subsidence impacts on creeks have been completed monthly for all monitoring pools on Stonequarry Creek, Cedar Creek and Matthews Creek within the active subsidence zone of LW W3 and LW W4. The purpose of these surveys is to note whether change has occurred to pool level, drainage or overland flow, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify rock bar and/or stream base cracking, gas release, or increased iron precipitation.

Creek monitoring locations are illustrated on **Figure 2-6**, and a summary of creek observations for the reporting period is provided below:

- Pool water level and overland connective flow was influenced by a major rainfall event that occurred from late February to early March 2022, as well as during May and July 2022. These rainfall events resulted in catchment base-flow recharge;
- Surficial fracturing of the controlling rockbar at Pool SR17 and a rockbar at Pool SR20 have been noted;
- There were no other surface fracturing or cracking noted in the waterways during the reporting period;
- No reduction in pool flow or connective overland flow was observed in the waterways during the reporting period;
- Some minor iron hydroxide precipitation was observed in Stonequarry Creek, Cedar Creek and Matthews Creek during the reporting period, however these levels did not exceed pre-Longwall West 1 baseline levels; and
- No gas release was noted in the waterways during the reporting period.

The surficial fracturing of the controlling rockbar at Pool SR17 was first noted following the visual inspection on 17 November 2021. The fractures occurred in thinly bedded, laminated sandstone and were likely in response to mining related differential compression in combination with the presence of existing delamination in the rockbar surface formed by natural weathering processes. This surficial fracturing is discussed further in **Section 3.2.2** and **Appendix C**.

The surficial fracturing of a rockbar at Pool SR20 was noted following the inspection on 18 August 2022. Two fractures were noted and it was confirmed that one crack was the development of an existing (pre-mining) joint / discontinuity, while the other was first observed during mining of LW W4. During the latest inspection on 15 November 2022, it was noted that both cracks appear to be getting wider. The new crack was noted to have an increase in maximum width from 6 mm (noted on 27 October 2022) to 21 mm (noted on 15 November 2022). The development of the existing joint / discontinuity was also noted to have increased in maximum width from 7 mm (noted ton 27 October 2022) to 14 mm (noted on 15 November 2022). This surficial fracturing is discussed further in **Section 3.2.2** and **Appendix C**.

2.2.4 Surface Water Quality

Surface water quality data has been recorded at the following sites (refer to **Figure 2-5**):

- Cedar Creek: Cedar US, CC1A, CA, CB, CD, CE, CG;
- Matthews Creek: ME, MB, MG; and
- Stonequarry Creek: SA, SB, SD, SE, SF.

Field analyses are undertaken for pH, electrical conductivity (EC), dissolved oxygen, temperature and oxidation reduction potential. Laboratory analyses are undertaken for pH, EC, TDS, alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium, fluoride, nitrate+nitrite, total kjeldahl nitrogen, phosphorus and the following total and dissolved metals: aluminium, arsenic, barium, copper, lead, lithium, manganese, nickel, selenium, strontium, zinc and iron.

A summary of observations for the reporting period is provided in **Table 2-2**. Charts illustrating water quality results for monitored pools on Matthews Creek, Cedar Creek and Stonequarry Creek are presented in Appendix C of the Surface Water Review reports (refer to **Appendix B**).

To date, there has been negligible evidence of an influence of mining LW W1-W4 on surface water quality in Matthews Creek, Cedar Creek or Stonequarry Creek. The water quality characteristics of monitoring sites following commencement of mining LW W1-W4 have been largely consistent with baseline conditions and/or consistent with reference site conditions.

Although isolated occurrences of elevated dissolved aluminium were recorded at some monitoring sites on Cedar Creek and Stonequarry Creek during the reporting period, these levels occurred during and following above average rainfall. Additionally, a historically high concentration of dissolved aluminium was recorded at reference sites during this period, indicating that the elevated dissolved aluminium concentrations were likely catchment wide and related to the prevailing climatic conditions.

The variability of pH at monitoring site SD during August and September 2022 was noted to be only slightly above/below the trigger levels. The pH values recorded at monitoring site SD for much of the reporting period follow a similar trend to the reference sites for the majority of the review period. It is likely that these two consecutive results are an anomaly or a result of field sampling issues including calibration of field instrumentation.

Further discussion of the elevated water quality occurrences and related TARP triggers is provided in **Section 3.2.3**.

Table 2-2 Summary of Notable Results for Key Water Quality Parameters for the Reporting Period

Parameter	Matthews Creek	Cedar Creek	Stonequarry Creek
pH	• Near neutral pH conditions. • Consistent with baseline values.	• Near neutral to slightly acidic pH conditions. • Generally higher pH values were recorded during the review period in comparison to the baseline period.	• Near neutral to slightly alkaline pH conditions for most sites. • Historically high pH values recorded at SD and SF in March and August 2022. • Historically high pH values recorded at SG in March 2022. • Historically low pH recorded at SD in September 2022. • The pH values recorded at all other monitoring sites were generally consistent with baseline values.
Electrical Conductivity	• Field EC values were consistent with baseline values.	• Field EC values are slightly below the historical range.	• Field EC values were consistent with or slightly less than baseline values.
Dissolved Aluminium	• Concentrations were elevated in January, March, April, August and October 2022 following periods of above average rainfall. • Concentrations were consistent with baseline values.	• Concentrations were elevated in January-April, July-August and October 2022 following periods of above average rainfall. • Historically high concentrations recorded in at reference site CCR in January and February, at all monitoring sites except CC1 and CB in March, at Cedar US in April, and at CCR, Cedar US and CF in July.	• Concentrations were elevated and variable for the majority of the review period. The elevated concentrations occurred following a period of above average rainfall. • Historically high concentrations were recorded at all monitoring sites except selected sites.
Dissolved Barium	• Concentrations generally stable over the review period and consistent with baseline values.	• Concentrations recorded over the duration of the review period were generally less than baseline values.	• Dissolved barium concentrations recorded over the duration of the review period were consistent with or less than baseline values.
Dissolved Iron	• Concentrations were slightly elevated for the review period, however were generally consistent with baseline values.	• Concentrations generally consistent over the review period and with baseline values.	• A slight decline in the dissolved iron concentration was recorded at all sites during the review period, however, values were generally consistent with baseline values.
Dissolved Manganese	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values.
Dissolved Nickel	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values with the exception of a historical elevated concentration recorded at Cedar US in August 2022.	• Concentrations recorded at all sites were consistent with or less than baseline values.

Parameter	Matthews Creek	Cedar Creek	Stonequarry Creek
Dissolved Zinc	• Concentrations recorded at all sites were consistent with or less than baseline values.	• Concentrations recorded at all sites were consistent with or less than baseline values with the exception of a historically elevated value recorded at Cedar US in August 2022.	• Concentrations recorded at all sites were consistent with or less than baseline values.
Sulphate	• Concentrations recorded at all sites were generally consistent with baseline values.	• Concentrations recorded at all sites were generally consistent with baseline values.	• A decreasing trend in sulphate concentrations was recorded at all sites over the duration of the reporting period. • Concentrations recorded at all sites were generally consistent with baseline values.

2.2.5 Flooding

Following the completion of mining in the Western Domain, a post-mining flood study was completed to assess the potential impacts of subsidence on flooding in Matthews Creek, Cedar Creek and Stonequarry Creek. This assessment was completed to fulfil the requirements of Condition 7 of DA 67/98, which requires that mining does not result in the subsidence of any habitable floors to below the 1 in 100 year flood level (1% annual exceedance probability [AEP] flood level).

The report (WRM, 2022) concluded that flooding is confined to the Matthews Creek system (which includes Matthews Creek, Cedar Creek and Stonequarry Creek), and subsidence has not resulted in any habitable floor areas to fall below the 1 in 100 year flood level.

2.2.6 Recommendations and Actions

2.2.6.1 Current Surface Water Monitoring Recommendations

As discussed in the Surface Water Review for September to December 2022 (**Appendix B**), ATC Williams recommended that re-calibration of field instrumentation be completed due to intermittent records of potentially erroneous field pH values. Progress of this recommendation will be provided in the next quarterly surface water and groundwater monitoring report for the Western Domain.

2.2.6.2 Previous Surface Water Monitoring Recommendations

Table 2-3 provides the recommendations as made in the previous Surface Water Review for March to September 2022, along with an update on the progress of these recommendations.

Table 2-3 Surface Water Monitoring Recommendations from the previous Surface Water Review and Current Progress

Item	Previous Recommendation	Progress of Recommendation
1	Monitoring site CCR: This site is recommended for decommissioning as the reference bolt has not been located and as such the raw data recorded from 8 December 2021 has not been able to be converted to a water level measurements. In addition, this site is influenced by backwater effects from the downstream weir. Cedar US is considered more of a representative reference site for Cedar Creek;	Monitoring site CCR was decommissioned in October 2022.

Item	Previous Recommendation	Progress of Recommendation
2	Monitoring site CCR: This site is recommended for decommissioning as the flow control at this site, comprised predominantly of sand and rubble, was washed away in recent flood events and is therefore no longer a suitable monitoring site for water level measurements. Two alternative representative reference sites are located on Stonequarry Creek (sites SC1 and SE); and	Monitoring site SG was decommissioned in October 2022.
3	Re-calibration of field instrumentation has been recommended due to questionable pH results in the field.	Re-calibration of field instrumentation was completed as requested by field personnel.

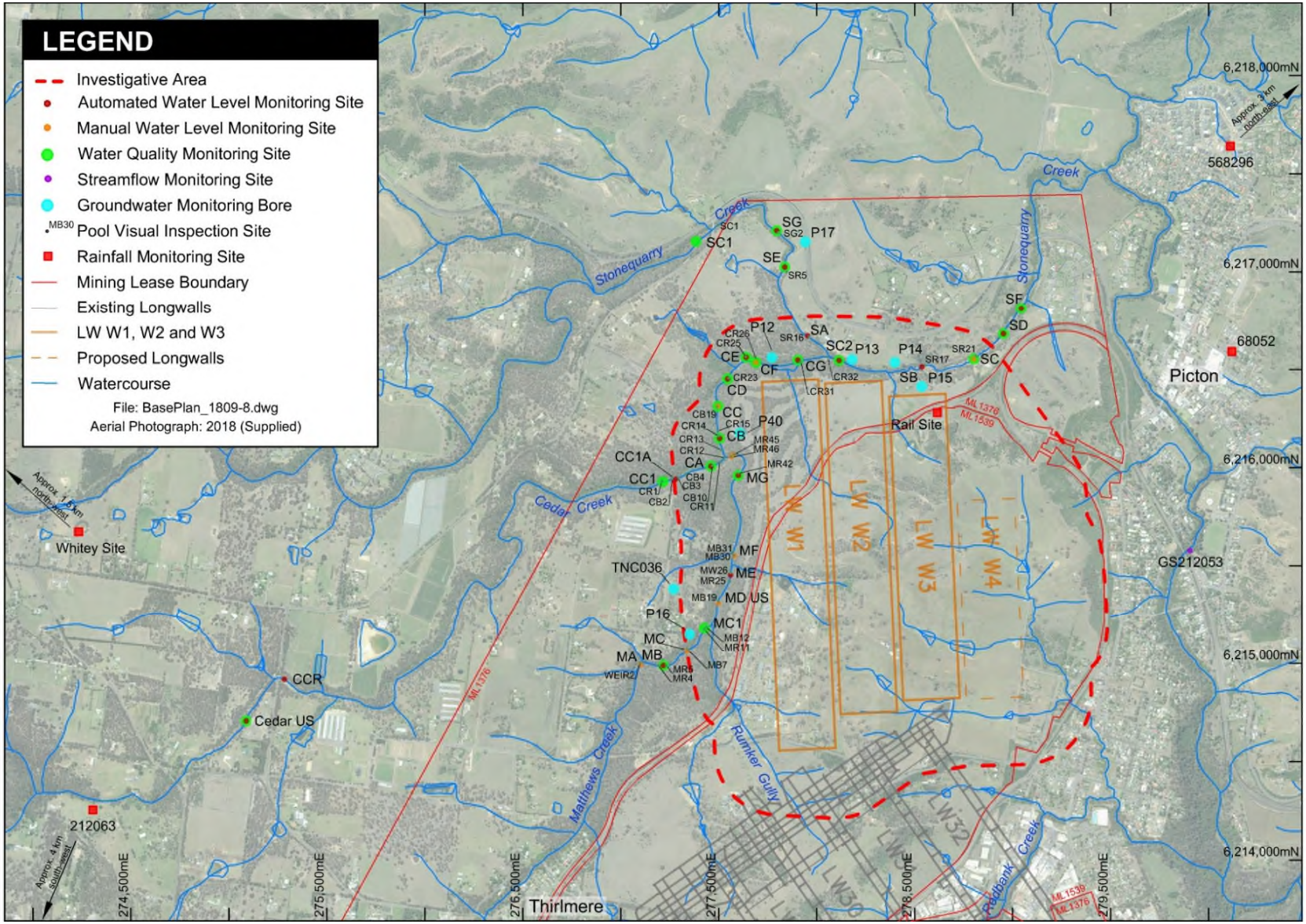


Figure 2-5 *LW W3-W4 Surface Water Monitoring Locations (source: ATC Williams, Surface Water Reviews, Appendix B)*

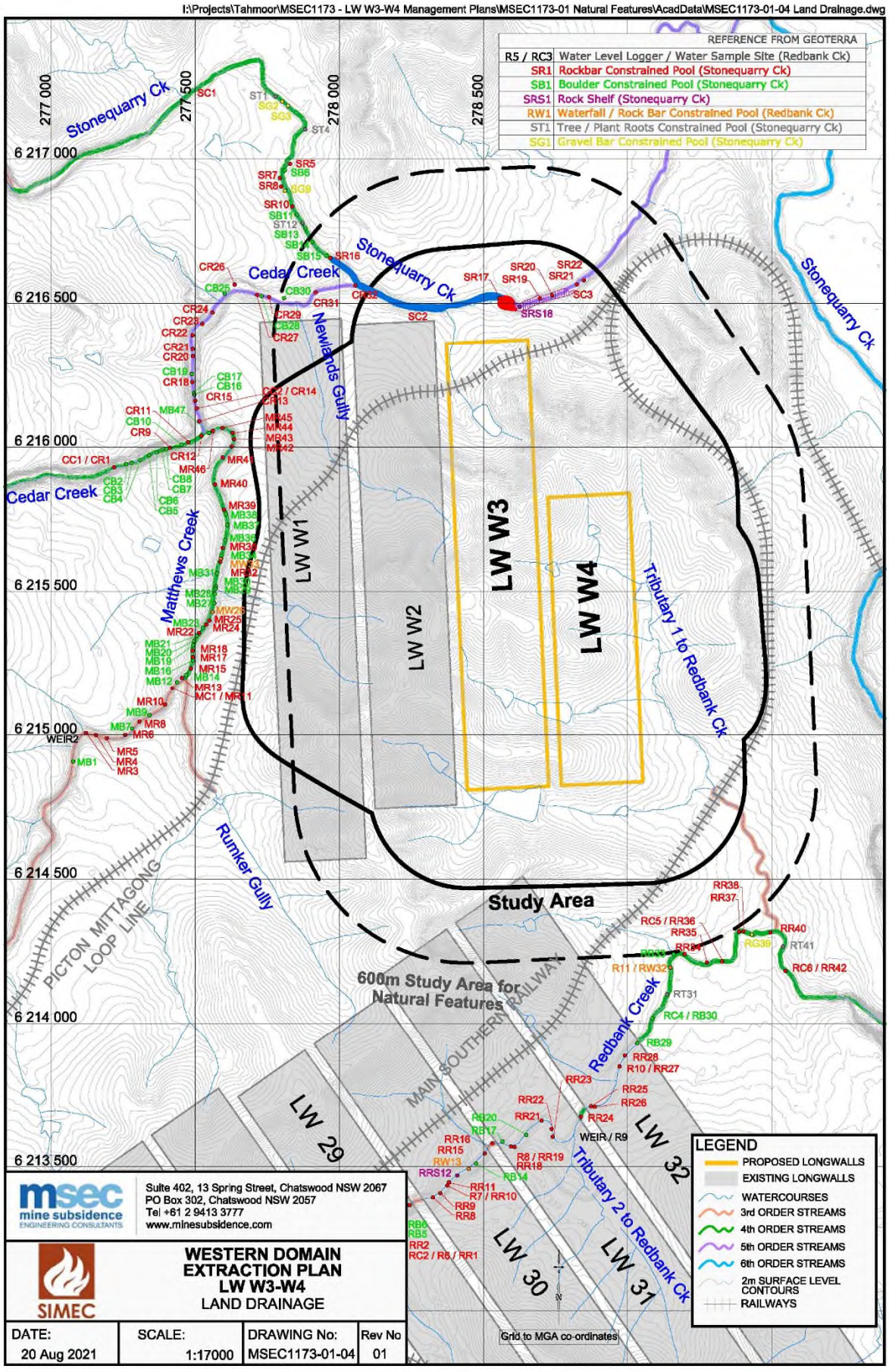


Figure 2-6 LW W3-W4 Creek Monitoring Locations (source: MSEC, 2021; LW W3-W4 Subsidence Predictions and Impact Assessment Report)

2.3 Groundwater Monitoring

The LW W3-W4 Water Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on groundwater in accordance with Condition 13H(vii)(c) of DA 67/98.

During this reporting period, the LW W3-W4 Water Management Plan have been implemented to monitor groundwater:

- Shallow groundwater levels, quality and pressures, and deep groundwater levels / pressures – monthly monitoring data reviewed and reported by SLR on a monthly (during mining) and quarterly (post-mining) basis (refer to **Appendix D**); and
- Mine water intake – data for this reporting period reviewed and reported by SLR (refer to **Appendix D**).

The following sections summarise the observations made during the reporting period for each groundwater category. Performance against all Groundwater Management Plan TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.3.1 Groundwater Bore Levels

A total of 17 open standpipe piezometers (OSPs) have been installed at six locations in the Western Domain – P12 to P17, and a number of private groundwater bores form part of the groundwater monitoring program for LW W3-W4. It is noted that Tahmoor Coal no longer has access to piezometers P13 and P17 due to land access constraints. The locations of these groundwater bores are illustrated in **Figure 2-7**.

Further detail on the below groundwater level triggers, including graphs showing progressive groundwater levels, are provided in the SLR groundwater reports (refer to **Appendix D**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.4**.

2.3.1.1 Monitoring bores

At most monitoring sites, groundwater levels have clearly responded to the above average rainfall condition observed throughout December 2021 to April 2022 and early July 2022 (i.e. marked by significant flood events in the region). Potential mining effect in the range of 0.5 m to 3 m water level reduction were observed at some sites in the eastern and southern parts of the Western Domain during the extraction of LW W4.

Groundwater level at P12 is still recovering from a maximum groundwater depressurisation of 11m in February 2021 at P12C. As of December 2022, groundwater levels at sites P12 are within baseline level for P12A, 0.5m above baseline level for P12B, and mostly recovered to a level of 178.4 mAHD at P12C by December 2022.

To the north of LW W3-W4 (sites P14-P15), groundwater levels continued to respond to rainfalls although minor declines (less than 1m) were observed during the early part of LW W4 but could also be associated with lower rainfall in June 2022 and/or aquifer column being close to saturation. Groundwater levels at P14 and P15 sites remained above the creek bed elevation, suggested strengthening of baseflow conditions along Stonequarry Creek over the reporting period. Groundwater levels at P14A were observed at 1.2 m above baseline levels (at 169.9 mAHD) as of December 2022.

Groundwater levels at P16A remains with groundwater levels approximately 1m below baseline levels throughout the reporting period. A localised long-term impact on groundwater levels is to be considered at P16A. Deeper groundwater levels (P16B and P16C) at this site have also recovered more slowly than at other sites (e.g. P12, P13, P14). This long-term impact remains localised and is possibly related to its position near the centre of the long edge of LW W1. Additional groundwater monitoring data will inform whether post mining conditions (i.e. following valley closure) will allow groundwater to completely recover at P16 sites.

A minor decline was observed in the shallow Hawkesbury Sandstone at P40A, either a result of LW W4 and/or delayed post mining effect related to LW W1, W2, or LW W3. This is consistent with previous observations made regarding consistent and minor declines at P14-P15 during the extraction of LW W3. Although minor declines were observed at P40 during mining, groundwater levels at P40 demonstrated overall recovery. At the end of the reporting period, groundwater levels at P40A, B, C and D remained above the surveyed creek bed elevation at Cedar Creek which favour baseflow condition (i.e. gaining condition) in the vicinity of surface monitoring site CB.

2.3.1.2 Private bores

No groundwater depressurisation or reduction in yield was observed at the private bores with available groundwater levels across the Western Domain. Groundwater levels in the private bores (i.e. where available) generally responded to rainfall events. No effects on groundwater levels due to post-mining operations at LW W4 during the reporting period were identified.

2.3.2 Groundwater Pressures

Five VWP arrays have been installed at locations TNC36, TNC40, TNC43 and WD01 and P41 (refer to **Figure 2-7**). TNC043 was decommissioned due to terminated site access and has been removed from the TARP assessment from July 2022 onwards.

Further detail on the below groundwater level triggers, including graphs showing progressive groundwater levels, are provided in the SLR groundwater reports (refer to **Appendix D**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.5** and **Section 3.2.6**.

LW W3 and LW W4 extraction had no significant effects on shallow and deep groundwater across the Western Domain throughout the reporting period.

To the east of the Western Domain, no depressurisation was observed above and within the Lower Fault Zone at P41 which suggests the unlikely activation of the Nepean Fault during LW W4 (i.e. unlikely increase in hydraulic properties nor increased in aquifers connectivity). In addition, the lack of anomalous behaviour in the inflow hydrograph (i.e. no unexpected and sustained increase in inflow) suggests that the LW W3 and W4 have not interacted with the Nepean Fault Complex (or that the fault complex is not 'hydraulically charged' in this area).

A period of stable groundwater level was identified between October 2021 and February 2022 in the upper Hawkesbury Sandstone aquifer at TNC36 in the three upper instruments HBSS-65m, HBSS-97m and BGSS-169m. From February 2022, groundwater recovery in the Hawkesbury Sandstone aquifer improved at TNC036 in the three upper instruments HBSS-65m, HBSS-97m and BGSS-169m. The rate of recovery accelerated in late February 2022 at all monitoring sites due to the completion of LW W3, and the exceptional wetter condition in February-March 2022. Groundwater level at TNC036 HBSS-97m and HBSS-169m had recovered to 188.3 mAHD and 181.8 mAHD at the end of the reporting period, respectively.

Deeper strata at TNC036 (BGSS-214m) showed depressurisation as of September 2022 with an ongoing clear depressurisation in BGSS-412m (i.e. due to Tahmoor Mine and possibly to other regional mining), as expected for deep strata near to a longwall, within a magnitude that exceed the predicted modelled drawdown (+ 15-20 m of observed). As of December 2022, levels at BGss-214m had recovered to above the modelled drawdown.

To the south, a mild depressurisation (in the range of 3 m) was observed at TNC040 during August 2022 and likely due to the progression of LW W4 toward this site. TNC040 is located approximately 430 m from the southern edge of LW W4 which makes it the closest groundwater monitoring site to the south. This depressurisation does not appear to be transmitted to the next site located further south (i.e. P9).

2.3.3 Mine Water Intake

Tahmoor Coal has a Groundwater Licence (WAL 36442) to extract 1642 ML/year of groundwater make from underground.

The inferred water make (groundwater that has seeped into the mine from the strata) is calculated from the difference between total mine inflows and total mine outflows. This calculation is assisted by input from flow meters installed on fresh water supply lines that pump water into the mine (mine inflow from Sydney Water supply to underground workings), and flow meters on three pipelines that extract water from underground (mine outflow). In addition, mine inflow and outflow also includes a measurement of water that enters and exits the mine through other means such as moisture in air vented in and out of the mine (water in vented air), and moisture in coal extracted from the mine.

Water make calculations provide an indication of the groundwater pumped out of the total Tahmoor Mine underground workings, which include water make from the Western Domain.

SLR completed an analysis of water make for Tahmoor Mine recorded between 1 January 2009 to 31 December 2022 (**Appendix D**). During this period, observed inflows to Tahmoor Mine have been ranging between 2 to 6 ML/d.

The observations of water make confirm that during extraction of LW W3 and LW W4 groundwater inflow to the mine stayed within ranges previously observed which suggest that no anomalous inflow to the mine occurred, which was a potential risk related to the faults mapped in the Nepean Fault Complex to the west of LW W4. During LW W3 and LW W4, the average inflow to the mine was 4.2 ML/d and 4.3 ML/d respectively, remaining below the average annual entitlement of 4.5 ML/d.

The Western Domain blocks have been sealed in October 2022 and since then an average groundwater inflow of 2.3 ML/day has been reported from the Tahmoor North workings. Groundwater entitlement was not exceeded for the 2022-23 water year and as of December 2022 remain below the limit for the 2022-23 water year (based on a pro-rata calculation).

2.3.4 Groundwater Quality

A total of 17 open standpipe piezometers (OSPs) have been installed at six locations in the Western Domain – P12 to P17, and a number of private groundwater bores form part of the groundwater monitoring program for LW W3-W4. It is noted that Tahmoor Coal no longer has access to piezometers P13 and P17 due to land access constraints. The locations of these groundwater bores are illustrated in **Figure 2-7**.

Further detail on the above groundwater quality triggers, including graphs showing progressive groundwater quality results for pH, EC and selected metals, are provided in the SLR reports included in **Appendix D**. Further detail and discussion of TARP triggers for groundwater quality are also discussed in **Section 3.2.7**.

2.3.4.1 Electrical conductivity and pH

The recovery in groundwater levels at the open standpipes is accompanied by stable pH and EC across the Western Domain.

During the reporting period, elevated pH levels were noted at P12B and P16C. At P12B, the elevated pH was noted since October 2021 and was confirmed to be related to the integrity of the bore rather than mining impact. These elevated levels were recorded during a period of above average rainfall.

During the reporting period, elevated EC levels were noted at P15A-D, P16A and GW115860. An increasing trend in EC at these sites was noted to be minor, and the cause of the increase remains difficult to assess as baseline data is not available. The salinity at GW115860 has been steadily increasing from 621 µS/cm in January 2021 to 1,246 µS/cm in March 2022. The beneficial use classifications remain unchanged at the private bore GW115860 and no significant increase in EC was identified along Stonequarry Creek.

TARP triggers for groundwater quality are discussed are discussed further in **Section 3.2.7**.

2.3.4.2 Metal concentrations

A number of elevated metal concentrations were noted during the review period, and these short-term increases (less than three months) were noted to be likely due to above average rainfall conditions during the reporting period or due to limited baseline data resulting in a conservative trigger level.

There are no clear trends in metal concentrations that may be linked to mining operations.

An increase in dissolved zinc concentrations at P16C was noted during December 2022. Natural fluctuations of zinc concentrations in nested bores P16A and P16B following rainfall events suggested that the increase at P16C (the lower Hawkesbury Sandstone) is localised. A sustained increase in groundwater levels at P16C since early 2022 could have locally mobilsed a naturally occurring source of zinc (in the range of 0.10-0.15 mg/L). Also, the mild steel casing at P16C could be contributing to a higher zinc concentration. It is likely that a natural fluctuation in groundwater quality and major flood events in 2022 are the reason for higher zinc concentrations at this bore.

Higher concentrations in Fe at site P12 is likely due to iron staining in the bore (previously observed at P16 and during bore census conducted by GeoTerra in 2019).

Strontium levels at P15A exceeded the trigger of 2.31 mg/L from October 2021 to May 2022 monitoring rounds. The high remained localised during this period, with no significant increases observed at other nearby monitoring sites (i.e. less than 0.3 mg/L increase). The trigger level at P15A for strontium was revised to 4 mg/L in line with the US health benchmark in June 2022, as the trigger was assessed to be too conservative for this site. Further discussion on strontium is provided in **Section 3.2.7**.

High concentrations of Ba at GW115860 were reported during the reporting period, with concentrations reaching 0.39 mg/L in January 2022. An investigation assessed that the levels were unlikely to be attributed to mining. A revised trigger level was calculated as it appeared that the trigger level was conservative and could not be based on pre-mining data.

2.3.5 Recommendations and Actions

2.3.5.1 Current Groundwater Monitoring Recommendations

As discussed in the Groundwater Review for September to December 2022 (**Appendix D**), the following groundwater recommendations were made for this reporting period by SLR:

- Continue the monitoring program, reporting groundwater level and quality data in the next groundwater review report for January-March 2023;

- For P12C, P16B, P16C, TNC036 (HBSS-97m) and TNC036-169m with Level 2 TARPs in place for groundwater levels, continue monitoring and reviewing groundwater level response;
- For TNC036 (BGSS-214m and BGSS-412.5m) with Level 2 TARPs in place for groundwater levels, continue to evaluate groundwater levels against model predictions and the rate of depressurisation over time;
- For all sites with Level 1 TARPs in place for groundwater quality, continue monitoring pH, EC and metal concentrations against TARP trigger levels;
- For all sites with Level 2 TARPs in place for groundwater quality (EC, pH and metals), continue monitoring concentrations against TARP trigger levels;
- For site P12C with a Level 2 TARP in place for groundwater quality (iron and manganese), continue closely monitoring Fe and Mn concentrations at the nearby monitoring bores (P12A and P12C);
- For site P15D with a Level 2 TARP in place for groundwater quality (iron), continue closely monitoring Fe concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860;
- For site P16C with a Level 3 TARP in place for groundwater quality (zinc), continue closely monitoring Zn concentrations at the nearby monitoring bores (P16A, B and private bore GW105546 and GW105467);
- For site P15A, B and C with a Level 2 TARP in place for groundwater quality (strontium), continue closely monitoring Sr concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW105228 and GW115860;
- For site P15A and GW105228 with a Level 2 TARP in place for groundwater quality (lithium), continue closely monitoring Li concentrations at the nearby monitoring bores (P14A-D) and nearby private registered bores GW115860;
- Complete an extended purge at P12C, P15A, P15D, P16C in the next round of monitoring to remove groundwater potentially contaminated with iron stain, grout or other localised source of metals before sampling;
- For the next round of monitoring, undertake sampling of groundwater levels and yield test at GW105546 and GW105467; and
- Investigate blockages at P16B and GW072402.

Progress of these recommendations will be provided in the next quarterly surface water and groundwater monitoring report for the Western Domain.

2.3.5.2 Groundwater Recommendations from the previous Six Monthly Subsidence Impact Report (November 2022) and Quarterly Groundwater Report (September 2022)

Table 2-4 provides the recommendations as made in the previous Six Monthly Subsidence Impact Report (October 2021 to May 2022, dated 17 June 2022) for groundwater, along with an update on the progress of these recommendations. This table also provides the recommendations as made in the previous Quarterly Groundwater Report (April to June 2022, dated 24 August 2022) that were unresolved in the previous Six Monthly Subsidence Impact Report, along with an update on the progress of these recommendations.

Table 2-4 Groundwater recommendations from the previous Six Monthly Subsidence Impact Report and Quarterly Groundwater Report and Current Progress

Item	Previous Recommendation	Progress of Recommendation
1	Ongoing monthly collection and quarterly analysis of monitoring data post mining: monthly monitoring and quarterly analysis of surface water and groundwater level and water quality data recorded in the vicinity of the Investigative Area and at upstream reference sites should continue to be undertaken and the investigation findings updated to incorporate additional monitoring data and analysis findings (HEC, 2021). The surface water and groundwater monitoring data should continue to be assessed in accordance with the TARP, as documented in the WMP.	Completed as part of this Six Monthly Subsidence Impact Report (**Sections 2.2, 2.3** and **3.2**) and **Appendix D**.
2	If surface water exceedances at site SC (SC3) are identified following mining of LW W4, groundwater levels at site P41C could be used to infer groundwater levels beneath site SC, or sites SD and SF further downstream, acknowledging that the distance from the piezometers and the creek reduces reliability, but these piezometers provide the best data to assess the potential exceedance. Observed groundwater levels were used in the past to identify or infer potential change in groundwater-surface water interaction at surface water monitoring sites. Extrapolation of groundwater levels from piezometers P41C-D could be used to assess possible groundwater-surface water interactions prior to, during and post-mining of LW W4.	No exceedances of surface water level occurred during the September to December 2022 period at site SC, as discussed in **Section 2.2.2** and **Appendix B**.
3	Analysis and incorporation of post-mining groundwater level data from proposed new VWP borehole WD02 above LW W2 and establish trigger level for groundwater levels for each VWP pressure sensor. Identify any exceedances in groundwater level at this site related to mining and consider implication regarding height of fracturing.	Drilling of the new VWP borehole WD02 above LW W2 is in progress at time of writing. Trigger levels for groundwater levels for each VWP pressure sensor will be established following installation. Any exceedances in groundwater level at this site related to mining will be identified and the implications regarding height of fracturing will be considered following installation.
4	Confirm the installation depth of the pump at GW104090 and conduct work on the suspected blockage of bore GW072402.	Regarding GW104090, it has been confirmed that this private bore has no pump installed and has been reported to be sheared. An active subsidence claim with SA NSW is in place for this bore. This bore will be discontinued from the current monitoring program. Regarding GW072402, it has been confirmed that this bore is blocked and there are no planned usages for this bore in the future. The reason for the blockage is unknown and unlikely to be related to mining effects. This bore will be discontinued from the current monitoring program.

Item	Previous Recommendation	Progress of Recommendation
5	Conduct groundwater purging at monitoring sites P15A and P16C in relation to higher strontium and zinc concentrations respectively.	Groundwater purging at monitoring sites P15A and P16C was conducted in December 2022.
6	Continue to monitor and review groundwater quality and groundwater level, as per the monitoring program. In particular, close attention will be paid to groundwater level at P16B, P16C, TNC036 (HBSS-97m and BGSS-169m), and all sites associated with a Level 2 TARP trigger for groundwater quality.	Completed as part of this Six Monthly Subsidence Impact Report (**Sections 2.2.2, 2.2.3** and **3.2**) and **Appendix D**. During October to December 2022, P16B, P16C, TNC036-97m and TNC036-169m all triggered a Level 2 TARP trigger for groundwater level. Only P16C triggered a groundwater quality TARP trigger (Level 3).
7	Continue to closely monitor concentrations of strontium at P15A and nearby groundwater monitoring sites and private bores.	Completed as part of this Six Monthly Subsidence Impact Report (**Sections 2.2.2, 2.2.3** and **3.2**) and **Appendix D**. During October to December 2022, concentrations of strontium at P15A were still exceeding baseline conditions, however concentrations have continued to decrease following a peak in June 2022.
8	Convene Tahmoor Coal Environmental Response Group to review responses on a quarterly basis.	Completed on a monthly basis during this reporting period.
9	Complete an extended purge at P15A in the next round of monitoring to remove at least three screen length volumes (screen length being 1.5 m) before sampling.	An extended purge at P15A was conducted in December 2022. Further groundwater monitoring will be conducted with groundwater quality analysed on a quarterly basis.
10	At P16B and P16C (and potentially P16A), it is recommended to develop a diversion drain to divert the surface run-off away from the well heads. If bore P16B and P16C are damaged, repair/resealing is required followed by measurement of groundwater levels.	A diversion drains to divert the surface run-off away from the well heads of P16B and P16C was developed in early November 2022. At the same time, the bore seals for these bores were cleaned and re-installed. Further monitoring will be able to determine if these actions have eliminated the issues at these bores.
11	Complete an extended purge at P12B in the next round of monitoring to remove groundwater potentially contaminated with grout before sampling.	An extended purge at P12B was conducted in December 2022. pH at P12B was observed within normal condition during the reporting period.

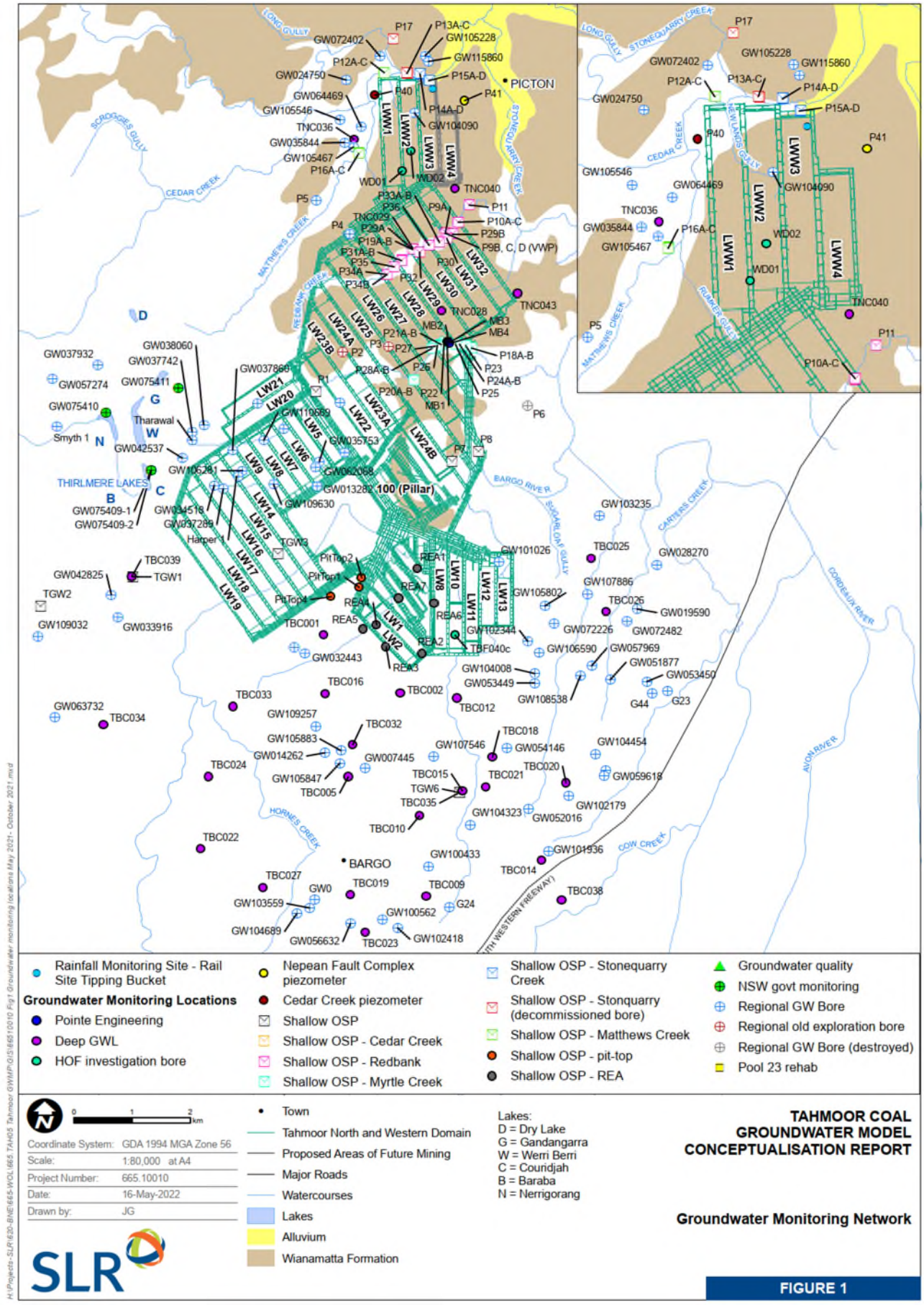


Figure 2-7 *LW W3-W4 Groundwater Monitoring Bores (source: Groundwater Six-Month Review, SLR; Appendix D)*

2.4 Land Monitoring

The LW W3-W4 Land Management Plan was prepared to manage the potential environmental consequences of LW W3-W4 extraction on steep slopes, dams, agricultural land, and land in general in accordance with Condition 13H(vii)(e) of DA 67/98. In addition, monitoring of cliffs and rock outcrops in the LW W1-W2 Study Area in accordance with the LW W1-W2 Land Management Plan was completed as part of post-mining monitoring for LW W2.

During this reporting period, the LW W1-W2 Land Management Plan and LW W3-W4 Land Management Plan have been implemented to monitor the following landscape features:

- Cliffs and rock outcrops – 3-monthly visual inspections and reporting by geotechnical engineers from Douglas Partners;
- Steep slopes, and dams – monthly (during mining) and quarterly (post-mining) visual inspections and reporting by geotechnical engineers from Douglas Partners. Where deemed necessary, the monitoring frequency of selected dams was increased to fortnightly;
- Stonequarry Sewage Treatment Plan retention basin (Dam FD7) – weekly visual inspections and reporting by Newcastle Geotechnical during mining;
- Dams in active subsidence zone – weekly visual inspections and reporting by Building Inspection Services; and
- Agricultural land – monthly (during mining) and quarterly (post-mining) visual inspections and reporting by Building Inspection Service.

The following sections summarise the observations made during the reporting period for each land category. Performance against all Land Management Plan TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.4.1 Cliffs and Rock Outcrops

Visual and photographic surveys for subsidence impacts on cliffs have been completed every three months in accordance with the LW W1-W2 Land Management Plan until August 2022. The purpose of the surveys was to note any new instabilities in the cliff structures that have occurred since the commencement of LW W1-W2 mining, including freshly exposed rock face, debris scattered around the base of a cliff or overhang, and tension cracks. Surveys were completed by a walk through along the valley bed was conducted from Stonequarry Creek to the intersection of Cedar Creek and Matthew Creek.

The locations of cliffs and rock outcrops within the LW W1-W2 Study Area are illustrated in **Figure 2-8**.

During the reporting period, cliffs C03 to C09 along Cedar Creek and M01 and M02 along Matthews Creek were inspected, and there were no indications of recent rockfalls or signs of stress relief (tension cracking) along the sections of cliff monitored.

As there are no cliffs or rock outcrops within the LW W3-W4 Study Area (refer to **Figure 2-9**), no monitoring of these features has been completed during the extraction of LW W4.

2.4.2 Steep Slopes

Visual and photographic surveys for subsidence impacts on structures near steep slopes have been completed monthly for features within the LW W3-W4 active subsidence zone. The locations of steep slopes within the LW W3-W4 Study Area are illustrated in **Figure 2-8**.

During the reporting period, structures located on Stonequarry Creek Road, Booyong Close, Attunga Close, Carramar Close, Thirlmere Way, Star Street, Connellan Crescent, and the Waste Water Treatment Plant (WWTP) were inspected. There were no signs of distress or changes in the areas inspected that could be attributed to mine subsidence.

2.4.3 Dams

Visual and photographic surveys for subsidence impacts on dams were completed on a weekly and monthly basis of dams within the LW W3-W4 active subsidence zone. The location of dams within the LW W3-W4 Study Area are illustrated in **Figure 2-10**.

High rainfall was noted from June 2022 onwards, resulting in water flowing over the spillways of numerous dams including farm dams 1-6, 8, 10, 12-18, and 20. At these dams, wet and boggy conditions were also noted due to overflow from the spillways. Many of the dams in the Study Area were also noted to have sections of subvertical upstream faces, which are probably the result of cattle trafficking the water edges where the dam levels are below full capacity. Shallow soil slumping at some dams were noted to have resulted as a result.

In particular, farm dam 3 (FD3) was noted to progress to localised slumping in the southern spillway cut batter and the upstream embankment face. In September 2022, a larger landslide was noted to be developing in the hillside to the south of the southern spillway. Tahmoor Coal reduced the pond level of FD3 by syphoning method as a precautionary action. This change was not considered to be due to mine subsidence, and remained unchanged since the October 2022 inspection.

None of the above items were considered to be due to mine subsidence. However, due to active mining in the area, monitoring frequency was increased by Douglas Partners (monthly to fortnightly) and Building Inspection Services (weekly to thrice weekly) for selected dams. The monitoring frequency from November 2022 onwards was reduced back to that prescribed in the monitoring program.

2.4.4 Agricultural Land

Visual and photographic surveys for subsidence impacts on agricultural land have been completed monthly at inspection points within the LW W3-W4 active subsidence zone and have been completed on a quarterly basis during the post-mining monitoring period. Inspections points were set up prior to the commencement of LW W3 mining to provide vantage of agricultural land within the LW W3-W4 Study Area. The purpose of the surveys is to note whether change has occurred to agricultural land, and to assist in determining if any change can be attributed to mining impacts. Surveys noted the presence of erosion, condition of boundary and internal fencing components, paddock gate condition, out-building condition, paddock dam condition, presence of any surface slumping or cracking, and the presence of vegetation dieback.

Agricultural land identified within the LW W3-W4 Study Area are illustrated on **Figure 2-11**.

During the reporting period, it was noted that seasonal changes had affected vegetation growth, however there were no observable changes to agricultural land in comparison to pre-mining baseline data.

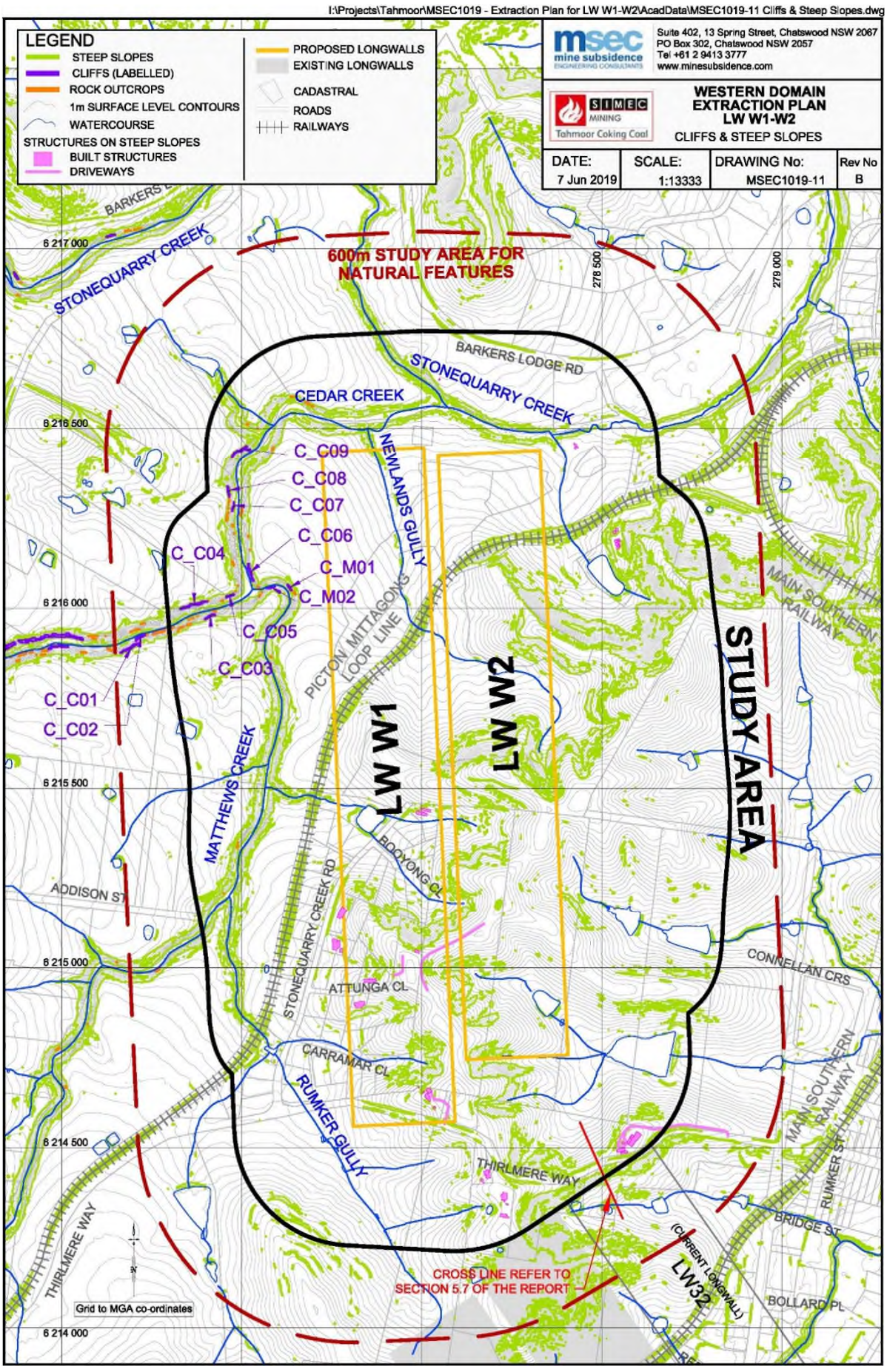


Figure 2-8 Cliffs, rock outcrops and steep slopes within the LW W1-W2 Study Area (source: MSEC, 2019 - LW W1-W2 Subsidence Predictions and Impact Assessment Report)

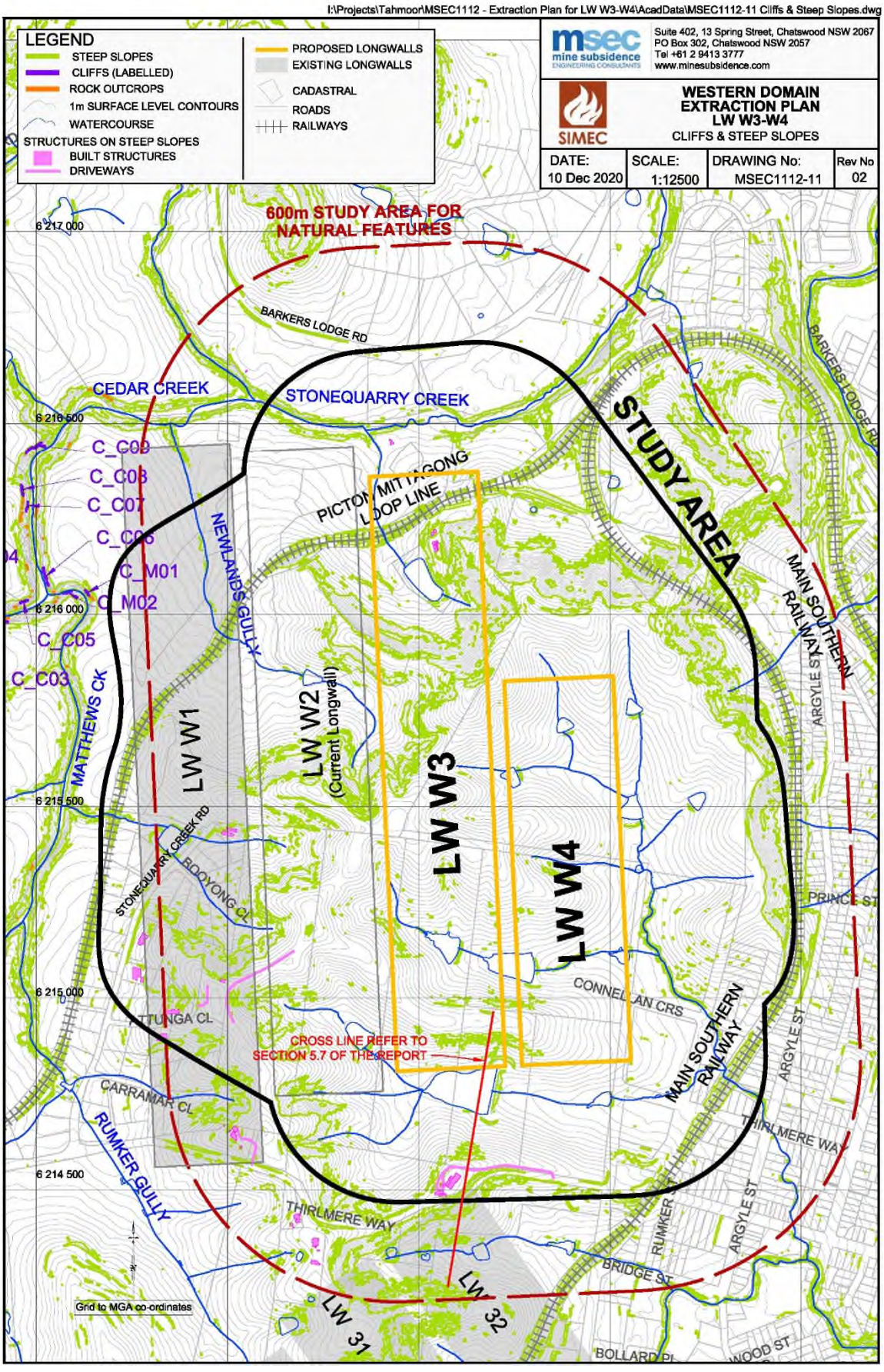


Figure 2-9 Steep slopes within the LW W3-W4 Study Area (source: MSEC, 2021 - LW W3-W4 Subsidence Predictions and Impact Assessment Report)

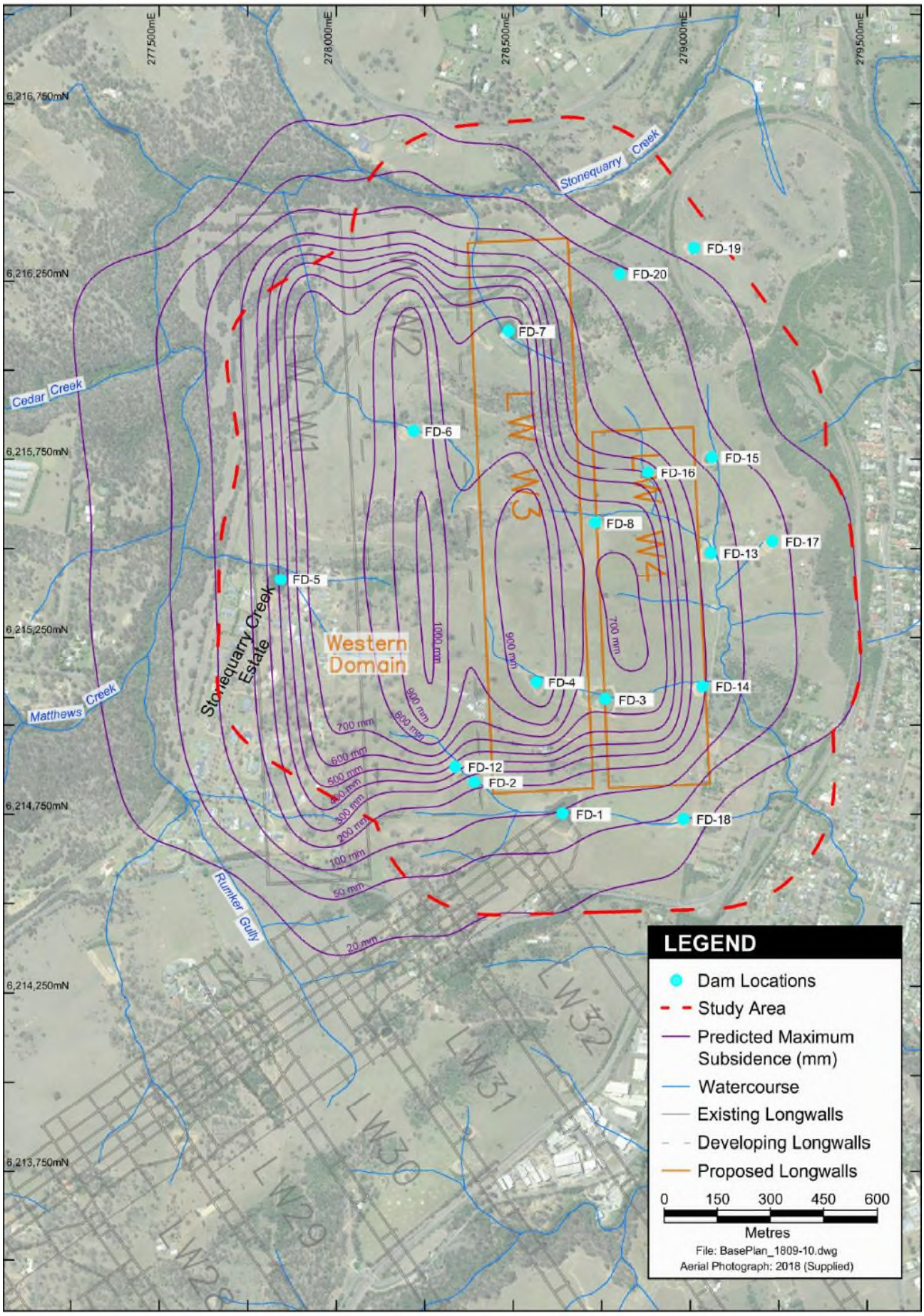


Figure 2-10 Dams within the LW W3-W4 Study Area (source: LW W3-W4 Water Management Plan)

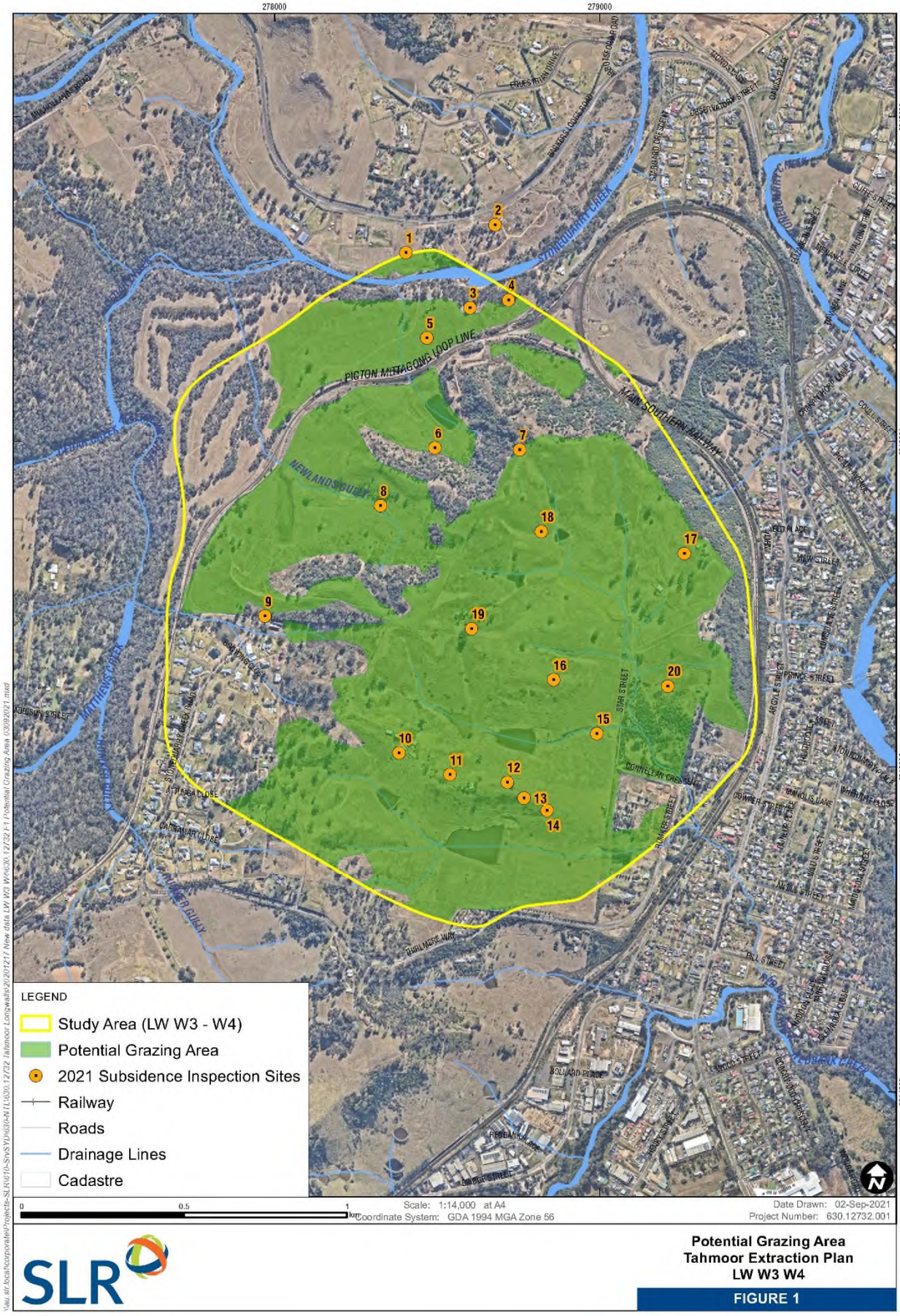


Figure 2-11 Agricultural land and inspection points within the LW W3-W4 Study Area (source: SLR Agricultural Subsidence Monitoring LW W3-W4 Report (SLR, 2021))

2.5 Biodiversity Monitoring

The LW W3-W4 Biodiversity Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on aquatic and terrestrial flora and fauna in accordance with Condition 13H(vii)(d) of DA 67/98.

During the reporting period, the LW W3-W4 Biodiversity Management Plan has been implemented to monitor ecology in the Study Area, as outlined below:

- Aquatic ecology – macroinvertebrate monitoring during Autumn 2022 and Spring 2022 by Niche Environment and Heritage; and
- Terrestrial ecology – amphibian and riparian vegetation monitoring during Autumn 2022 and Spring 2022 by Niche Environment and Heritage.

The following sections summarise the observations made during the reporting period for aquatic and terrestrial ecology. Performance against all Biodiversity Management Plan TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.5.1 Aquatic Ecology

The aquatic ecology monitoring program for LW W3-W4 has been designed to monitor subsidence-induced impacts on aquatic ecology. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Aquatic habitat assessment:
    - The Australian River Assessment System (AUSRIVAS); and
    - Riparian Channel and Environment (RCE) Inventory.
- Macroinvertebrate survey:
    - AUSRIVAS macroinvertebrate sampling;
    - Quantitative benthic macroinvertebrate monitoring program; and
    - Water quality sampling.

The aquatic ecology monitoring program is primarily focused on macroinvertebrate monitoring regimes including AUSRIVAS and quantitative using Before After Control Impact (BACI) design. A total of sixteen locations were sampled within Stonequarry Creek, Cedar Creek and Matthews Creek comprised of eight impact sites and eight control sites. The locations of monitoring sites are illustrated in **Figure 2-12**.

2.5.1.1 Autumn 2022 Monitoring Results

Aquatic monitoring for autumn 2022 was conducted by Niche Environment and Heritage in March 2022. The following results were observed for Autumn 2022 monitoring:

- There was aquatic habitat present at all sites in autumn 2022;
- All sites had similar riparian and channel condition prior to pre-mining sampling, except for SQC4 which has been subject to habitat modifications a result of causeway construction by a landowner;
- AUSRIVAS OE50 scores were generally comparable to pre-mining stream surveys, despite fluctuations in scores and associated Bands in autumn 2022 when compared to spring 2021;
- SIGNAL2 scores were low but were comparable to pre-mining scores and indicated more moderate levels of pollution or environmental stress in autumn 2022 than in recent surveys;
- Ephemeroptera Plecoptera Trichoptera (EPT) scores at all sites were similar or slightly increased when compared to pre-mining surveys;

- Number of taxa were within the range of pre-mining results but were generally slightly reduced when compared to recent surveys, which is anticipated in seasons of elevated flows;
- The macroinvertebrate assemblages showed variability spatially (site level) and temporally (between surveys); and
- The assemblage results in autumn 2022 were different to those of previous surveys, reflecting the prevailing elevated flows and associated changes in habitats present.

2.5.1.2 Spring 2022 Monitoring Results

Aquatic monitoring for spring 2022 was conducted by Niche Environment and Heritage in September 2022. The following results were observed for this monitoring:

- There was aquatic habitat present at all sites in spring 2022;
- All sites had similar RCE condition scores prior to pre-mining sampling, except for a general increase in aquatic habitat;
- AUSRIVAS OE50 scores were generally higher or comparable to pre-mining stream surveys and the previous autumn 2022 survey;
- SIGNAL2 scores were low but were comparable to pre-mining scores and indicated more moderate levels of pollution or environmental stress in spring 2022 than in previous surveys;
- Ephemeroptera Plecoptera Trichoptera (EPT) scores at all sites were similar or slightly increased when compared to pre-mining surveys;
- The number of taxa recorded were within the range of pre-mining results but were generally slightly reduced when compared to recent surveys, which is anticipated in seasons of elevated flows;
- The macroinvertebrate assemblages showed variability spatially (site level) and temporally (between surveys);
- Despite some changes observed spatially and temporally, the quantitative results in spring 2022 did not indicate a deterioration or change in assemblage, density or richness indicative of subsidence impact; and
- The results are likely the response to the variability of existing stressors within the catchment and influence of above-average rainfall and flows.

The quantitative macroinvertebrate analysis identified some spatial and temporal differences that indicate changes in the sample reaches, however these changes do not necessarily indicate that mining has caused an impact to the waterway. It is likely that the changes observed are the result of natural variability responding to catchment-scale influences. Additionally, the surface water and ground water monitoring and subsidence impact monitoring did not identify any ecologically significant changes to the water level, water quality, flow and flow paths, or new physical impacts to the structure of the bedrock within the sample reaches. This indicates that there are unlikely to be subsidence related impacts that could influence stream health at this time.

2.5.2 Terrestrial Ecology

The terrestrial ecology monitoring program for LW W3-W4 has been designed to monitor subsidence-induced impacts on terrestrial ecology including riparian vegetation and amphibian monitoring. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Riparian vegetation monitoring involving floristic surveys within established vegetation monitoring plots;
- Amphibian monitoring along established transects:
    - Spotlighting;
    - Call provocation;
    - Listening for diagnostic frog calls; and

- Tadpole identification.

In particular, two threatened frog species – the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophryne australis*) – were targeted in the amphibian monitoring.

A total of eight locations were sampled within Stonequarry Creek, Cedar Creek and Matthews Creek comprised of four impact sites and five control sites. The locations of monitoring sites are illustrated in **Figure 2-13**.

2.5.2.1 Autumn 2022 Monitoring Results

Riparian vegetation monitoring for Autumn 2022 was conducted by Niche Environment and Heritage between 21-26 April 2022, and amphibian monitoring for Autumn 2022 was conducted between 11-19 April 2022.

The following results were observed for Autumn 2022 monitoring:

Riparian monitoring:

- River-flat Eucalypt Forest, which is listed as an EEC under the BC Act, was recorded at control Site 9 and impact Site 11, along Stonequarry Creek;
- Autumn 2022 impact Sites had a slightly higher mean flora species richness than control Sites. However, control Sites had higher percentage vegetation cover than impact Sites. This is likely due to persistent rainfall patterns, stream morphology, human disturbance and altered flow regimes (e.g., flood events) increasing weed dominance at control Sites;
- Sites 3, 5, 6, 7, 8 and 9 appeared to be more influenced by seasonal changes and flooding events (e.g. witnessed in 2020, 2021 and 2022) than Sites further up the catchment (Sites 4, 10 and 11) which tended to be protected in deep gullies and canyons; and
- Statistical analyses identified a significant difference between vegetation cover for 'After' data between control and impact Sites, specifically, Autumn 2021 and Autumn 2022. Given that there were noticeable reductions in vegetation cover across control Sites 6, 7, 8 and 9, as well as impact Site 5, impacts cannot be attributed to mining. Based on stream morphology, persistent rainfall during the La Niña climatic period, and other associated factors, these Sites appeared to be heavily affected by the recent (March 2022) flooding event (e.g. destabilisation of the embankments, loss of riparian vegetation and large accumulation of flood debris). Continuation of monitoring is recommended to observe the recovery of vegetation cover with time, at impact and control Sites post-natural disaster event.

Amphibian monitoring:

- Amphibian detection rates were variable between Before and After monitoring for most Sites. In Autumn 2022, the most widespread and abundant amphibian species was the Common Eastern Froglet (*Crinia signifera*), which was detected at all but two of the Sites. Stony Creek Frog (*Litoria lesueuri*) was detected at two of the nine Sites, one of which is an impact Site (Sites 3). The greatest number of amphibians detected were at Site 11 (impact) with 35 Common Eastern Froglet individuals recorded;
- For all Autumn data, there was a significant difference in amphibian assemblages at the control Sites and impact Sites, and a significant difference in amphibian assemblages Before and After. There was also a significant BACI interaction for amphibian assemblages. This means the 'Impact' had a significantly different effect on control Sites, when compared with impact Sites. However, amphibian numbers appear to have increased at impact Sites (After), while control Sites appear to have a similar number of individuals for before and after. Given amphibian numbers are increasing at impact Sites, the BACI interaction for this round of monitoring appears not to be a viable indicator of mining impacts;

- The two amphibian species detected represent an otherwise normal assemblage of common species that may be expected to be present in the Study Area under the current climatic conditions;
- The targeted threatened amphibian species were not detected during the survey and appear not to be present in the Study Area, at least not in numbers that can be detected by the current monitoring program. While the Study Area contains superficially suitable habitat, it is possible that the species would no longer be able to survive in the area due to the impact of the multiple flooding events that have occurred over the past three years, including a major flooding event that preceded the Autumn 2022 surveys. Predation pressures from two introduced predators: the Plague Minnow and the Freshwater Crayfish (*Cherax destructor*), both of which were detected at all Sites, may also be impacting on the suitability of the habitat for these threatened frogs; and
- Amphibian detection rates fluctuated between monitoring events for most Sites, likely due to the highly variable weather and climatic conditions experienced across all monitoring events.

2.5.2.2 Spring 2022 Monitoring Results

Riparian vegetation monitoring for Spring 2022 was conducted by Niche Environment and Heritage between 30 October and 4 November 2022, and amphibian monitoring for Spring 2022 was conducted between 25–27 October 2022.

The following results were observed for Spring 2022 monitoring:

Riparian monitoring:

- River-flat Eucalypt Forest, which is listed as an Endangered Ecological Community (EEC) under the NSW Biodiversity Conservation Act 2016 (BC Act), and Critically Endangered Ecological Community (CEEC) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) was recorded at control Site 9 and impact Site 11, along Stonequarry Creek;
- Spring 2022 impact Sites had a slightly lower mean flora species richness than control Sites. Similarly, vegetation cover was lower at impact Sites, when compared to control Sites. This is likely due to persistent rainfall patterns, human disturbance and altered flow regimes increasing weed dominance at control Sites;
- For Spring 2022, there was a significant BACI interaction for vegetation cover between control and impact Sites. The results of the analyses indicate that vegetation cover at control Sites is shifting differently to impact Sites. Exotic vegetation cover had increased at control sites compared to impact sites. However, the native cover has reduced at both control and impact Sites, indicating they were affected in a similar way in response to severe flooding. Given that the reduction in native cover was observed at both impact and control Sites, there are no detectable subsidence related impacts on riparian vegetation; and
- Sites 3, 7, 8 and 9 tended to have higher soil fertility and organic matter loads, which lead to higher species diversity and generally more exotic species. These Sites appeared to be more influenced by seasonal changes and flooding events (e.g., 2021 and 2022) than those Sites further up the catchment (Sites 4, 5, 6 and 10) that tended to be protected in deep gullies and canyons.

Amphibian monitoring:

- Amphibian detection rates were variable between Before and After monitoring for most Sites. In Spring 2022, the most widespread amphibian species was the Common Eastern Froglet (*Crinia signifera*), which was detected at all but one of the Sites. Striped Marsh Frog (*Limnodynastes peronii*) and Stony Creek Frog (*Litoria lesueuri*) were both detected at five of the nine Sites, three of which are impact Sites (Sites 4, 5, 11). The greatest number of amphibians detected was at Site 4 with 38 Stony Creek Frog individuals recorded;
- There was no significant difference in species diversity between control Sites and impact Sites;
- The seven amphibian species detected represent an otherwise normal assemblage of common species that may be expected to occur in the Study Area under the current climatic conditions;
- The targeted threatened amphibian species were not detected during the survey and appear not to be present in the Study Area, at least not in numbers that can be detected by the current monitoring program. While the Study Area contains superficially suitable habitat, it is possible that the species would no longer be able to survive in the area due to the presence of two introduced predators: the Plague Minnow and the Yabby, both of which were detected at all Sites;
- The amphibian community present contains at least seven species which are likely still viable indicators of impending or current environmental change; and
- Amphibian detection rates fluctuated between monitoring events for most Sites, likely due to the highly variable weather and climatic conditions experienced across all monitoring events.

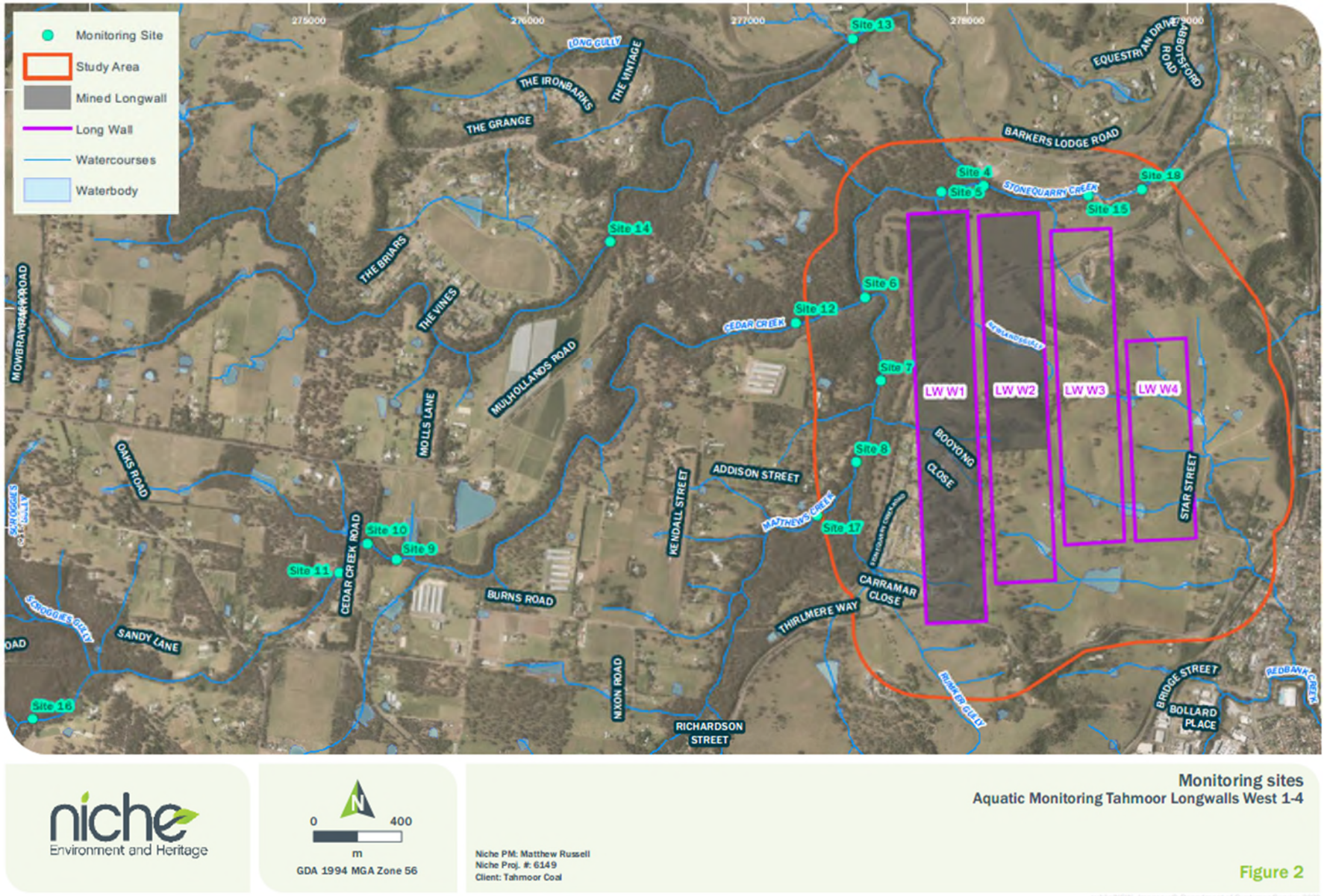


Figure 2-12 LW W1-W4 Aquatic Ecology Monitoring Locations (source: Niche, 2022a)

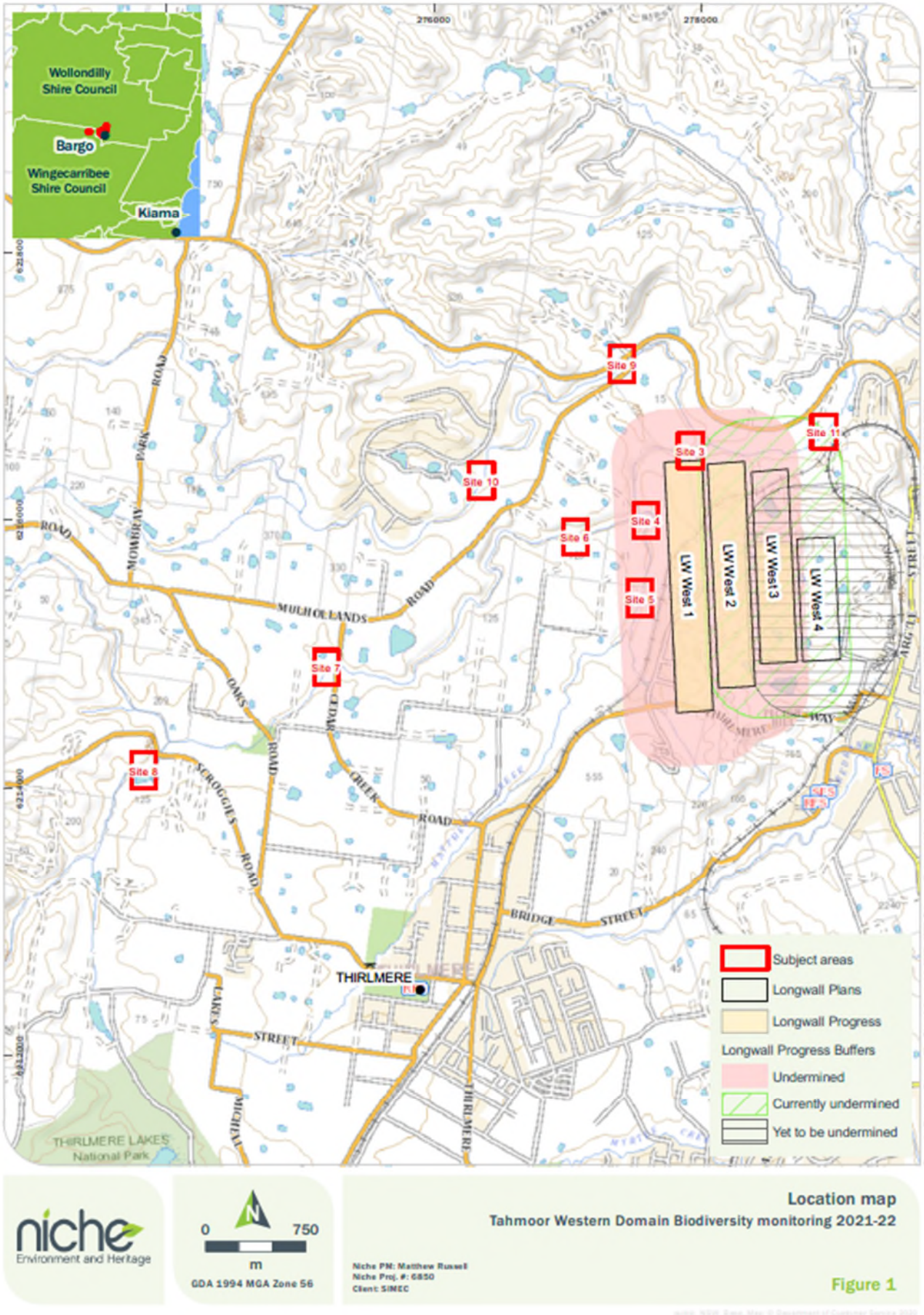


Figure 2-13 LW W1-W4 Terrestrial Ecology Monitoring Locations (source: Niche, 2022b)

2.6 Heritage Monitoring

The LW W3-W4 Heritage Management Plan were prepared to manage the potential environmental consequences of LW W3-W4 extraction on Aboriginal heritage and historical heritage sites and values in accordance with Condition 13H(vii)(f) of DA 67/98.

The following sections summarise the observations made during the reporting period for Aboriginal and historical heritage items. Performance against all Heritage Management Plan TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.6.1 Aboriginal Heritage

During this reporting period, the LW W3-W4 Heritage Management Plan and the LW W3-W4 Stonequarry Creek Rockbar Management Plan has been implemented to monitor subsidence impacts for the following Aboriginal heritage items:

- Grinding grooves:
    - Monthly review of GNSS unit movements by MSEC (refer to **Appendix A** for referenced reports);
    - Weekly or monthly monitoring of the SR17 Rockbar in accordance with the Stonequarry Creek Rockbar Management Plan (refer to **Appendix F** for referenced reports); and
    - LW W3 and LW W4 End of panel review of Aboriginal heritage items by an EMM Archaeologist and RAP representatives (EMM, 2022a; EMM, 2022b).
- Scarred Tree:
    - LW W3 and LW W4 end of panel review of Aboriginal heritage items by an EMM Archaeologist and RAP representatives (EMM, 2022a; EMM, 2022b).

LW W3 End of Panel Aboriginal Heritage Review

An end of panel monitoring inspection following LW W3 extraction was carried out by an EMM archaeologist and a RAP representative on 26 April 2022, and the findings of this inspection reported in an end of panel report (EMM, 2022a). The focus of the fieldwork was to conduct archaeological monitoring of Aboriginal sites associated with the underground coal mining of LW W3 after completion of its panel extraction in the Tahmoor Mine Western Domain. The locations of Aboriginal heritage items within the Study Area of LW W3-W4 are illustrated in **Figure 2-14**.

In accordance with the subsidence monitoring program, the inspection related to one grinding groove site and one modified tree. The six open artefact sites did not require monitoring.

The grinding groove site (AHIMS #52-2-2068) has been monitored during LW W3 extraction through the GNSS units and various other monitoring strategies as outlined in the Stonequarry Creek Rockbar Management Plan. Two triggers to the Stonequarry Creek Rockbar TARPs were noted during the reporting period, as discussed in **Section 3.2.8**. The Subsidence Technical Committee confirmed that fracturing was identified approximately 40 m downstream of the nearest grinding grove site on the north-eastern side of the access track. No evidence of fracturing was evident at any of the grinding groove sites.

During the end of panel inspection, no subsidence related impacts were observed to any of the Aboriginal sites inspected, and as such no additional management strategies are required.

LW W4 End of Panel Aboriginal Heritage Review

An end of panel monitoring inspection following LW W4 extraction was carried out by an EMM archaeologist and a RAP representative on 23 August 2022, and the findings of this inspection reported in an end of panel report (EMM, 2022c). The focus of the fieldwork was to conduct archaeological monitoring of Aboriginal sites associated with the underground coal mining of LW W4 after completion of its panel extraction in the Tahmoor Mine Western Domain. The locations of Aboriginal heritage items within the Study Area of LW W3-W4 are illustrated in **Figure 2-14**.

In accordance with the subsidence monitoring program, the inspection related to one grinding groove site and one modified tree. The six open artefact sites do not require monitoring.

The grinding groove site (AHIMS #52-2-2068) has been monitored during LW W4 extraction through the GNSS units and various other monitoring strategies as outlined in the Stonequarry Creek Rockbar Management Plan. Two triggers to the Stonequarry Creek Rockbar TARPs were noted during the reporting period, as discussed in **Section 3.2.8**. The Subsidence Technical Committee confirmed that the fracturing was identified approximately 40 m downstream of the nearest grinding grove site on the north-eastern side of the access track. No evidence of fracturing was evident at any of the grinding groove sites.

During the end of panel inspection, no subsidence related impacts were observed to any of the Aboriginal sites inspected, and as such no additional management strategies are required.

2.6.2 Historical Heritage

During this reporting period, the LW W3-W4 Heritage Management Plan was implemented to monitor subsidence impacts for the following historical heritage items:

- Sandstone and brick culverts along the PMLL:
    - Monthly visual inspection by Newcastle Geotechnical; and
    - End of panel review of PMLL historical heritage items by an EMM Archaeologist (refer to **Appendix E** for referenced reports; EMM, 2022c; EMM, 2022d).
- Weatherboard House:
    - End of panel review by an EMM Archaeologist (EMM, 2022e).

LW W3 End of Panel Historical Heritage Review

EMM consultants completed an end of panel monitoring inspection on 5 April 2022 focused on the eight historical brick and sandstone culverts within the Study Area of LW W3-W4 (**Appendix E**). The locations of historical heritage items are illustrated in **Figure 2-15** and **Figure 2-16**.

During the extraction of LW W3, the culverts have been continuously monitored at weekly intervals by Mark Delaney, principal engineering geologist at Newcastle Geotech, as part of the subsidence monitoring program.

As discussed in **Section 3.2.9** of this report, visual inspections during the previous reporting period noted the development of a number of cracks and spalling of sandstone blocks on sandstone culverts at 88.400 km and 88.980 km along the Picton-Mittagong Loop Line. The end of panel inspection confirmed that impacts to the two culverts had occurred.

Following the completion of LW W3 mining, the end of panel heritage inspection confirmed that no additional cracking, worsening of existing cracks or spalling had occurred (**Appendix E**).

No other impacts to historical heritage were observed following the completion of LW W3 mining.

LW W4 End of Panel Historical Heritage Review

EMM consultants completed an end of panel monitoring inspection on 11 November 2022 of the eight historical brick and sandstone culverts within the Study Area of LW W3-W4 (**Appendix E**), and an end of panel monitoring inspection on 17 October 2022 of the Weatherboard House (local heritage item listed on the *Wollondilly Local Environment Plan 2011*). The locations of historical heritage items are illustrated in **Figure 2-15** and **Figure 2-16**.

During the extraction of LW W4, the culverts have been continuously monitored at monthly intervals by Newcastle Geotech as part of the subsidence monitoring program.

Following the completion of LW W4 mining, it was confirmed that no new impacts to the portal ends of the culverts have been observed during the monitoring throughout the extraction of LW W4, and the end of panel heritage inspection confirmed that no additional cracking, worsening of existing cracks or spalling had occurred (**Appendix E**).

The removal of the RCP sleeves from the PMLL culverts following the completion of mining in the Western Domain enabled a full inspection of the culverts. This inspection noted cracking in the sandstone culvert at 88.400 km that had formed during the extraction of longwalls in the Western Domain.

No other impacts to historical heritage were observed during this reporting period.

An inspection of the Weatherboard House (Item 221 in Schedule 5 of the *Wollondilly Local Environment Plan 2011*) at the end of mining in the Western Domain confirmed that negligible changes to pre-existing cracks and to the overall structure of the weatherboard cottage and garage are likely to have occurred. The buildings remain stable and in generally good condition with no significance changes, impacts to or loss of original fabric or built elements.

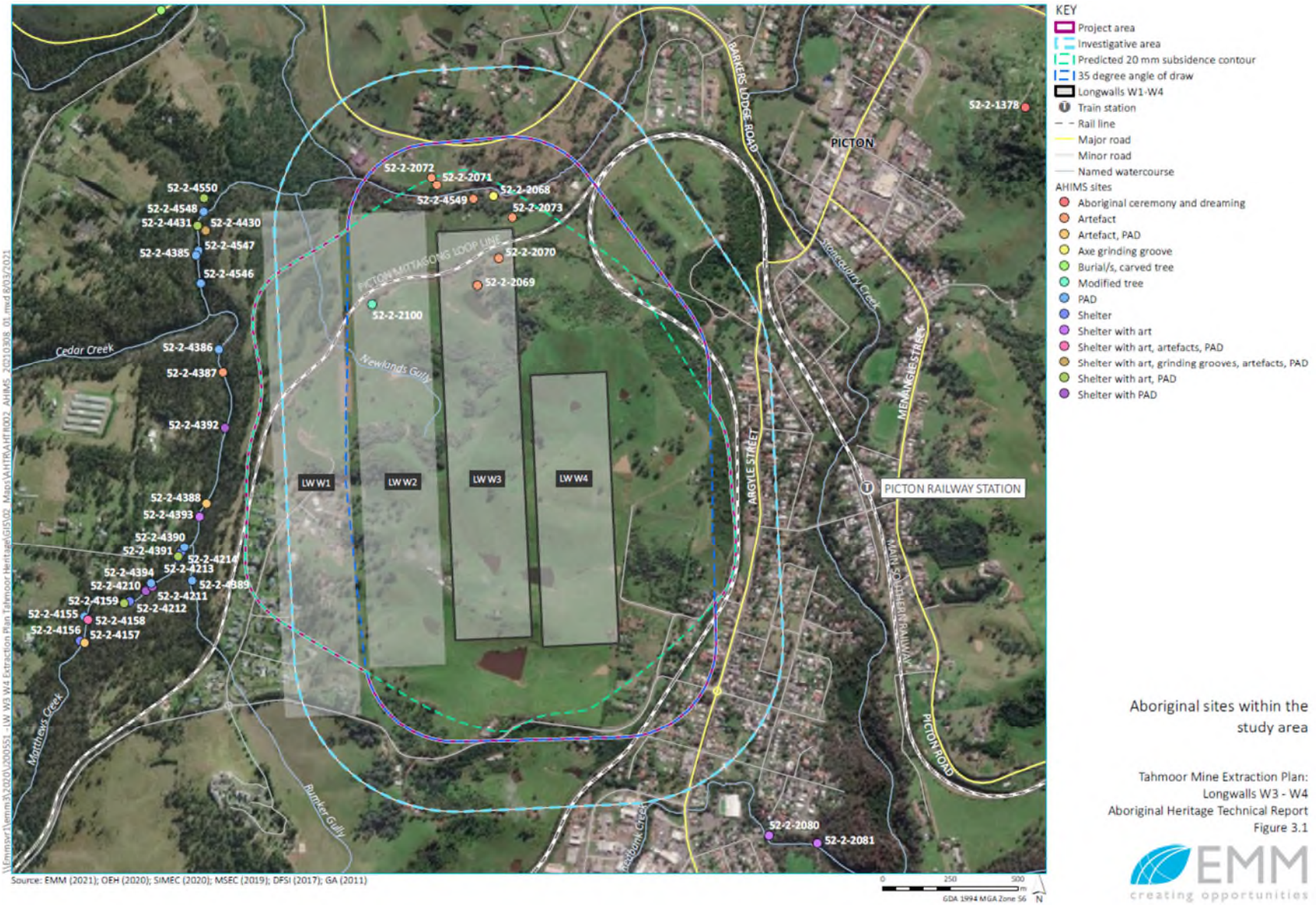


Figure 2-14 Aboriginal heritage Sites in the LW W3-W4 Study Area and Surrounds (Source LW W3-W4 Heritage Management Plan)



Figure 2-15 Historical Heritage Sites (registered sites) in the LW W3-W4 Study Area and Surrounds (Source LW W3-W4 Heritage Management Plan)

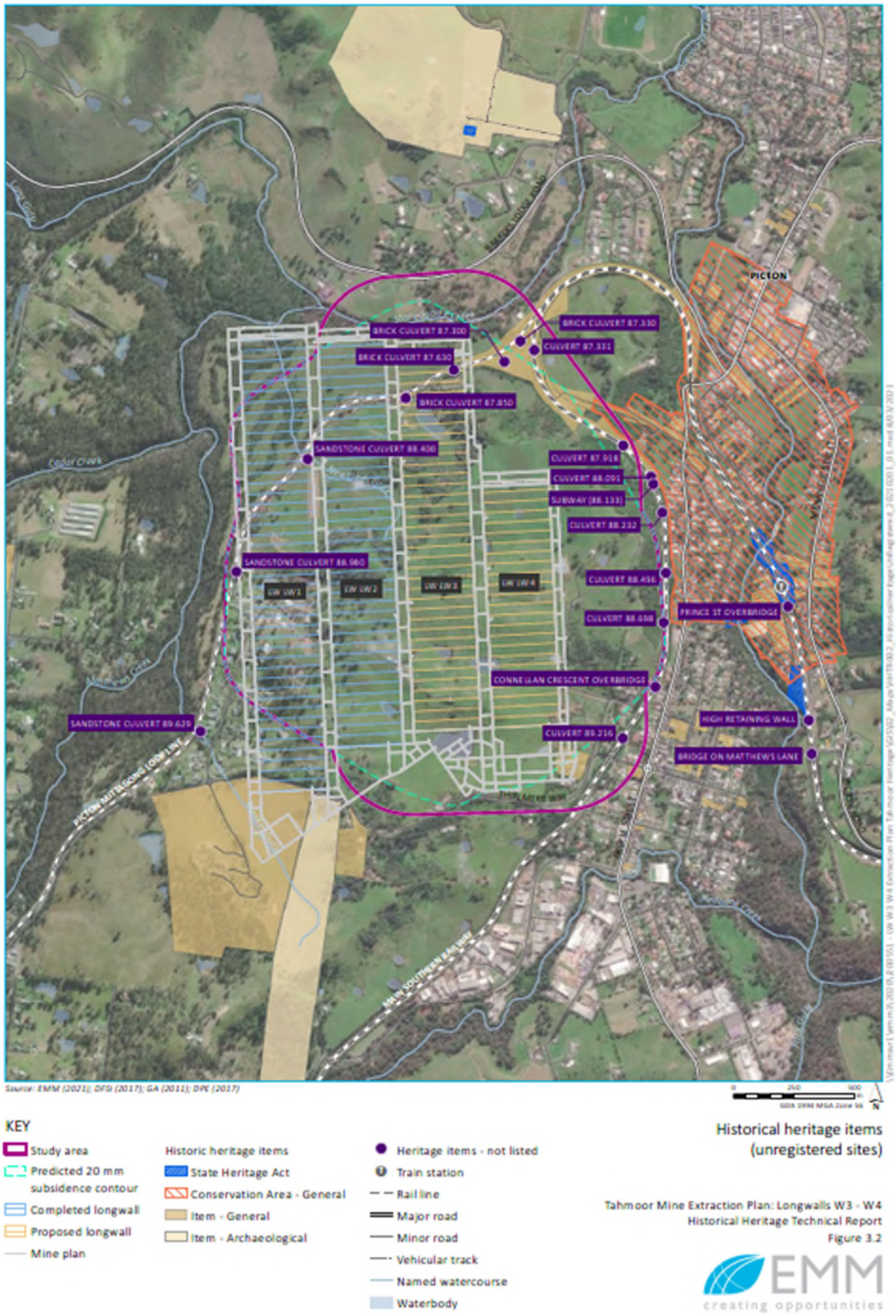


Figure 2-16 Historical Heritage Sites (unregistered sites) in the LW W3-W4 Study Area and Surrounds (Source LW W3-W4 Heritage Management Plan)

2.7 Built Features Monitoring

The LW W3-W4 Built Features Management Plan and associated sub-plans were prepared to manage the potential environmental consequences of LW W3-W4 extraction on built features in accordance with Condition 13H(vii)(b) of DA 67/98.

During this reporting period, the LW W3-W4 Subsidence Monitoring Program have been implemented to monitor subsidence impacts on infrastructure owned by Endeavour Energy (electrical infrastructure), Sydney Water (potable water infrastructure and sewer infrastructure), Bradcorp (sewer infrastructure), Jemena (gas infrastructure), Wollondilly Shire Council (roads, bridges and culverts), Telstra (telecommunications infrastructure), NBN (telecommunications infrastructure), ARTC (rail infrastructure), Transport Heritage NSW (rail infrastructure), Weatherboard House (historical building) and private property owners. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-4**.

A weekly review of the subsidence survey results during the reporting period has been completed by MSEC, in addition to end of panel reports following the completion of LW W3 and LW W4, and one post-mining report following the completion of LW W4 (referred documents provided in **Appendix A**).

The following sections summarise the observations made during the reporting period for built infrastructure. Performance against all built infrastructure TARPs for the reporting period are summarised in **Table 3-3** and **Table 3-4**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

A comparison between assessed and observed impacts to surface features is summarised in Table 3 of the MSEC LW W3 Subsidence Monitoring Report 27 and Table 3 of the MSEC LW W4 Subsidence Monitoring Report 20 (refer to **Appendix A**).

2.7.1 Local Roads and Built Structures

A number of impacts to local roads and built structures occurred during the reporting period, as summarised below:

- Stonequarry Creek Road - impacts to kerb drain (January 2022) and a property (March 2022);
- Connellan Crescent - impacts to road surface (March 2022);
- Carramar Close - impacts to road surface (March 2022);
- Booyong Close - impacts to a property (March 2022); and
- Thirlmere Way - impacts to road surface (March 2022).

Impacts noted during LW W3 and LW W4 extraction were noted to be largely related to large rain events (end February to early March 2022) and heavy traffic as opposed to subsidence.

Where appropriate, Tahmoor Coal has completed temporary repairs to roads and built structures within the Stonequarry Estate and Thirlmere Way. All residential impacts have been referred to SA NSW.

2.7.2 Main Southern Railway

Two Blue Level Triggers were noted on the Main Southern Railway during the reporting period (as discussed in **Section 3.2.10**), however these changes were also attributed to rainfall events rather than mine subsidence.

2.7.3 Picton Mittagong Loop Line

The two sandstone culverts on the PMLL that have been impacted by subsidence (as discussed in **Section 2.6**) will be remediated.

2.7.4 Transport NSW Infrastructure

Very gradual and minor closure was observed to develop across Stonequarry Creek at Victoria Bridge, which is located approximately 1000 metres from LW W3. The timing of the closure coincided with the final stages of mining LW W3, a period of heavy rainfall and completion of abutment strengthening works by TfNSW. Visual inspections did not identify any impacts associated with mine subsidence however the gap between the deck and the eastern abutment was observed to almost close during the mining of LW W3. The buffer board was replaced on 7 June 2022 and the gap reinstated. A gap of 35 mm was measured between the structural cross beam and abutment on 10 June. The gap has gradually reduced over time to 19 mm. Rates of change showed a reduction throughout the remainder of and after LW W4 mining completion. TfNSW has agreed to continue surveys on a monthly period, unless adverse changes are observed. Automated, continuous monitoring of GNSS units and laser distance meters will continue to monitor continuously and results will be reported once a month.

2.7.5 Other Built Features

No other subsidence impacts to built features were observed during this reporting period.

2.8 Public Safety Monitoring

The LW W3-W4 Public Safety Management Plan were prepared to manage the potential consequences as a result of LW W3-W4 extraction on public safety within the Study Area in accordance with Condition 13H(vii)(g) of DA 67/98.

As noted in **Section 1.3** of this report, management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan. Monitoring of cliffs, rock outcrops and steep slopes and other landscape features has been conducted for the reporting period in accordance with the LW W1-W2 Land Management Plan and LW W3-W4 Land Management Plan (refer to **Section 2.4** for a summary of monitoring results). In addition, monitoring of infrastructure items has also been conducted for the reporting period in accordance with the LW W3-W4 Built Features Management Plan (refer to **Section 2.7** for a summary of monitoring results).

No subsidence impacts were identified during the reporting period that were considered to pose a risk to public safety.

3 Overview of Impacts and Actions

3.1 Summary of Impacts

This section provides a comprehensive summary of all impacts during the reporting period, including a revised characterisation according to the relevant TARPs (if required).

Table 3-1 and **Table 3-2** provides a summary of the TARP levels that support the LW W3-W4 Extraction Plan. A summary of monitoring results for relevant TARPs is given in **Table 3-3** and **Table 3-4**. A full list of TARPs for environmental features that are applicable is provided in Appendix D of the LW W3-W4 Extraction Plan.

Table 3-1 Risk Levels for Environmental Feature TARPs

Risk Level	Trigger Description
Level 1	Normal – Operations within predicted impacts.
Level 2	Within Prediction – Operations within predicted impacts but exceeds or potentially exceeds predictions.
Level 3	Almost Exceeds Prediction – Operations within predicted impacts but are likely to almost exceed predictions.
Level 4*	Exceeds Prediction – Operations exceed predicted impact.

Note: * Level 4 is only used in the Water Management Plan TARPs.

Table 3-2 Trigger Levels for Railway Features (applicable to Picton-Mittagong Loop Line, Main Southern Railway, Transport for NSW, and Stonequarry Creek Rockbar features)

Trigger Level	Trigger Description
Green	Observations within predictions. Operate as normal.
Blue	Observations outside predictions but within operating tolerance. Investigate cause. Some action may be required to prevent operating restrictions.
Yellow	Restrictions on operations. Action required. Appropriate speed restriction applied until altered to Green or Blue level.
Red	Stop trains until altered to Green or Blue level.

As all results during this report period are consistent with the current TARPs, a revision of the TARPs for environmental features is not considered necessary at this point in time.

Table 3-3 Summary of TARP Triggers for January to June 2022

Aspect	Feature	Corresponding Management Plan and TARP	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022
Surface Water	Stonequarry Creek flow	Water Management Plan – Downstream reduction in catchment flow rate in Stonequarry Creek at Picton Gauging Station (GS212053)	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]
	Pool water level	Water Management Plan – Impact to pool water level	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.
	Natural drainage behaviour	Water Management Plan – Impact to pool level, natural drainage behaviour or overland connected flow	LEVEL 3 TRIGGERED[2] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) in Stonequarry Creek.	LEVEL 3 TRIGGERED[2] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) in Stonequarry Creek.	NA - Monitoring during March 2022 was unable to be obtained at monitoring site SB (Pool SR17) in Stonequarry Creek due to high water flow over the rockbar. All other sites did not note any impacts to natural drainage behaviour.	LEVEL 3 TRIGGERED[2] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) in Stonequarry Creek.	NA - Monitoring during May 2022 was unable to be obtained at monitoring site SB (Pool SR17) in Stonequarry Creek due to high water flow over the rockbar. All other sites did not note any impacts to natural drainage behaviour.	LEVEL 3 TRIGGERED[2] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) in Stonequarry Creek.
	Flood levels	Water Management Plan – Impact to flood levels	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.
	Stream water quality	Water Management Plan – Stream water quality impact	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred in CB (Al), SC2 (Al), SC (Al) and SD (Al).	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred in CG (Al).	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred at CA (Al), CG (Al), SC2 (Al), SC (Al) and SD (Al).	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred at CG (Al), SC2 (Al) and SC (Al).	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred at CG (Al), SC2 (Al) and SC (Al).	LEVEL 2 TRIGGERED[3] Surface water quality triggers occurred at CG (Al).
Groundwater	Groundwater bore level	Water Management Plan – Groundwater levels at monitoring bores and private groundwater bores	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometers P12C and P16C.	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometers P12C and P16C.	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometers P12C and P16C.	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometers P12C and P16C.	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometer P16C.	LEVEL 3 TRIGGERED[4] Water level trigger occurred at piezometer P16C.
			LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometers P16B.	LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometers P16B.	LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometer P16B.	LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometer P16B.	LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometers P12C and P16B.	LEVEL 2 TRIGGERED[5] Water level trigger occurred at piezometers P12C and P16B.
	Shallow groundwater pressures	Water Management Plan – Shallow groundwater pressures at VMPs TNC036, TNC040, and TNC034	LEVEL 4 TRIGGERED[6] Depressurisation trigger occurred at TNC36 (intakes 97 mbgl).	LEVEL 4 TRIGGERED[6] Depressurisation trigger occurred at TNC36 (intakes 97 mbgl).	LEVEL 3 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 97 mbgl).	LEVEL 3 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 97 mbgl).	LEVEL 3 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 97 mbgl).	LEVEL 3 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intake 97 mbgl).
			LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation trigger occurred at TNC36 (intake 169 mbgl).
	Deep groundwater pressures	Water Management Plan – Deep groundwater pressures at VMPs TNC036, TNC040, and TNC043	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[9] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).

Aspect	Feature	Corresponding Management Plan and TARP	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022
	Groundwater quality	Water Management Plan – Groundwater quality at monitoring bores and private groundwater bores	POTENTIAL LEVEL 4 TRIGGERED[10] Groundwater quality triggers occurred in P15A (Sr), GW115860 (EC and Ba). LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred in P12B (pH upper), P14B (Al), GW104090 (Ba, Sr), GW105228 (Ba), GW072402 (Ba).	POTENTIAL LEVEL 4 TRIGGERED[10] Groundwater quality triggers occurred in P15A (Sr). LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred in P12A (Cu, Pb), P12B (pH upper), P14A (Li), P14C (Al), P15B (Sr), P15A (EC), P15C (Sr, Al), P15D (Fe, Ba), P16B (Sr).	POTENTIAL LEVEL 4 TRIGGERED[10] Groundwater quality triggers occurred at P12B (pH upper), P15A (Sr). LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred at P12B (Li), P15A (EC), P15B (EC), P15C (Sr, Mn), P16B (Fe).	POTENTIAL LEVEL 4 TRIGGERED[10] Groundwater quality triggers occurred at P12B (pH upper), P15A (Sr). LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred at P12B(Al), P15A (EC), P15B (EC, Zn, Sr), P15D (Fe), GW115860 (EC)	POTENTIAL LEVEL 4 TRIGGERED[10] Groundwater quality triggers occurred at P12B (pH upper), P15A (Sr). LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred at P14A (Zn), P14C (Zn), P14D (Zn), P15A (EC), P15B (EC, Zn), P15C (Fe), P15D (Fe), P16A (Zn), P16B (Zn, Li), P16C (Zn)	LEVEL 2 TRIGGERED[11] Groundwater quality triggers occurred at P12C (Fe, Mn), P14A (Al), P15A (Mn, Li, Sr), P15B (EC, Sr), P15C (EC, Fe, Sr), P15D (EC, Fe, Mn), P16A (pH upper), P16C (Zn, Al)
Landscape	Cliff lines	Land Management Plan – Cliff line damage or instability	NR – Next 3-monthly inspection of cliffs due in April 4022.	NR – Next 3-monthly inspection of cliffs due in April 2022.	NA – No inspection completed in March 2022 due to heavy rainfall.	No signs of cliff line damage or instability	NR – Next quarterly inspection due in July 2022.	NR – Next quarterly inspection due in July 2022.
	Steep Slopes	Land Management Plan – Steep slope damage or instability	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	NA – No inspection completed in March 2022 due to heavy rainfall.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	NA – No inspection completed in June 2022 due to heavy rainfall.
	Surface cracking	Land Management Plan – Surface cracking (excluding railway corridor)	No signs of change in the areas inspected that could be attributed to mine subsidence.	No signs of change in the areas inspected that could be attributed to mine subsidence.	NA – No inspection completed in March 2022 due to heavy rainfall.	No signs of change in the areas inspected that could be attributed to mine subsidence.	No signs of change in the areas inspected that could be attributed to mine subsidence.	NA – No inspection completed in June 2022 due to heavy rainfall.
	Dams (monthly)	Water Management Plan – Impacts to dams	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	NA – No inspection completed in March 2022 due to heavy rainfall.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	NA – No inspection completed in June 2022 due to heavy rainfall.
	Dams (weekly)	Water Management Plan – Impacts to dams	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	NA – No inspection completed in March 2022 due to heavy rainfall.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	
Agricultural Land	Agricultural Land	Land Management Plan – Agricultural land	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.
Aquatic Ecology	Macroinvertebrates	Biodiversity Management Plan – Decline or significant negative change in macroinvertebrate indicators.	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required till Autumn 2022.	Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.
		Biodiversity Management Plan – Reduction in aquatic habitat through loss of pools or associated reduction in water quality (AURIVAS habitat assessment)	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required till Autumn 2022.	No signs of mining impact resulting in a reduction in aquatic habitat.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.
Terrestrial Ecology	Amphibians	Biodiversity Management Plan – Decline in amphibian populations within watercourses of the Study Area	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required in Autumn 2022.	No signs of subsidence impacts to amphibian populations.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.

Aspect	Feature	Corresponding Management Plan and TARP	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022
	Riparian Vegetation	Biodiversity Management Plan – Dieback of riparian vegetation within watercourses of the Study Area	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required till Autumn 2022.	NR – Monitoring next required in Autumn 2022.	No signs of subsidence impacts to riparian vegetation.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.
Aboriginal Heritage	Grinding grooves, scarred tree	Heritage Management Plan – Aboriginal heritage	NR – No monitoring required till LW W3 is finished.	NR – No monitoring required till LW W3 is finished.	NR – No monitoring required till LW W3 is finished.	No signs of change at SR17 (grinding groove site) or scarred tree.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.
	SR17 Rockbar	Stonequarry Creek Rockbar Management Plan	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar.
			BLUE TRIGGER High resolution closure lines across the rockbar were noted to have extended.	BLUE TRIGGER High resolution closure lines across the rockbar were noted to have extended. Relative 3D surveys noted measured strains.	BLUE TRIGGER High resolution closure lines across the rockbar noted.	BLUE TRIGGER High resolution closure lines across the rockbar noted.	BLUE TRIGGER High resolution closure lines across the rockbar noted.	BLUE TRIGGER High resolution closure lines across the rockbar noted.
Historical Heritage	Railway Culverts	Heritage Management Plan	NR – No monitoring required till LW W3 is finished.	NR – No monitoring required till LW W3 is finished.	NR – No monitoring required till LW W3 is finished.	LEVEL 3 TRIGGERED[12] LW W2 End of Panel Monitoring confirmed cracking and spalling at sandstone culverts at 88.980 km and 88.400 km exceeds prediction. LW W3 End of Panel Monitoring did not note any additional impacts.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.
	Weatherboard House	Heritage Management Plan	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.
Built Features	Picton-Mittagong Loop Line	Picton-Mittagong Railway Management Plan	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.
	Main Southern Railway	Main Southern Railway Management Plan	BLUE TRIGGER Ballast Top Subway (86.838 km) – Small increase in closure near the top of the arch on the Up side.	BLUE TRIGGER Ballast Top Subway (86.838 km) – Small increase in closure near the top of the arch on the Up side.	BLUE TRIGGER Picton Tunnel (87.85 km) – Increasing change in Cant observed at southern end of Tunnel.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Electricity Infrastructure	Endeavour Energy Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Gas Infrastructure	Jemena Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Potable Water	Sydney Water Potable Water Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Sewerage Infrastructure	Stonequarry Creek Sewer Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	**Minor settlement of backfill material following rainfall and minor erosion hole (not mining related).**	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.

Aspect	Feature	Corresponding Management Plan and TARP	January 2022	February 2022	March 2022	April 2022	May 2022	June 2022
	Telecommunications	Telstra Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
		NBN Co Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Local roads, bridges and culverts	Wollondilly Shire Council Management Plan	**Impact to concrete kerb drain on Stonequarry Creek Road (Report 17).**	No impacts observed in areas monitored this month.	Impacts to pavement at Connellan Crescent, as well as deterioration of Thirlmere Way road surface (Report 22). Impacts to Carramar Close, Thirlmere Way and other streets due to heavy rainfall (Report 23 for LW W3).	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	Deterioration of Connellan Crescent road surface noted (Report 2), likely due to wet weather.
	Built Structures	Built Structures Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	**Impacts to properties on Stonequarry Creek Road and Booyong Close (Report 23)**	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	NR – No structures located above LW W4.
	Transport for NSW Infrastructure	Transport for NSW Management Plan	No impacts observed in areas monitored this month.	No impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.

Notes:

NR – Monitoring not required this month.

NA – Monitoring data not available as monitoring not completed this month or reporting not yet available.

[1] Stonequarry Creek flow assessment unable to be completed due to invalidation of current model calibration as a result of revision of the rating curve for Stonequarry Creek at Picton (GS 212053) in July 2020 and change of streamflow records from December 2015.

[2] Level 3 TARP for natural drainage behaviour (LW W3-W4 Water Management Plan): Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking in account climatic conditions and observations during baseline monitoring period.

[3] Level 2 TARP for stream water quality (LW W3-W4 Water Management Plan): The trigger for pH, EC or dissolved metals defined below occurs in one month, and there is no visual evidence of an increase in iron precipitation that was not observed in the baseline period.

[4] Level 3 TARP for groundwater bore level (LW W3-W4 Water Management Plan): Water level declines below the water level of TARP Significance Level 3 (calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[5] Level 2 TARP for groundwater bore level (LW W3-W4 Water Management Plan): Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[6] Level 4 TARP for shallow groundwater pressures (LW W3-W4 Water Management Plan): Water level reduction greater than the maximum modelled drawdown following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or anthropogenic factors.

[7] Level 3 TARP for shallow groundwater pressures (LW W3-W4 Water Management Plan): Water level declines below the water level of TARP Significance Level 3 following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[8] Level 2 TARP for shallow groundwater pressures (LW W3-W4 Water Management Plan): Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than 200 m depth) following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[9] Level 2 TARP for deep groundwater pressures (LW W3-W4 Water Management Plan): Calculated or observed drawdown (based on 2009 – 2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.

[10] Level 4 TARP for groundwater quality (LW W3-W4 Water Management Plan): Medium to long term increase in salinity and/or metals or a change in pH outside of baseline variability with the effect persisting for greater than 3 months or after a significant rainfall recharge event AND the reduction in water quality is determined not to be controlled by climatic or anthropogenic factors.

[11] Level 2 TARP for groundwater quality (LW W3-W4 Water Management Plan): Short term increase (<3 months) in salinity and/or metals, or change in pH outside of baseline variability. The effect does not persist after a significant rainfall recharge event. AND/OR a similar trend or response has been noted at other monitored bores or private groundwater bores.

[12] Level 3 TARP for historical heritage (LW W3-W4 Heritage Management Plan): Historical heritage site monitoring indicates environmental consequences to heritage site(s).

Table 3-4 Summary of TARP Triggers for July to December 2022

Aspect	Feature	Corresponding Management Plan and TARP	July 2022	August 2022	September 2022	October 2022	November 2022	December 2022
Surface Water	Stonequarry Creek flow	Water Management Plan – Downstream reduction in catchment flow rate in Stonequarry Creek at Picton Gauging Station (GS212053)	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]	NA – Assessment unable to be completed due to invalidation of current model calibration.[1]
	Pool water level	Water Management Plan – Impact to pool water level	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	No pool water level triggers occurred.	LEVEL 3 TRIGGERED[2] Pool water level at monitoring site CB (Pool CR14) for the period 9 to 30 December 2022.
	Natural drainage behaviour	Water Management Plan – Impact to pool level, natural drainage behaviour or overland connected flow	NA - Monitoring during July 2022 was unable to be obtained at monitoring site SB (Pool SR17) in Stonequarry Creek due to high water flow over the rockbar. All other sites did not note any impacts to natural drainage behaviour.	LEVEL 3 TRIGGERED[3] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	LEVEL 3 TRIGGERED[3] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	LEVEL 3 TRIGGERED[3] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	LEVEL 3 TRIGGERED[3] Natural drainage behaviour trigger occurred at monitoring site SB (Pool SR17) and Pool SR20 in Stonequarry Creek.	NA – Monitoring is not required till February 2023 in accordance with the post-mining monitoring schedule.
	Flood levels	Water Management Plan – Impact to flood levels	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	NR – Flood modelling required after completion of LW W4.	No dwellings that were outside the pre-mine 1% AEP flood extent are within the post-mine 1% AEP flood extent.
	Stream water quality	Water Management Plan – Stream water quality impact	LEVEL 2 TRIGGERED[4] Surface water quality triggers occurred at CG (Al), SC2 (Al) and SC (Al).	LEVEL 2 TRIGGERED[4] Surface water quality triggers occurred at SD (pH).	LEVEL 2 TRIGGERED[4] Surface water quality triggers occurred at SD (pH).	LEVEL 2 TRIGGERED[4] Surface water quality triggers occurred for aluminium at MC1, CA, CB, CG, SC2, SC and SD.	LEVEL 2 TRIGGERED[4] Surface water quality triggers occurred for aluminium at CG, SC2, SC and SD.	No stream water quality triggers occurred.
Groundwater	Groundwater bore level	Water Management Plan – Groundwater levels at monitoring bores and private groundwater bores	LEVEL 3 TRIGGERED[5] Water level trigger occurred at piezometer P16C. LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C and P16B.	LEVEL 3 TRIGGERED[5] Water level trigger occurred at piezometer P16C. LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C and P16B.	LEVEL 3 TRIGGERED[5] Water level trigger occurred at piezometer P16C. LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C and P16B.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C, P16B and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C, P16B and P16C.	LEVEL 2 TRIGGERED[6] Water level trigger occurred at piezometers P12C, P16B and P16C.
	Shallow groundwater pressures	Water Management Plan – Shallow groundwater pressures at VMPs TNC036, TNC040, and TNC034	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).	LEVEL 2 TRIGGERED[7] Depressurisation trigger occurred at TNC36 (intakes 97 and 169 mbgl).
	Deep groundwater pressures	Water Management Plan – Deep groundwater pressures at VMPs TNC036, TNC040, and TNC043	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intakes 214 and 412.5 mbgl).	LEVEL 2 TRIGGERED[8] Depressurisation triggers occurred in TNC36 (intake 412.5 mbgl).

Aspect	Feature	Corresponding Management Plan and TARP	July 2022	August 2022	September 2022	October 2022	November 2022	December 2022
	Groundwater quality	Water Management Plan – Groundwater quality at monitoring bores and private groundwater bores	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (Pb, Al), P12B (Fe), P12C (Fe, Mn), P15A (Mn, Li, Sr), P15B (Sr), P15C (Sr), P15D (Fe), P16C (Cu, Zn), GW105228 (Li), GW115860 (EC, Sr)	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (Pb, Al), P12B (Fe), P12C (Fe, Mn), P14A (Cu), P14C (Cu), P14D (Fe, Cu), P15A (Mn, Li, Sr), P15B (Sr), P15C (As, Sr), P15D (Fe), P16A (Cu), P16C (Cu, Zn)	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (Pb, Al), P12B (Fe), P12C (Fe, Mn), P14A (Cu), P14B (Li, Ba, Sr), P14D (Cu), P15A (Mn, Li, Sr, EC), P15B (EC, Cu), P15C (EC, Al, Sr), P15D (Fe), P16C (Cu, Zn, Al)	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12A (Al), P12C (Mn), P14A (Cu), P14C (Cu), P15A (Sr, EC), P15B (Sr, EC), P16A (Cu, pH upper), P16B (EC), P16C (Cu, Zn, Sr), GW104090 (Sr, pH upper), GW115860 (pH upper), GW105228 (pH upper)	LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12C (Mn, Fe), P14A (Cu), P14D (Cu, Al), P15A (Sr, EC), P15B (Sr, EC), P15C (As), P15D (Mn), P16B (Cu, Sr, EC), P16C (Zn)	LEVEL 3 TRIGGERED[10] Groundwater quality trigger occurred at P16C (Zn). LEVEL 2 TRIGGERED[9] Groundwater quality triggers occurred at P12C (Mn, Fe), P14C (Cu), P15A (Sr), P15B (Sr), P15D (Cu), P16A (pH lower), P16B (Cu, Sr), P16C (Cu)
Landscape	Cliff lines	Land Management Plan – Cliff line damage or instability	NA – No inspection completed in July 2022 due to heavy rainfall.	No signs of cliff line damage or instability	NA – No further monitoring is required.	NA – No further monitoring is required.	NA – No further monitoring is required.	NA – No further monitoring is required.
	Steep Slopes	Land Management Plan – Steep slope damage or instability	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.	NR – Next quarterly inspection due in December 2022.	NR – Next quarterly inspection due in December 2022.	No signs of cracking or movement on steep slopes near structures in the areas inspected that could be attributed to mine subsidence.
	Surface cracking	Land Management Plan – Surface cracking (excluding railway corridor)	No signs of change in the areas inspected that could be attributed to mine subsidence.	No signs of change in the areas inspected that could be attributed to mine subsidence.	No signs of change in the areas inspected that could be attributed to mine subsidence.	NR – Next quarterly inspection due in December 2022.	NR – Next quarterly inspection due in December 2022.	No signs of change in the areas inspected that could be attributed to mine subsidence.
	Dams	Water Management Plan – Impacts to dams	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	No signs of change to farm dams inspected that could be attributed to mine subsidence.	NR – Next quarterly inspection due in December 2022.	No signs of change to farm dams inspected that could be attributed to mine subsidence.
Agricultural Land	Agricultural Land	Land Management Plan – Agricultural land	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	No signs of change since baseline at sites inspected.	NR – No monitoring required this month. Post-mining monitoring requires quarterly inspections.	NR – No monitoring required this month. Post-mining monitoring requires quarterly inspections.	No signs of change since baseline at sites inspected.
Aquatic Ecology	Macroinvertebrates	Biodiversity Management Plan – Decline or significant negative change in macroinvertebrate indicators.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.
		Biodiversity Management Plan – Reduction in aquatic habitat through loss of pools or associated reduction in water quality (AURIVAS habitat assessment)	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	No signs of mining impact resulting in a reduction in aquatic habitat.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.
Terrestrial Ecology	Amphibians	Biodiversity Management Plan – Decline in amphibian populations within watercourses of the Study Area	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	No signs of subsidence impacts to amphibian populations.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.
	Riparian Vegetation	Biodiversity Management Plan – Dieback of riparian vegetation within watercourses of the Study Area	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	NR – Monitoring next required in Spring 2022.	No signs of subsidence impacts to riparian vegetation.	NR – Monitoring next required in Autumn 2023.	NR – Monitoring next required in Autumn 2023.
Aboriginal Heritage	Grinding grooves, scarred tree	Heritage Management Plan – Aboriginal heritage	NR – No monitoring required till LW W4 is finished.	No signs of change at SR17 (grinding groove site) or scarred tree.	NR – No further monitoring is required as mining is complete in the Western Domain.	NR – No further monitoring is required as mining is complete in the Western Domain.	NR – No further monitoring is required as mining is complete in the Western Domain.	NR – No further monitoring is required as mining is complete in the Western Domain.

Aspect	Feature	Corresponding Management Plan and TARP	July 2022	August 2022	September 2022	October 2022	November 2022	December 2022
	SR17 Rockbar	Stonequarry Creek Rockbar Management Plan	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar. BLUE TRIGGER High resolution closure lines across the rockbar noted.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar. BLUE TRIGGER High resolution closure lines across the rockbar noted.	YELLOW TRIGGER Detailed visual inspection noted fractures on rockbar. BLUE TRIGGER High resolution closure lines across the rockbar noted.	NR – No further monitoring required.	NR – No further monitoring required.	NR – No further monitoring required.
Historical Heritage	Railway Culverts	Heritage Management Plan	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	LEVEL 3 TRIGGERED[11] No additional impacts to cracking on the portal faces of culverts at 88.980 km and 88.400 km. Cracking inside the barrel of culvert at 88.400 km noted following removal of RCP sleeves, attributed to Western Domain mining.	NR – No further monitoring required.	NR – No further monitoring required.
	Weatherboard House	Heritage Management Plan	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	NR – No monitoring required till LW W4 is finished.	No signs of change at Weatherboard House	NR – No further monitoring required.	NR – No further monitoring required.
Built Features	Picton-Mittagong Loop Line	Picton-Mittagong Railway Management Plan	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	Results are within survey tolerance. Visual inspections did not identify any issues.	NR – No further monitoring required.
	Main Southern Railway	Main Southern Railway Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.
	Electricity Infrastructure	Endeavour Energy Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Gas Infrastructure	Jemena Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Potable Water	Sydney Water Potable Water Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Sewerage Infrastructure	Stonequarry Creek Sewer Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Telecommunications	Telstra Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
		NBN Co Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Local roads, bridges and culverts	Wollondilly Shire Council Management Plan	Deterioration of road surves along Connellan Crescent, Rumker Street and Star Street due to wet weather (Report 5 and 8).	No mining impacts observed in areas monitored this month.	Deterioration of the road surface on Rumker Street noted due to heavy vehicle traffic adjacent to a development site (Report 16).	Deterioration of the road surface along Thirlmere Way due to weather and traffic (Report 18).	No mining impacts observed in areas monitored this month.	NR – No further monitoring required.
	Built Structures	Built Structures Management Plan	NR – No structures located above LW W4.	NR – No structures located above LW W4.	NR – No structures located above LW W4.	NR – No structures located above LW W4.	NR – No structures located above LW W4.	NR – No further monitoring required.
	Transport for NSW Infrastructure	Transport for NSW Management Plan	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.	No mining impacts observed in areas monitored this month.

Notes:

NR – Monitoring not required this month.

NA – Monitoring data not available as monitoring not completed this month or reporting not yet available.

[1] Stonequarry Creek flow assessment unable to be completed due to invalidation of current model calibration as a result of revision of the rating curve for Stonequarry Creek at Picton (GS 212053) in July 2020 and change of streamflow records from December 2015.

[2] Level 3 TARP for pool water level (LW W3-W4 Water Management Plan): The recorded water level has declined, although not atypically, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) AND the above has not occurred at one of the upstream pools (beyond mining effects).

[3] Level 3 TARP for physical features and natural behaviour of pools (LW W3-W4 Water Management Plan): Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking in account climatic conditions and observations during baseline monitoring period.

[4] Level 2 TARP for stream water quality (LW W3-W4 Water Management Plan): The trigger for pH, EC or dissolved metals defined below occurs in one month, and there is no visual evidence of an increase in iron precipitation that was not observed in the baseline period.

[5] Level 3 TARP for groundwater bore level (LW W3-W4 Water Management Plan): Water level declines below the water level of TARP Significance Level 3 (calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[6] Level 2 TARP for groundwater bore level (LW W3-W4 Water Management Plan): Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[7] Level 2 TARP for shallow groundwater pressures (LW W3-W4 Water Management Plan): Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than 200 m depth) following the commencement of extraction at LW W1 (and LW W2, W3 and W4) AND the reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[8] Level 2 TARP for deep groundwater pressures (LW W3-W4 Water Management Plan): Calculated or observed drawdown (based on 2009 – 2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.

[9] Level 2 TARP for groundwater quality (LW W3-W4 Water Management Plan): Short term increase (<3 months) in salinity and/or metals, or change in pH outside of baseline variability. The effect does not persist after a significant rainfall recharge event. AND/OR a similar trend or response has been noted at other monitored bores or private groundwater bores.

[10] Level 3 TARP for groundwater quality (LW W3-W4 Water Management Plan): Short term increase (<3 months) in salinity and/or metals, or change in pH outside of baseline variability. The effect does not persist after a significant rainfall recharge event. AND/OR the change in water quality is determined not to be controlled by climatic or anthropogenic factors.

[11] Level 3 TARP for historical heritage (LW W3-W4 Heritage Management Plan): Historical heritage site monitoring indicates environmental consequences to heritage site(s).

3.2 Summary of Actions

During the reporting period, there were ten (10) environmental aspects that were associated with TARP triggers. This section provides a summary of actions resulting from triggers being met in the TARPs, as well as required remediation actions. All triggers have been reviewed by the Environmental Response Group / Structural Response Group / specialists to determine any further actions (if required).

3.2.1 Pool Water Level TARP – Level 3 Triggers for Pool Water Level Reduction

3.2.1.1 Background

The following TARP trigger occurred during the current reporting period for water level (refer **Appendix B**):

- Monitoring Site CB – Level 3 TARP triggers occurred at pool CR14 (Cedar Creek) between 9 to 30 December 2022.

Water level decline at monitoring site CB (pool CR14) below the baseline minimum from 9 to 30 December 2022 by a maximum of 0.46 m. The recorded water level declined, although not atypically, below the recorded baseline minimum level (for more than one 24 hour period) during these periods and the same did not occur at an upstream pool (beyond mining effects). Therefore, in accordance with the LW W3-W4 Water Management Plan, a Level 3 TARP significance in relation to pool water level decline at monitoring site CB has been derived for this period.

Further discussion of this trigger is provided in **Section 2.2.2** and the Surface Water Review (refer **Appendix B**).

3.2.1.2 Actions Completed

The following actions have been completed in light of the Level 3 TARP trigger during this reporting period:

- *Continue monitoring as per monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Continue monthly review of data* – quarterly result analysis and reporting in accordance with the post-mining monitoring program;
- *Review relevant surface water level, groundwater level and streamflow data to assess comparative trends* – completed as part of this report (refer to **Appendix B**), which suggested that gaining conditions (groundwater contribution to the surface water system) were occurring during this time period in the vicinity of monitoring site CB (pool CR14);
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed and included a discussion of this TARP trigger;
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger; and
- *Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached* – considered as part of the Surface Water Review (**Appendix B**). Given the decline in water level at monitoring site CB has occurred intermittently since late 2020 and there has been negligible indication of an associated impact to downstream monitoring sites, increased frequency of monitoring is not deemed to be required. The water level records for this site will continue to be monitored in accordance with the LW W3-W4 Water Management Plan.

Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021, including the current report provided in **Appendix B**. These reports include a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and any recommendations in relation to ongoing monitoring or corrective actions.

3.2.1.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan, and the next 3-monthly Monitoring Report will be provided to DPE in June 2023.

3.2.2 Natural Drainage Behaviour TARP - Level 3 Trigger for Fracturing

3.2.2.1 Background

The following TARP triggers occurred during the current reporting period for natural drainage behaviour (refer **Appendix B**):

- Rockbar SR17 – Level 3 TARP trigger for laminar fracturing on the SR17 rockbar from November 2021. It is noted that due to high water flow in Stonequarry Creek, observation at the rockbar was unable to be made during the March, May and July 2022 monitoring events; and
- Rockbar SR20 – Level 3 TARP trigger for fracturing on a rockbar at SR20 from August 2022.

A detailed discussion of these triggers is provided in the Surface Water Review (refer **Appendix B** and **Appendix C**), and a summary is provided below.

Rockbar SR17 was initially reported at a Level 3 TARP trigger on 28 October 2021 due to surficial fracturing of the controlling rockbar (*pers. comm.* MSEC). Brienen Environment & Safety reported this as laminar fracturing and extension of a natural crack in the rockbar following their inspection on 17 November 2021.

Since the initial observation of the laminar fracturing, no gas release or iron precipitation has been noted during visual inspections. In addition, the continuous water level records and manual water levels indicate that the fracturing of the rockbar has not resulted in an impact to the pool water holding capacity. Consequently, a Level 3 trigger significance in relation to physical features and natural behaviour of rockbar SR17 has been derived for this observation (17 November 2021 to current).

Rockbar SR20 was reported by Brienen Environment & Safety (BES, 2022) as a Level 3 significance due to surface fracturing (Natural Drainage Behaviour TARP - Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions) AND no reduction in pool water level, drainage or overland connected flow, taking in account climatic conditions and observations during baseline monitoring period), and was first observed on 18 August 2022. No gas release or iron precipitation were observed during the visual inspections and actions completed are discussed below.

3.2.2.2 Actions Completed

In accordance with the Stonequarry Creek Rockbar Management Plan, mining of LW W3 was temporarily suspended on 28 October 2021 following initial identification of surficial fracturing of the rockbar at pool SR17. Subsequently, the Subsidence Technical Committee convened to review the required actions and responses in accordance with the Stonequarry Creek Rockbar Management Plan TARP. Additional monitoring, inspection and reporting was then implemented in accordance with the TARP. Subsequent visual inspections identified an increase in the extent of fracturing. On 1 November 2021, approval was granted to recommence mining of LW W3 subject to the continuation of monitoring at an increased frequency and initial progress of the longwall capped to a maximum of 50 metres per week.

It is noted that this fracturing has not affected the water level at Pool SR17.

Geotechnical reviews of the rockbar identified that:

- The fractures occurred in thinly bedded, laminated sandstone and were considered a response to mining related differential compression in combination with the presence of existing delamination in the rockbar surface formed by natural weathering processes;
- There was no evidence of new cracking outside the existing fractured area;

- The extension of the fractured area was associated with a veneer of sandstone sitting on top of competent sandstone;
- The fracturing was considered consistent with subsidence monitoring results and was effectively an extension of the original fracture site; and
- The fracturing provided a release for mining induced stress and was confined to the sheeted sandstone above the competent sandstone.

The following actions have been completed in light of the Level 3 TARP trigger during this reporting period:

- *Continue monitoring as per monitoring program* - monthly monitoring was ongoing during the reporting period, during both the active subsidence period and the post-mining period. The frequency of monitoring going forward will be quarterly during the post-mining monitoring phase;
- *Continue monthly review of data* – completed on a monthly basis during the reporting period. Reporting will now be completed on a quarterly basis during the post-mining stage;
- *Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climate:*
    - Rockbar SR17 – In response to the Level 3 trigger exceedances in relation to physical features at rockbar SR17, the Environmental Response Group convened and the surface water level data was reviewed. The water level records for monitoring site SB indicated that the surficial fracturing of the rockbar has not resulted in an impact to the pool water holding capacity. The water levels recorded at monitoring site SB (rockbar SR17) have not declined below the baseline minimum water level and no atypical water level behaviour was recorded at this site between 1 October 2021 and 7 September 2022 (extent of available monitoring data); and
    - Rockbar SR20 – In response to the Level 3 trigger exceedances in relation to physical features at rockbar SR17, the Environmental Response Group convened and surface water level data, pre-mining drone footage and subsidence measurements were reviewed. From a review of pre-mining drone footage, it was determined that one of the fractures was initially observed in July 2019 during pre-mining survey. The water level records for monitoring sites SB (upstream), SC and SD (downstream) indicated that the fracturing has not resulted in an impact to pool water holding capacity. The water level recorded at monitoring sites SB, SC and SD has not declined below the baseline minimum water level during the reporting period. Additionally, MSEC indicated that there was no measurable change in closure associated with the fracturing based on the latest survey.
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger; and
- *Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached* - an increase in the frequency of visual inspections and review of data in relation to rockbar physical features, natural drainage behaviour and pool water level is not considered to be required at this stage. However monthly visual inspections have continued into the post-mining period, which is an increase in the monitoring frequency for this stage compared to that which has been described in the WMP.

3.2.2.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan, with monthly visual inspections to continue at rockbars SR17 and SR20.

3.2.3 Surface Water Quality TARP – Level 2 Trigger for Surface Water Quality

3.2.3.1 Background

The following TARP triggers occurred during the current reporting period for surface water quality (refer **Appendix B**):

- Monitoring Site CA – Level 2 TARP trigger for Aluminium in October 2022;
- Monitoring Site CB – Level 2 TARP trigger for Aluminium in January, March and October 2022;
- Monitoring Site CG – Level 2 TARP trigger for Aluminium in February to July, and October to November 2022;
- Monitoring Site SC2 – Level 2 TARP trigger for Aluminium in January, March to May and July and October to November 2022;
- Monitoring Site SC – Level 2 TARP trigger for Aluminium in January, March to May, July, and October to November 2022;
- Monitoring Site SD – Level 2 TARP trigger for high pH levels in August 2022, low pH levels in September 2022, and Aluminium in January, March, October and November 2022; and
- Monitoring Site MC1 – level 2 TARP trigger for Aluminium in October 2022.

As discussed in **Section 2.2.4**, the elevated concentrations of dissolved aluminium across Matthews, Cedar and Stonequarry Creek were noted to be catchment wide and related to the prevailing climatic conditions. In addition, the pH variability at Monitoring Site SD appeared to be anomalous and may be related to instrumentation or field measurement issues.

A detailed discussion of these triggers is provided in the Surface Water Review documents (refer **Appendix B**), and a summary is provided in **Section 2.2.4**.

3.2.3.2 Actions Completed

The following actions have been completed in response to the Level 2 TARP triggers during this reporting period:

- *Continue monitoring as per monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Continue monthly review of data including analysis of water quality trend along creek (upstream to downstream) to identify spatial changes* – completed on a monthly basis during the reporting period. Reporting will now be completed on a quarterly basis during the post-mining stage;
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed following the reporting of this data, including discussions of these TARP triggers; and
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger.

3.2.3.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan.

3.2.4 Groundwater Bore Level TARP – Level 2 and 3 Triggers for Open Standpipe Piezometer Groundwater Levels

3.2.4.1 Background

During this reporting period, a number of groundwater intakes in OSPs have recorded reduced water level elevation below the baseline range. This was noted in the following OSP intakes (refer to **Appendix D**):

- P12C – Level 3 TARP trigger from January to April 2022, and Level 2 TARP trigger from May to December 2022;
- P16B – Level 2 TARP trigger from the entire reporting period; and

- P16C – Level 3 TARP trigger from January to September 2022, and Level 2 TARP trigger from October to December 2022.

During the reporting period, groundwater level at this bore recovered above the TARP Level 3 (175 mAHD) in May 2022 which reduced the TARP to Level 2 (179.5 mAHD). At the end of the reporting period, groundwater level at P12C was stable at 178.4 mAHD, just below the TARP level 2.

P16B recorded a Level 4 TARP trigger from December 2020 to August 2021. During the reporting period, a TARP Level 2 applied at P16B for the entire reporting period. Groundwater levels are observed at 197.4 mAHD in December 2022, and a Level 2 TARP trigger could remain in the short to medium term as a long-term groundwater impact is likely at P16.

P16C recorded a Level 4 TARP trigger from December 2020 to August 2021. During the reporting period a Level 3 TARP trigger applied to P16C from January to September 2022, which was then reduced to a Level 2 TARP trigger in October 2022. Groundwater levels were observed at 197.4 mAHD in December 2022, and a Level 2 TARP trigger could remain in the short to medium term as a long-term groundwater impact is likely at P16.

3.2.4.2 Actions Completed

On 30 December 2020, Level 4 TARP triggers for the reduced water level elevations at P12C, P16B, P16C and TNC036 were notified to DPE and NRAR. This reduction was attributed to mining induced depressurisation of deeper groundwater aquifer, however this also correlated to a reduction in rainfall recharge events.

In light of the Level 4 TARP triggers, Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021. This Six Monthly Subsidence Impact Report includes this 3-monthly monitoring reporting. These reporting requirements include a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater, and any recommendations in relation to ongoing monitoring or corrective actions.

The following actions have been completed in light of the Level 2 and Level 3 TARP triggers during this reporting period:

- *Continue monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data and consideration of mining and external stresses* – monthly result analysis and reporting was completed during the mining period. Result analysis and report will be completed on a quarterly basis as monitoring has entered the post-mining stage;
- *Review relevant surface water level, groundwater level and streamflow data to assess comparative trends* – completed as part of 3-monthly Monitoring Reporting for surface water and groundwater. The next monitoring report will be provided to DPE in June 2023;
- *Compare against base case and deterministic model scenarios* – completed as part of the groundwater reports (**Appendix D**);
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers; and
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger.

It is noted that a drain to divert surface run-off was installed in early November 2022 at P16B and P16C along with re-sealing the monitoring bores so that that no surface water run-off flows into the bore.

3.2.4.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program, and the next 3-monthly Monitoring Report will be provided to DPE in June 2023.

3.2.5 Shallow Groundwater Pressures TARP – Level 2, 3 and 4 Triggers for Shallow Vibrating Wire Piezometer Groundwater Pressure

3.2.5.1 Background

During this reporting period, a number of groundwater intakes in shallow (<200 mbgl) Vibrating Wire Piezometers (VWPs) have recorded a trend of depressurisation below the baseline range. This trend has been noted in the following VWP intakes (refer to **Appendix D**):

- TNC036 HBSS-97m – Level 4 TARP trigger from January to February 2022, Level 3 TARP trigger from March to June 2022, and a Level 2 TARP trigger from July to December 2022; and
- TNC036 HBSS-169m – Level 2 TARP trigger from the entire reporting period.

At TNC036 HBSS-97m, groundwater levels declined marginally below the trigger TARP Level 4 (180 mAHD) for short periods of time (five days) in February 2022. A recovery of groundwater level at this intake was noted shortly after this trigger to a Level 2 TARP trigger in July 2022. Groundwater levels have remained below the threshold for TARP Level 2 till the end of the reporting period and are likely to reduce to a TARP Level 1 in the next reporting period.

At TNC036 HBSS-169m, groundwater levels remained below the trigger TARP Level 2 (192.5 mAHD) for the entire reporting period.

3.2.5.2 Actions Completed

On 30 December 2020, Level 4 TARP triggers for the reduced water level elevations at P13C, P16B, P16C and TNC036 were notified to DPE and NRAR. This reduction was attributed to mining induced depressurisation of deeper groundwater aquifer, however this also correlated to a reduction in rainfall recharge events. The Level 4 TARP triggers observed during this reporting period are a continuation of the trend as previously notified.

In light of the Level 4 TARP triggers, Tahmoor Coal have been providing quarterly (3-monthly) monitoring reports for surface water and groundwater as per the request by DPE on 25 June 2021. This report incorporates the 3-monthly monitoring reporting requirement, including a review and interpretation of monitoring data, assessment against performance measures and performance indicators for surface water and groundwater (Refer to **Section 2.2**; **Appendix B**; **Appendix D**), and any recommendations in relation to ongoing monitoring or corrective actions (**Section 2.3.5**).

The following actions have been completed in light of the Level 2, 3 and 4 TARP triggers during this reporting period:

- *Continue monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data and consideration of mining and external stresses* – monthly result analysis and reporting was completed during mining. Result analysis and report will be completed on a quarterly basis as monitoring has entered the post-mining stage;
- *Compare against base case and deterministic model scenarios* – completed as part of the Groundwater Report (**Appendix D**);
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers; and
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger.

3.2.5.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program, and the next 3-monthly Monitoring Report will be provided to DPE in June 2023.

3.2.6 Deep Groundwater Pressures TARP – Level 2 Trigger for Deep Vibrating Wire Piezometer Groundwater Pressure

3.2.6.1 Background

During this reporting period, groundwater intakes in deep (>200 mbgl) VWPs have recorded a trend of depressurisation below the baseline range. These trends have been noted in the following VWP intakes (refer to **Appendix D**):

- TNC036 BGSS-214m – Level 2 TARP triggered from January to November 2022; and
- TNC036 BGSS-412.5m – Level 2 TARP trigger from the full reporting period.

The groundwater level observed at TNC036-BGSS-214m exceeded the modelled drawdown from mid-2020 but remains within the 30 m predicted drawdown in October and November 2022, resulting in a TARP Level 2 exceedance. As of December 2022, the observed drawdown does not exceed the modelled drawdown resulting in a TARP Level 1.

3.2.6.2 Actions Completed

The following actions have been completed in light of the Level 2 TARP triggers during this reporting period:

- *Continue monitoring program* - monthly monitoring is ongoing according to the monitoring program;
- *Ongoing review of water level data* – monthly result analysis and reporting was completed during mining. Result analysis and report will be completed on a quarterly basis as monitoring has entered the post-mining stage;
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis, including the discussion of any groundwater level TARP triggers; and
- *Response as defined by Environmental Response Group* – there were no actions regarding this TARP trigger.

3.2.6.3 Proposed Actions

Groundwater monitoring will continue under the existing monitoring program.

3.2.7 Groundwater Quality TARP – 'Potential' Level 4 and 3 Triggers for Groundwater Quality

3.2.7.1 Background

The following potential Level 4 and 3 TARP triggers occurred during the current reporting period for groundwater quality:

- P12B – 'Potential' Level 4 TARP trigger for pH from March to May 2022;
- P15A – 'Potential' Level 4 TARP trigger for Strontium from January to May 2022;
- GW115860 – 'Potential' Level 4 TARP trigger for Electrical Conductivity and Barium in January 2022; and
- P16C – Level 3 TARP trigger for Zinc in December 2022.

A number of Level 2 TARP triggers occurred for groundwater quality (refer to **Table 3-3** and **Table 3-4**). These short-term increases in groundwater quality are considered to be due to natural fluctuations rather than mining related effects.

A summary of the water quality trends for potential Level 4 TARP triggers is provided in the section below. Further discussion of these triggers is provided in the groundwater report located in **Appendix D**.

Dissolved zinc concentrations at P16C triggered a Level 3 TARP trigger in December 2022, likely due to a natural fluctuation in groundwater quality and major flood events in 2022. A TARP Level 4 may be considered in the next review period if further increase in dissolved zinc concentrations is observed at P16C, and if similar increases in zinc concentrations above the trigger level are also seen at P16A and P16B.

3.2.7.2 Actions Completed

As discussed in the groundwater reports in **Appendix D**, the following actions were completed in response to the potential Level 4 TARP triggers for this reporting period:

- *Continue monitoring as per monitoring program* - monthly groundwater monitoring is ongoing according to the monitoring program;
- *Continue monthly review of data and consideration of mining and external stresses (in groundwater monthly report)* – completed monthly during mining. Result analysis and reporting will be completed on a quarterly basis as monitoring has entered the post-mining stage. Analysis of the potential Level 4 TARP triggers is complete, and these trigger levels have been resolved in this reporting period; and
- *Convene Tahmoor Coal Environmental Response Group to review response* - completed following the reporting of this data, which included the discussion of these TARP triggers.

Investigations into these potential Level 4 TARP triggers were completed to the cause of these triggers (i.e. has or has not been attributed to mining-related impacts). A summary of the investigations is provided below.

pH at P12B

The higher pH at this bore was likely due to an issue with the integrity of the bore, with recent high surface runoff flushing cement/grout into the bore. Investigations by SLR in January 2022 found that the reason for the increase in pH at P12B is unclear and could potentially be related to compromised bore integrity, however an increasing trend was also observed at GW072402. At this time, a mining-related effect is plausible, however the consequences of this effect (if it is mining-related) are considered minor.

The TARP trigger level was reduced to a TARP Level 1 in June 2022 as the source of the pH increase was determined not to be related to mining but to grout contamination. Since July 2022, pH has reduced to within the baseline limit.

Strontium at P15A

SLR investigated the recent Sr exceedances at P15A in January 2022 with no clear mining-impact identified. The following presents a summary of the findings:

- Since the start of monitoring at site P15A-D, the Sr concentrations are above the ranges reported at unaffected sites and above the pre-mining Sr concentrations at P14A-P14D except for P15D within pre-mining Sr concentrations at P14;
- No exceedances in Sr concentrations were identified at surface water monitoring sites along Stonequarry Creek, with all surface water monitoring sites across the Western Domain within TARP Level 1 for water quality during the reporting period;
- From the U.S Environmental Protection Agency, Sr concentrations in drinking water are assessed relative to the health-based screening level benchmark of 4 mg/L. Values greater than 4 mg/L are considered high, between 2 mg/L and less than 4 mg/L are considerate moderate and less than 2.0 mg/L are considered low. At P15A, Sr concentrations are considered moderate (less than 4.0 mg/L);
- Since monitoring started at P15A, the higher Sr concentrations observed at P15A compared to other sites (i.e. P14, GW105228 and GW115860) and compared to the deeper piezometers (i.e. P15B-D) suggest a localised Sr source in groundwater at piezometer P15A;

- The range of strontium in natural soils is highly variable, from 50 mg/kg to 1000 mg/kg. P15A is located within the mapped alluvium and may be screened within alluvial soil with a higher Sr concentration compared to the deeper lithology of weathered and fresh Hawkesbury Sandstone. No bore logs are available to review and verify the lithology at this location; and
- The Sr concentrations at nearby registered bores GW105228 and GW115860 are considered low (less than 2 mg/L) suggesting no risk of human-health concerns and that the increase in Sr concentrations at P15A is possibly localised.

The trigger level at P15A for Sr was revised to 4 mg/L in June 2022, as the trigger was assessed to be too conservative for this site.

The concentration of strontium were reported as a TARP Level 2 from June 2022. Strontium concentrations at site P15B and P15C have started to increase above the trigger level in July 2022 however the overall increase to September 2022 is within the range of 0.2 mg/L, considerably less than previously observed at P15A.

Barium at GW115860

SLR investigated the potential TARP Level 4 for Ba at GW115860 (refer to **Appendix D**). The following summarises the findings:

- Ba concentration at GW105228 (110 m from GW115860) are stable within 0.20-0.25 mg/L since monitoring started;
- The short record of Ba concentrations at site P15A-D shows fluctuation within the range of 0.08 to 0.21 mg/L, generally lower than at GW105228; and
- No exceedances or increasing trends in Ba concentrations were identified at sites P14A-D and P15A-C (only 180 m and 65 m from LW W3) between October 2021 and January 2022 (SLR, 2021a, 2022a) except at P15D (TARP Level 2) in February 2022 slightly increasing at the trigger level.

A mining-related effect on Ba at GW115860 was assessed to be unlikely but could not be excluded at the time of the investigation. A revision to the Ba trigger level was undertaken as it appeared that the trigger level was conservative and could not be based on pre-mining data. The revised trigger level for Ba at bore GW115860 is 0.51 mg/L and remains conservative (i.e. lower than) with respect to the relevant guideline values considered.

EC at GW115860

SLR investigated the trigger exceedances at GW115860 for EC (refer to **Appendix D**). The following summarises the findings:

- The reason for the increased EC at GW115860 is unclear, although it is consistent with the trend observed at nearby bore GW105228. Therefore, this trigger is a 'potential' Level 4 TARP trigger, and it has not been confirmed that the cause is mining;
- No drawdown was observed during the extraction of LW LW3 at GW115860, and hence drawdown does seem to be the cause of the change in EC;
- The increase in EC at GW115860 (to 1,246 µS/cm) does not change the beneficial use classification of the groundwater extracted at this site, and therefore the currently observed effects are considered to be immaterial. Indeed, salinity (TDS) at GW115860 remains within the desirable palatability of less than 600 mg/L (class A1 category). Groundwater quality at GW115860 remains suitable for all beneficial uses, including the current purpose; and

- Given the low salinity of groundwater at GW115860, and the small incremental change in that salinity in relation to the beneficial use classifications it is recommended to continue observing this bore over the next monitoring period (April 2022) to see if EC decreases, otherwise to revise the trigger. The most reliable method to revise the trigger would be to adopt the EC trigger from GW105228 for use at GW115860 as it has been derived from a longer record period.

EC concentrations naturally lowered in February 2022, resulting in a return to Level 1.

3.2.7.3 Proposed Actions

The current monitoring program will continue in accordance with the LW W3-W4 Water Management Plan. In addition, the following actions are proposed for groundwater quality investigations:

- At all sites with Level 2 trigger for groundwater quality, to continue monitoring program and a review of water quality data in the next quarterly groundwater report;
- Continue monitoring Zn concentrations at P16C and nearby P16A, P16B and private bores; and
- Continue monitoring Sr concentration at P15A and nearby groundwater monitoring sites (P15B-D, P14A-D) and private bores (GW105228 and GW115860).

3.2.8 Stonequarry Creek Rockbar TARP – Yellow Trigger for visual inspection and Blue Trigger for High Resolution Closure Lines and Relative 3D Surveys

3.2.8.1 Background

During this reporting period, a number of triggers continued to occur in accordance with the Stonequarry Creek Rockbar Management Plan TARPs. These TARP triggers included:

- Blue Trigger for extension of High Resolution Closure Lines across the SR17 Rockbar, first observed in October 2021, continued with extensions of HRC-A to HRC-H lines by 1.0 mm to 7.0 mm (Stonequarry Creek Rockbar Status Report 53, **Appendix F**);
- Yellow Trigger for fractures on the SR17 Rockbar during detailed visual inspection, first observed on 28 October 2021, with fractures noted in the south-east corner of the rockbar. This included a 2 mm wide crack and opening of natural joint near prism RBF02, a 3 mm extension between prisms RBF01 and RBF02, a reduction in the holding water level of a small man-made pond in the rockbar below historical norm, re-emergence of iron staining at times of low water flow, and evidence of vehicle movement by non-Tahmoor Coal constituents across the rockbar on 11 August near the Aboriginal heritage grinding grooves (Stonequarry Creek Rockbar Status Report 53, **Appendix F**); and
- Blue Trigger for measured strains in Relative 3D Surveys, noted on 14 February 2022 for measured strain between RBF04 and RBF05 (Stonequarry Creek Rockbar Status Report 41, **Appendix F**).

A copy of the referenced reports is provided in **Appendix F**.

3.2.8.2 Actions Completed

Following the Blue Trigger for the extension of High Resolution Closure Lines across the SR17 Rockbar on 11 October 2021, the Stonequarry Creek Rockbar Technical Committee met and reviewed the results, considered the Key Assessment Criteria and determined that the current survey, visual inspections, monitoring and management measures remained suitable. The results were then reviewed on a twice weekly basis. Regular updates were also provided to DPE on the status of the rockbar throughout mining, including the outcomes of the Technical Committee meetings.

In accordance with the Stonequarry Creek Rockbar Management Plan, mining of LW W3 was temporarily suspended on 28 October 2021 following initial identification of surficial fracturing of the rockbar at pool SR17. Subsequently, the Subsidence Technical Committee convened to review the required actions and responses in accordance with the Stonequarry Creek Rockbar Management Plan TARP. The Subsidence Technical Committee confirmed that the fracturing was identified approximately 40m downstream of the nearest grinding grove site on the north-eastern side of the access track. No evidence of fracturing was evident at any of the grinding groove sites.

Additional monitoring, inspection and reporting was then implemented in accordance with the TARP. Subsequent visual inspections identified an increase in the extent of fracturing. On 1 November 2021, approval was granted to recommence mining of LW W3 subject to the continuation of monitoring at an increased frequency.

Geotechnical reviews of the rockbar identified that:

- The fractures occurred in thinly bedded, laminated sandstone and were considered a response to mining related differential compression in combination with the presence of existing delamination in the rockbar surface formed by natural weathering processes;
- There was no evidence of new cracking outside the existing fractured area;
- The extension of the fractured area was associated with a veneer of sandstone sitting on top of competent sandstone;
- The fracturing was considered consistent with subsidence monitoring results and was effectively an extension of the original fracture site; and
- The fracturing provided a release for mining induced stress and was confined to the sheeted sandstone above the competent sandstone.

In addition, no evidence of fracturing was evident at any of the grinding groove sites.

The Technical Committee reviewed the latest observations on 26 September 2022. Monitoring results indicate that little to no measurable change has been observed at the rockbar where the fracturing has occurred. The water level in the small man-made pond is also holding water and has returned to normal level.

A final survey was conducted in October 2022, one month after the completion of LW W4 mining. This survey noted minor changes in horizontal distances both along and across the rockbar, and minor ground shortening in the southeast corner of the rockbar.

Following the Blue Trigger for the measured strain across the SR17 Rockbar on 14 February 2022, the Stonequarry Creek Rockbar Technical Committee noted that this site has been managed in accordance with the yellow trigger level since fractures were first observed on 28 October 2021.

3.2.8.3 Proposed Actions

No further monitoring is required as LW W3 and LW W4 mining is complete.

3.2.9 Historical Heritage TARP – Level 3 Trigger for Sandstone Culvert Impacts

3.2.9.1 Background

Visual inspections during the previous reporting period noted the development of a number of minor cracks and spalling of sandstone blocks on sandstone culverts at 88.400 km and 88.980 km along the Picton-Mittagong Loop Line. The LW W4 end of panel inspection confirmed that impacts to the two culverts had triggered a Level 3 TARP trigger for historical heritage in accordance with the LW W1-W2 Heritage Management Plan.

During the current reporting period, it was confirmed that no new impacts to the portal faces of the culverts have been observed during the monitoring throughout the extraction of both LW W3 and LW W4, and the LW W3 and LW W4 end of panel heritage inspection confirmed that no additional cracking, worsening of existing cracks or spalling had occurred (**Appendix E**). A Level 3 TARP trigger remains relevant.

A full inspection of the Picton-Mittagong Loop Line culverts was able to be completed during the LW W4 end of panel inspection as reinforced concrete pipe (RCP) sleeves from the barrel of the culverts had been removed. This inspection noted that several cracks had formed since the commencement of mining in the Western Domain in the barrel of the sandstone culvert at 88.400 km. These cracks were not noted in the pre-mining inspection report by Robinson Rail in July 2019 (refer **Appendix E**).

Cracking on the portal ends of the sandstone culverts at 88.980 km and 88.400 km and the barrel of the culvert at 88.400 km results in a Level 3 TARP trigger due to confirmed mining-related impacts.

Cracking and spalling of the sandstone blocks on these culverts are illustrated in **Figure 3-1, Figure 3-2** and **Figure 3-3**.



Figure 3-1 *Cracking on the portal ends at culvert 88.400 km. This cracking has not worsened during the mining of LW W4.*



Figure 3-2 *Cracking in the barrel of culvert 88.400 km. This cracking has formed during the mining of the Western Domain.*



Figure 3-3 Cracking at culvert 88.980 km. Pre-mining (left) and post-mining (right) inspection photographs. Cracking along the mortar and spalling of the arch stones has not worsened significantly during extraction of LW W4.

3.2.9.2 Actions Completed

As per the Historical Heritage TARP, the following actions have been completed:

- *Continue monitoring program as per monitoring program* - monitoring according to the monitoring program has now finished with the completion of LW W4;
- *Convene Tahmoor Coal Environmental Response Group to review response* – completed on a monthly basis. This TARP trigger was discussed shortly after the identification of the trigger on 14 September 2021. Discussion of the cracking in the barrel of culvert 88.400 km was discussed during the December 2022 ERG meeting;
- *Co-ordinate a site inspection with a structural engineer and qualified archaeologist or heritage architect* – completed as part of the LW W2 End of Panel inspection, as well as during the LW W3 End of Panel inspection and LW W4 End of Panel inspection;
- *Investigate exceedance of subsidence prediction* – completed as part of the LW W2 End of Panel Historical Heritage Report;
- *Review mine design / predictions against mine criteria* - completed as part of the LW W2 End of Panel Historical Heritage Report;
- *Review monitoring program and modify if necessary* - completed as part of the LW W2 End of Panel Historical Heritage Report, with no modifications were deemed required;
- *Notify DPE and Heritage NSW within one week of awareness of the event* – Tahmoor Coal notified DPE and Heritage NSW of the trigger via the NSW Major Projects Planning Portal on 21 September 2021. A site visit was undertaken with DPE representatives on 12 April 2022 and a warning letter from DPE was received on 16 May 2022 regarding the breach against Section 4.2(1)(b) of the *Environmental Planning and Assessment Act 1979.* Cracking in the barrel of culvert 88.400 km is likely to be part of the same subsidence impact event that caused the identified cracking on the portal face. Therefore, as the cracking in the barrel is not likely to indicate a new subsidence impact event, no further notification is deemed required*;* and
- *Investigate and implement any additional management measures as required in consultation with Heritage NSW and DPE* – see discussion below.

Tahmoor Coal notified DPE and Heritage NSW of the trigger via the NSW Major Projects Planning Portal on 21 September 2021. A site visit with DPE was completed on 12 April 2022. A warning letter from DPE was received on 16 May 2022 regarding the breach against Section 4.2(1)(b) of the Environmental Planning and Assessment Act 1979.

Rehabilitation of the two culverts will be undertaken now that the full effects of LW W4 have been completed. A works program for the rehabilitation of the two culverts was submitted to DPE on 10 May 2022, as well as a report on the proposed rehabilitation methodology (JMA, 2022). All repair work on the impacted heritage structures will be completed as prescribed in the TfNSW Structures Repair Standard TMC302. Tahmoor Coal also provided the rehabilitation methodology to the Heritage Division of TfNSW on 19 May 2022.

3.2.9.3 Proposed Actions

In accordance with the LW W3-W4 Heritage Management Plan, monitoring of the sites is no longer required as mining in the Western Domain has been completed.

Rehabilitation of the two culverts will be undertaken now that the full effects of Western Domain longwall mining has been completed.

Tahmoor Coal has approached a number of heritage stonemasons to seek input into the repair methodology for the sandstone culverts. The proposed rehabilitation methodology (JMA, 2022) specifies detailed grout injection along the cracks and other associated repair methods consistent with cracks within masonry structure. Tahmoor Coal has been advised that the prescribed repair specifications within the rehabilitation methodology are not within the skill set of a Heritage Stonemason. Tahmoor Coal are therefore currently engaging an experienced grout injection company, who will also arrange for a repointing subcontractor to complete the mortar joint repairs following the grout injection task.

Tahmoor Coal previously advised DPE that a proposed completion date of 31 March 2023 was likely to be achievable. Tahmoor Coal advised DPE that the works are more likely that they could be completed by 30 June 2023, and approval of this extended works completion date from DPE was received on 27 February 2023.

3.2.10 Main Southern Railway TARP – Blue Trigger at Ballast Top Subway (88.133 km), Ballast Top Subway (86.838 km) and Picton Tunnel (87.85 km)

3.2.10.1 Background

During the reporting period, the following TARP triggers occurred related to Main Southern Railway features:

- Ballast Top Subway (86.838 km) - Blue Level Trigger for small increase in closure near the top of the arch on the Up side, first noted in January 2022 (MSR Status Report 19); and
- Picton Tunnel (87.85 km) – Blue Level Trigger for increasing change in Cant observed at southern end of the Tunnel, observed in March 2022 (MSR Status Report 28).

These triggers are documented in the reports referenced, which are included in **Appendix G**.

3.2.10.2 Actions Completed

Following the Blue Level Trigger for the Ballast Top Subway (86.838 km), a structural inspection was completed on 7 January 2022 and noted no immediate concern. Trains on the PMLL track were suspended until 5 February 2022. A geotechnical investigation confirmed that substantial footing was located in competent clay soils, and advised that the changes are not due to mine subsidence. The Rail Management Group reviewed the results and the structural report and agreed to increase the Blue Trigger Level from 20 mm to 25 mm, which resolved this Blue Level Trigger (refer to MSR Status Report 23, **Appendix G**).

Following the Blue Level Trigger for the Picton Tunnel (87.85 km), it was determined that the changes in track centres at 87.780 km was likely due to effects of weather as there was no measurable change across the width of the tunnel. This Blue Level Trigger was resolved (refer to MSR Status Report 29, **Appendix G**).

3.2.10.3 Proposed Actions

Visual inspection of MSR infrastructure will continue under the existing monitoring program during the Western Domain post-mining stage.

4 Assessment of Environmental Performance

4.1 Environmental Performance Measures and Indicators

The following development consents include subsidence impact performance measures as conditions for the extraction of LW W3-W4:

- DA 67/98 Modification 5:
  - Condition 13A – Performance Measures for Natural and Heritage Features;
  - Condition 13E – Performance Measures for Built Features;
- LW W3-W4 Extraction Plan Approval:
  - Condition 1 – Performance Measures for Stonequarry Creek, Cedar Creek and Matthews Creek.

The subsidence impact performance measures were adopted as part of the LW W3-W4 Extraction Plan and associated management plans. To assist in defining the performance measures, each measure has been assigned subsidence performance indicator(s).

These performance measures and indicators are provided in **Table 4-1**, as well as an assessment of performance.

Table 4-1 Assessment of Environmental Performance

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Water Management				
Stonequarry Creek, Cedar Creek and Matthews Creek (LW W3-W4 Extraction Plan Approval)	No subsidence impact or environmental consequence greater than minor*	This performance indicator will be considered to be exceeded if mining-induced fracturing in a rockbar or stream bed results in a reduction in pool water level below historically recorded water levels, taking into account rainfall and observations during the baseline monitoring period, for: • More than 10% of pools located within the 600 m Study Area for Natural Features; and/or • Pool SR17.	**No** Less than 10% of the pools within the Investigative Area have been impacted and the surficial fracturing of the rockbar at pool SR17 and surface cracking of SR20 in Stonequarry Creek has not resulted in an impact to pool water level. Consequently, there is negligible evidence to date of subsidence impacts with environmental consequences greater than minor associated with mining in the Western Domain.	Sections 2.2.2 and 2.2.3
	No connective cracking between the surface, or the base of the alluvium, and the underground workings.	This performance indicator will be considered to be exceeded if analysis of inflow data suggests high correlation to rainfall events and significant departure from recent groundwater model predictions. This would be supported by analysis of pre- and post-mining goaf centreline bore data.	**No** *Note: Post-mining goaf centreline bore data not yet available.*	Section 2.3.3
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	Flooding This performance indicator will be considered to be exceeded if subsidence results in the post-mining 1% AEP flood level being above the floor level of one or more dwelling.	**No**	Section 2.2.5

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Land Management				
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	Landscape Features This performance indicator will be considered to be triggered if subsidence impacts to landscape features result in the collapse of cliffs, rock outcrops or steep slopes in proximity to members of the public.	**No**.	Section 2.4
Biodiversity Management				
Threatened species, threatened populations, or endangered ecological communities (DA 67/98 Condition 13A)	Negligible environmental consequences**.	This performance indicator will be considered to be triggered if: • Changes in macroinvertebrate and stream health indicators are statistically significant; • If visual assessment of aquatic habitat identifies mining subsidence induced impacts. • Statistically significant changes in amphibian diversity is detected toward baseline attributed to mining, as detected during amphibian monitoring; and/or • Statistically significant changes in riparian vegetation is detected toward baseline attributed to mining, as detected during riparian monitoring.	**No**	Section 2.5

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
Heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**. Negligible loss of heritage value**.	Isolated finds/artefact scatters (AHIMS items) No performance indicators are currently established as impacts are predicted to be negligible.	**No** *Note: The LW W3-W4 Heritage Management Plan assessed the probability of impacts to isolated finds / artefact scatters from the proposed longwall mining as very unlikely. Impacts to open sites, such as artefact scatters, are limited to cracking in the surface soils which is unlikely to affect the artefacts. Therefore monitoring of these sites have not been included in the monitoring program.*	Not applicable
		Scarred tree (AHIMS item) This performance indicator will be considered to be triggered if: • subsidence monitoring identifies a perceptible tilt increase that places the tree at risk of falling; and/or • subsidence monitoring identifies a perceptible cracking in the tree unrelated to natural weathering or trauma damage	**No** *Note: The LW W3-W4 Heritage Management Plan assessed the probability of impacts to the scarred tree from the proposed longwall mining as very unlikely.* *Impacts to open sites, such as the scarred trees, are limited to cracking in the surface soils which is unlikely to affect the item. Therefore monitoring of this item has not been included in the monitoring program.*	Section 2.6.1
		Grinding grooves (AHIMS item) This performance indicator will be considered to be triggered if: • subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking; and • these subsidence impacts result in impacts to the heritage values of the site.	**No**	Section 2.6.1

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
Heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**. Negligible loss of heritage value**.	Main Southern Railway Heritage Items (Mushroom Tunnel, Picton Tunnel, Antill Street Underbridge, Picton Viaduct, Argyle Street Underbridge) This performance indicator will be considered to be triggered if subsidence monitoring identifies cracking of external brick work or physical impacts to the historical heritage values of the structure, measurable tilt or visible perceptible impacts such as subsidence induced cracking , exfoliation, brick movement or brick fall.	**No**	Section 2.6.2
		Main Southern Railway Heritage Items (Pedestain overbridge 86.1 km, MSR culverts, Subway 88.133 km, high retaining wall 84.687 km, bridge on Matthews Lane, Prince Street overbridge, Connellan Crescent Overbridge) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, brick movement or brick fall.	**No**	Section 2.6.2
		Cottage (Weatherboard) This performance indicator will be considered to be triggered if subsidence monitoring identifies damage to external cladding or internal finishes.	**No**	Section 2.6.2
		Redbank Uniting Church This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, brick movement or brick fall.	**No**	Section 2.6.2

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Heritage Management				
		Rural Landscape – Thirlmere Way This performance indicator will be considered to be triggered if subsidence monitoring identifies visual subsidence, surface cracks.	**No**	Section 2.6.2
		Rural landscape – Thirlmere Way (local heritage significance) No performance indicators are currently established as impacts are predicted to be negligible.	**No**	Section 2.6.2
Other Aboriginal and heritage sites (DA 67/98 Condition 13A)	Negligible subsidence impacts or environmental consequences**.	Loop line Sandstone culverts (local heritage significance) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, exfoliation, block movement or block fall.	**Yes** Cracking on sandstone culverts at 88.400 km and 88.980 km resulted in exceedance of subsidence performance indicators. DPE and Heritage NSW were notified of this exceedance on 21 September 2021. Tahmoor Coal will complete remediation now that the full effects of LW W3-W4 have been completed.	Sections 2.6.2 and 3.2.9
		Loop line brick culverts (local heritage significance) This performance indicator will be considered to be triggered if subsidence monitoring identifies visible perceptible impacts such as subsidence induced cracking, exfoliation, brick movement or brick fall.	**No**	Sections 2.6.2

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Built Feature Management				
Key Public Infrastructure: • Main Southern Railway; • Picton-Mittagong Loop Line; and • Electricity transmission lines and towers. (DA 67/98 Condition 13E)	Always safe and serviceable.	None allocated.	**No**	Section 2.7
	Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.	None allocated.	**No**	Section 2.7
Other Infrastructure: • Electricity distribution lines, poles and associated towers; • Unsealed roads and road culverts, fire trails, fences and other built features; and • Other public infrastructure. (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7
Privately-owned residences (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Subsidence Performance Measure Exceeded?	Section Discussed
Built Feature Management				
Other privately-owned built features and improvements, including farm dams, swimming pools, tennis courts, roads, tracks and fences (DA 67/98 Condition 13E)	Always safe.	None allocated.	**No**	Section 2.7
	Serviceability should be maintained wherever practicable.	None allocated.		
	Loss of serviceability must be fully compensated.	None allocated.		
	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	None allocated.	**No**	Section 2.7
Public Safety (DA 67/98 Condition 13E)	Negligible additional risk**.	None allocated.	**No**	Section 2.7
Mine workings				
First workings (DA 67/98 Condition 13A)	To remain long term stable and non-subsiding.	None allocated.	**No**	Not applicable
Second workings (DA 67/98 Condition 13A)	To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.	None allocated.	**No**	Not applicable

NOTES:

* minor is defined as *not very large, important or serious* by DPE.

** For the purpose of this Extraction Plan and associated documents, 'negligible' is defined as being 'so small and insignificant as to not be worth considering'. A negligible impact is viewed with regards to a long term context, causing little or no impact. If a short-term impact causes a greater than negligible impact, the impact can still be considered negligible if the impacts are of a limited duration and are considered negligible when considered over the long term.

5 Document Information

5.1 References

Brienan Environment and Safety (2022), Longwall West 4 Creek Monitoring Report (for monitoring completed on 27 October 2022).

Department of Planning and Environment (DPE) (2015), Draft Guidelines for the Preparation of Extraction Plans V5.

EMM Consulting (2022a), Aboriginal heritage monitoring report: Tahmoor Mine Longwall West 3 (LW W3) End Of Panel Monitoring Inspection.

EMM Consulting (2022b), Historical heritage monitoring report: Tahmoor Mine Longwall West 3 (LW W3) End of Panel Monitoring Inspection.

EMM Consulting (2022c), Aboriginal heritage monitoring report: Tahmoor Mine Longwall West 4 (LW W4) End Of Panel Monitoring Inspection.

EMM Consulting (2022d), Historical heritage monitoring report: Tahmoor Mine Longwall West 4 (LW W4) End of Panel Monitoring Inspection – Railway Culverts.

EMM Consulting (2022e), Historical heritage monitoring report: Tahmoor Mine Longwall West 4 (LW W4) End of Panel Monitoring Inspection – Weatherboard Cottage.

JMA (2022), Post-Mining Inspection Report, Picton-Mittagong Loop Line Culverts.

Mine Subsidence Engineering Consultants (MSEC) (2019), Tahmoor Coking Coal Operations – Longwalls W1 and W2, Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of the Proposed Longwalls W1 and W2 in Support of the Extraction Plan Application. Prepared for Tahmoor Coal, May 2019, document MSEC1019.

Mine Subsidence Engineering Consultants (MSEC) (2021), Tahmoor Coal – Longwalls W3 and W4, Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of the Proposed Longwalls W3 and W4 in Support of the Extraction Plan Application. Prepared for Tahmoor Coal, March 2021, document MSEC1112.

Niche (2022a), Aquatic Ecology Monitoring Report 2017-2022, report to Tahmoor Coal, 17 June 2022.

Niche (2022b), Terrestrial Ecology Monitoring Report, Riparian vegetation and amphibian monitoring Autumn 2022, report to Tahmoor Coal, 7 June 2022.

SLR (2021), Agricultural Subsidence Monitoring LW W3-W4, letter report to Tahmoor Coal, 26th August 2021, document 630.12953.001

WRM (2022), Matthews Creek Post-mining Flood Study, LW W1-W4, 15 December 2022, document 1072-08-B1.

Tahmoor Coal Documents:

- Extraction Plan LW W3-W4 Extraction Plan Main Document, TAH-HSEC-326
- Extraction Plan LW W3-W4 Water Management Plan, TAH-HSEC-328
- Extraction Plan LW W3-W4 Land Management Plan, TAH-HSEC-330
- Extraction Plan LW W3-W4 Biodiversity Management Plan, TAH-HSEC-325
- Extraction Plan LW W3-W4 Heritage Management Plan, TAH-HSEC-331

- Extraction Plan LW W3-W4 Stonequarry Creek Rockbar Management Plan, TAH-HSEC-352
- Extraction Plan LW W3-W4 Built Features Management Plan, TAH-HSEC-332
- Extraction Plan LW W3-W4 Public Safety Management Plan, TAH-HSEC-333
- Extraction Plan LW W3-W4 Subsidence Monitoring Program, TAH-HSEC-329

5.2 Glossary of Terms

Terms references to this document are provided below in **Table 5-1**.

Table 5-1 Glossary of Terms

Term	Definition
Active Subsidence Zone	The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front of the active longwall face and 450 m behind the active longwall face or following 500 m of longwall extraction.
Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence).
Built features	Includes any building or work erected or constructed on land, including dwellings and infrastructure such as a formed road, street, path, walk, or driveway; any pipeline, water sewer, telephone, gas or other infrastructure service main.
Cliffs	Continuous rockfaces having minimum heights of 10 m, minimum lengths of 20 m and minimum slopes of 2 to 1, i.e. having minimum angles to the horizontal of 63°.
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of mm, is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.
Curvature	Second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of 1/km (km-1), but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually in km. Curvature can be either hogging (i.e. convex) or sagging (e.g. concave).
Longwall	A system of mining coal in which the seam is extracted on a broad front or long face using a coal shearer and the roof is supported by hydraulic roof supports.
Reporting period	1 January 2022 to 31 December 2022.
Run of mine (ROM)	Raw coal production. The unprocessed mined coal that is conveyed to the CPP. ROM may consist of coal and rock.

Term	Definition
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Study Area	Study Area as defined in the LW W1-W2 Extraction Plan.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of mm. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Subsidence impacts	The physical changes or damage to the fabric or structure of the ground, its surface and environmental features, or built structures that are caused by the subsidence effects. These impacts considerations can include tensile and shear cracking of the rock mass, localised buckling of strata, bed separation, rock falls, collapse of overhangs, failure of pillars, failure of pillar floors, dilation, slumping and also include subsidence depressions or troughs.
Subsidence consequences	The knock-on results of subsidence impacts, i.e. any change in the amenity or function of a natural feature or built structure that arises from subsidence impacts. Consequence considerations include public safety, loss of flows, reduction in water quality, damage to artwork, flooding, draining of aquifers, the environment, community, land use, loss of profits, surface improvements and infrastructure. Consequences related to environmental features are referred to as environmental consequences.
Tilt	The change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the first derivative of the subsidence profile. Tilt is usually expressed in units of mm/m. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 %, or 1 in 1000.
Western Domain	Area to the north-west of the Main Southern Railway.

5.3 Abbreviations

Abbreviations used in this document are provided below in **Table 5-2**.

Table 5-2 Abbreviations

Abbreviation	Definition
AHIMS	Aboriginal Heritage Information System
ARTC	Australian Rail Track Corporation
AUSRIVAS	The Australian River Assessment System
BACI	Before After Control Impact design
BGSS	Bargo Sandstone
BIS	Building Inspection Service
CTF	Cease to flow
DA	Development Approval
DRNSW	Department of Regional NSW
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
EC	Electrical conductivity
EPA	NSW Environment Protection Authority
EPT	Ephemeroptera Plecoptera Trichoptera scores
GFG	GFG Alliance
GNSS	Global Navigation Satellite System units
HBSS	Hawkesbury Sandstone
HEC	Hydro Engineering and Consulting, now ATC Williams
Km	Kilometres
LW W1	Longwall West 1
LW W1-W2	Longwall West 1 to West 2
LW W2	Longwalls West 2
LW W3	Longwall West 3
LW W3-W4	Longwalls West 3 to West 4
LW W4	Longwall West 4
m	metres
mbgl	Metres below ground level
mg/L	Milligrams per litre
ML	Mining Lease
mm	millimetre
MSEC	Mine Subsidence Engineering Consultants
MSR	Main Southern Railway
NRAR	NSW Industry – Land & Water – Natural Resources Access Regulator – East
NSW	New South Wales
OE	Observed expected score
OSP	Open Standpipe Piezometers

Abbreviation	Definition
pH	pH units
PMLL	Picton-Mittagong Loop Line railway
RCE	Riparian Channel and Environment Inventory
RCP	Reinforced Concrete Pipe
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TfNSW	Transport for NSW
VMP	Vibrating Wire Piezometer
WWTP	Wastewater treatment plant

5.4 Document Distribution

This report and associated documents have been distributed according to **Table 5-3**.

Table 5-3 Distribution List for Six Monthly Subsidence Impact Report

Agency	Contact Person	Position	Electronic Copy
DPE - Planning	(Planning Portal)	(Planning Portal)	(https://www.planningportal.nsw.gov.au/major-projects)
	Jessie Evans	Director – Resource Assessments	Jessie.evans@planning.nsw.gov.au
	Gabrielle Allan	Team Leader	Gabrielle.Allan@planning.nsw.gov.au
DPE - Resources Regulator (Subsidence)	(General email)	(General email)	subsidence.monitoring@planning.nsw.gov.au nswresourcesregulator@service-now.com
	Ray Ramage	Mine Safety Officer - Subsidence	ray.ramage@planning.nsw.gov.au
DRNSW – Mining Exploration and Geoscience	(General email)	(General email)	resource.operations@planning.nsw.gov.au
DRNSW – Resources Regulator – Mining Act Inspectorate	(General email)	(General email)	nswresourcesregulator@service-now.com
	Greg Kininmonth	Manager Environmental Operations (Southern)	greg.kininmonth@planning.nsw.gov.au
Wollondilly Shire Council	(General email)	(General email)	council@wollondilly.nsw.gov.au
	David Henry	Acting Team Leader Environmental Services	david.henry@wollondilly.nsw.gov.au
Subsidence Advisory NSW	(General email)	(General email)	subsidencetechnical@customerservice.nsw.gov.au
	John Johnston	Technical Manager	John.Johnston@customerservice.nsw.gov.au

Agency	Contact Person	Position	Electronic Copy
NRAR	(General email)	(General email)	nrar.servicedesk@dpie.nsw.gov.au
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EPA	(General email)	(General email)	epa.illawarra@epa.nsw.gov.au
	Andrew Couldridge	Senior Operations Officer - Metropolitan Illawarra	andrew.couldridge@epa.nsw.gov.au
TCCCC Committee Members	Documents sent to TCCCC Committee Members at private email addresses.		

Appendix A – Subsidence Monitoring Reports

Appendix B – Surface Water Monitoring Reports

Appendix C – Creek Monitoring Reports

Appendix D – Groundwater Monitoring Reports

Appendix E – Historical Heritage Monitoring Reports

Appendix F – Stonequarry Creek Rockbar Status Reports

Appendix G – Main Southern Railway Status Reports

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APPENDIX 11

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Tahmoor Coal Pty Ltd

SIX MONTHLY SUBSIDENCE IMPACT REPORT

Tahmoor South Domain Longwalls South 1A – South 6A

18 October 2022 – 31 December 2022

Report 1 – March 2023

simecgfg.com

Document Control

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Executive Summary

This report is the first six-monthly report to be submitted since the commencement of extraction in the Tahmoor South Domain, in accordance with the requirements of the Longwall South 1A to South 6A (LW S1A-S6A) Extraction Plan.

Extraction of coal from Longwall South 1A (LW S1A) commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022. The reporting period of this report is from 18 October 2022 (commencement of extraction in Tahmoor South Domain) to 31 December 2022.

During the reporting period, the maximum observed vertical subsidence relating to the extraction of LW S1A was 200 mm recorded at the GNSS unit Site S01.

During the reporting period, there was five (5) environmental aspects that were associated with a TARP triggers. These TARP triggers are summarised below:

- Surface Water Level TARP (WMP3) – Level 1 triggered at monitoring site TT9 due to decline in recorded water level by greater than 10 cm below the recorded baseline minimum level for the period 27 to 30 December 2022. This trigger was considered to be related to the prevailing climatic conditions and likely unrelated to mining influences. Water level monitoring will continue in accordance with the LW S1A-S6A Water Management Plan; and
- Multiple triggers of groundwater TARPs WMP9, WMP10, WMP11 and WMP13 during the reporting period. Upon review of these TARP triggers, it was apparent that a revision of the TARPs in question was required as some parameters were too sensitive, resulting in triggers from typical short term fluctuations in parameters rather than trends indicating potential environmental consequences from longwall extraction. Following the revision of the TARPs, a re-assessment of the groundwater data against the TARPs noted that there were no residual TARP triggers for this reporting period. The LW S1A-S6A Water Management Plan and associated documents will be updated to reflect the revised groundwater TARPs, and submitted to DPE via the Planning Portal.

During the reporting period, there were no exceedances of environmental performance measures or indicators, as adopted from Condition C1 and Condition C5 of SSD 8445.

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1 Introduction

1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates the Tahmoor Mine, an existing underground coal mine located approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW) (refer to **Figure 1-1**). The mine has previously extracted longwalls to the north and west of the surface facilities and has been operating continuously since 1979 when coal was first mined using bord and pillar mining methods, followed by longwall mining methods since 1987.

Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Extracted coal is processed on site at the coal handling and preparation plant (CHPP) and coal clearance facilities prior to transportation via rail to Port Kembla and Newcastle for Australian domestic and export customers.

In April 2021, Tahmoor Coal received Development Application Approval (SSD 8445) from NSW Department of Planning and Environment (DPE, formerly NSW Department of Planning, Industry and Environment (DPIE)) for the Tahmoor South Domain using existing surface infrastructure and extension of underground longwall mining to the south of existing workings. The approval allows the extraction of up to 4 Mtpa of ROM coal, with a total of up to around 33 Mt of ROM coal proposed to be extracted over a 10-year period.

In addition to the SSD 8445 approval Tahmoor Coal also received conditions of approval (EPBC 2017/8084) under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) in October 2021.

The Tahmoor South Domain is located south of the Bargo River and east of Remembrance Driveway and the township of Bargo. Longwall mining would be used to extract coal from the Bulli coal seam within the bounds of Consolidated Coal Lease (CCL) 716 and CCL 747. Twelve longwalls are proposed in this domain which are divided into a series of six northern (A series) and six southern (B series) longwalls. The A series, Longwalls South 1A to South 6A (LW S1A-S6A), were the focus of the LW S1A-S6A Extraction Plan, for which approval was granted on 20 September 2022. The Study Area for this extraction plan is provided in **Figure 1-2**.

Extraction of coal from Longwall South 1A (LW S1A) commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022.

1.2 Purpose

1.2.1 Six-Monthly Subsidence Impact Report Requirements

The purpose of this report is to address the requirements for six-monthly reporting on impacts and environmental monitoring results associated with the extraction of LW S1A-S6A. These requirements are outlined in Section 7.1.1 of the LW S1A-S6A Extraction Plan, which are derived from the Section 6 of the DPE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). It is noted that an updated version of the Guidelines was published in October 2022.

This report provides a summary of subsidence and environment monitoring results, subsidence impacts and management actions undertaken during the reporting period. The reporting period for this report is defined in **Section 1.3**.

Reporting requirements are listed in **Table 1-1** below, together with the cross-reference where the requirements are addressed in this report.

Table 1-1 Six Monthly Subsidence Impact Report Requirements

Requirement No.	Requirement Description	Section Addressed
Reporting Requirements as per Section 7.1.1 of the LW S1A-S6A Extraction Plan		
1	A comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);	Section 3.1
2	Any proposed actions resulting from triggers being met in the TARP, or other actions;	Section 3.2
3	An assessment of compliance with all relevant performance measures and indicators; and	Section 4
4	A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and level data, piezometer readings.	Section 2

This report will be distributed to the stakeholders listed in **Section 5.4**.

1.2.2 Annual Review Requirements

An Annual Review for Tahmoor Mine operations during the previous calendar year is required in accordance with Condition E13 (SSD 8445) and is submitted by 31 March annually to Department of Planning and Environment and other stakeholders, as well as upload to the Tahmoor Coal Website. This Six-Monthly Subsidence Impact Report assists with the completion of the 2022 Annual Review and will be included as an appendix to the Annual Review.

The Annual Review will address compliance with Condition 22 of the EPBC Act (EPBC 2017/8084) approval, which requires the submission of an Annual Compliance Report to the Department by 31 March of each year (in accordance with email confirmation received on 16 June 2022).

1.3 Scope

1.3.1 Reporting Period

This report is the first six-monthly report to be submitted since the commencement of extraction of LW S1A, in accordance with the requirements of the LW S1A-S6A Extraction Plan. The reporting period of this report is from 18 October 2022 to 31 December 2022, and covers subsidence impacts observed during the extraction of LW S1A.

Table 1-2 summarises the monitoring and reporting completed during the reporting period, as well as the timeframe of data reviewed for each monitoring component.

1.3.2 LW S1A-S6A Study Area

The Extraction Plan Study Area for LW S1A-S6A is defined as the surface area that is likely to be affected by the extraction of LW S1A-S6A from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (mm) subsidence contour resulting from the extraction of LW S1A-S6A; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW S1A-S6A.

The Study Area is illustrated in **Figure 1-2**.

1.3.3 LW S1A-S6A Extraction Plan Context

The LW S1A-S6A Extraction Plan is part of the Tahmoor Coal Environmental Management Structure, as illustrated in **Figure 1-3**.

As part of the LW S1A-S6A Extraction Plan, a set of management plans was prepared to manage particular environment or built features with the LW S1A-S6A Study Area, which consisted of the following:

- Water Management Plan;
- Land Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Built Features Management Plan, with a number of sub-plans to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction; and
- Public Safety Management Plan.

The overall framework for subsidence monitoring and management of impacts of the LW S1A-S6A Extraction Plan is provided in the relevant Subsidence Monitoring Programs. Monitoring of environmental and built features has been completed by Tahmoor Coal in accordance with management plans listed above.

It is noted that the management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan.

Table 1-2 Monitoring and Reports Reviewed for this Reporting Period

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Subsidence Monitoring Program	Subsidence	General subsidence	• SMEC • Building Inspection Service	• Mine Subsidence Engineering Consultants (MSEC)	• Weekly reports during mining	Appendix A (referenced reports only)
Water Management Plan	Surface Water	Streamflow	• ALS • SMEC	• ATC Williams	• Quarterly report for 18 October 2022 to 31 December 2022.	Appendix B
		Pool water level				
		Stream water quality				
		Physical features and natural behaviour of pools and reaches	• Brienan Environment and Safety	• Brienan Environment and Safety	• Monthly reports during mining	Available on request
		Morphology and channel stability				
	Groundwater	Groundwater quality	• CES	• SLR	• Quarterly report for 18 October 2022 to 31 December 2022.	Appendix C
		Groundwater bore level at open standpipes and private bores				
		Shallow groundwater pressures				
		Deep groundwater pressures				
		Groundwater level and quality at Thirlmere Lakes	• NSW Government			
		Groundwater Inflow	• Tahmoor Coal			

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Land Management Plan	Landscape	Cliffs Natural Steep Slopes Farm Dams	• Douglas Partners	• Douglas Partners	• Monthly reports for all geotechnical features during mining.	Available on request
		Farm Dams	• Building Inspection Service (BIS)	• BIS	• Weekly dam inspection and reports for dams with active subsidence.	Available on request
	Agricultural Land	Agricultural Land	• SMEC • BIS	• MSEC	• Weekly inspections along local roads – completed as part of roads survey.	Appendix A (referenced reports only)
			• SLR	• SLR	• Visual inspections at the completion of each longwall – not required during this reporting period.	Not applicable
Biodiversity Management Plan	Aquatic Ecology	Macroinvertebrates	• Niche	• Niche	• Aquatic Ecology Monitoring Report for Spring 2022 (November 2022)	Available on request
	Terrestrial Ecology	Amphibians, riparian vegetation, threatened flora and fauna, Threatened Ecological Communities	• Niche	• Niche	• Terrestrial Ecology Monitoring Report for Spring 2022 (October and November 2022)	Available on request
Heritage Management Plan	Aboriginal heritage	Teatree Hollow 2013.1	• SMEC	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
			• BIS	• BIS	• Monthly inspection and reporting (alternate to Douglas Partners) during period of active subsidence for LW S1A, S2A, S3A and S4A.	Available on request
			• Douglas Partners	• Douglas Partners	• Monthly inspection and reporting (alternate to Douglas Partners) during period of active subsidence for LW S1A, S2A, S3A and S4A.	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S1A, S2A, S3A and S4A – not required during this reporting period.	Not Required.

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Heritage Management Plan	Historical heritage	Picton Weir Great Southern Road (partial)	• SMEC • BIS	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
		Bargo Cemetery	• SMEC • BIS	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.
		Wirrimbirra Sanctuary (Australian Wildlife Sanctuary)	• SMEC	• MSEC	• AWS Subsidence Status Reports (weekly).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S5A – not required during this reporting period.	Not Required.
		Tahmoor Colliery (Tahmoor Mine Site)	• SMEC • BIS	• MSEC	• Tahmoor Mine Site Status Reports (weekly) – none required during this monitoring period.	Not Required.
		Bargo Railway Bridge North (Wellers Road Overbridge)	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.
		Bargo Railway Viaduct	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Built Features Management Plan	Built Features	Local roads, bridges and culverts	• SMEC • BIS • Comms Network Solutions	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
		Potable Water Infrastructure				
		Sewerage Infrastructure				
		Gas Infrastructure				
		Electricity Infrastructure				
		Telecommunications Infrastructure				
		Residential structures				
		Structures for public amenity, commercial, industrial and agricultural purposes				
		Picton Weir				
		Main Southern Railway (MSR)	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period)	Available on request
		Tahmoor Mine Site	• SMEC • BIS	• MSEC	• Tahmoor Mine Site Status Reports (weekly) – none required during this monitoring period.	Not Required.
		Australian Wildlife Sanctuary (AWS)	• SMEC	• MSEC	• AWS Subsidence Status Reports (weekly)	Available on request

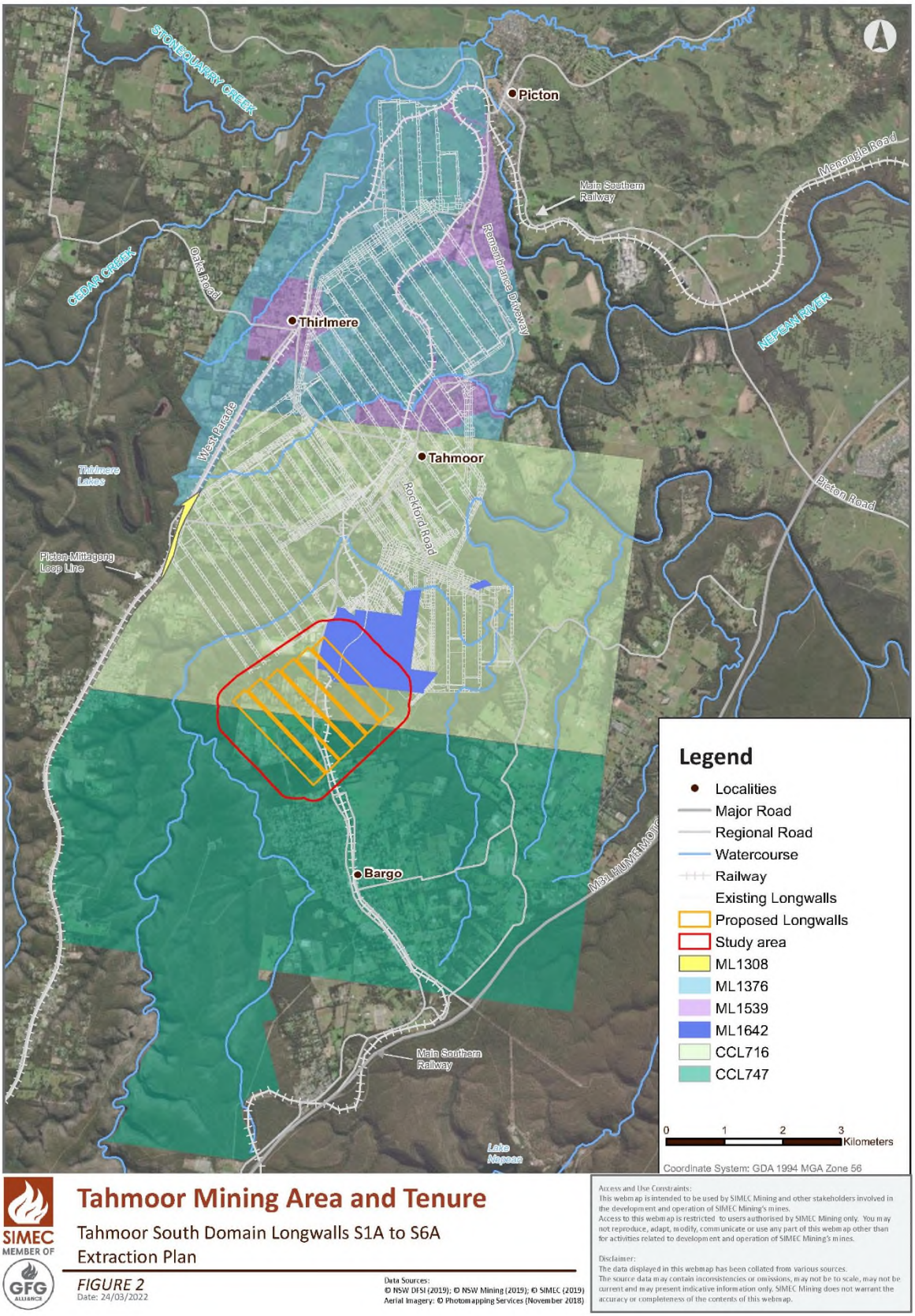


Figure 1-1 Tahmoor Mine Area and Tenure (source: LW S1A-S6A Extraction Plan)

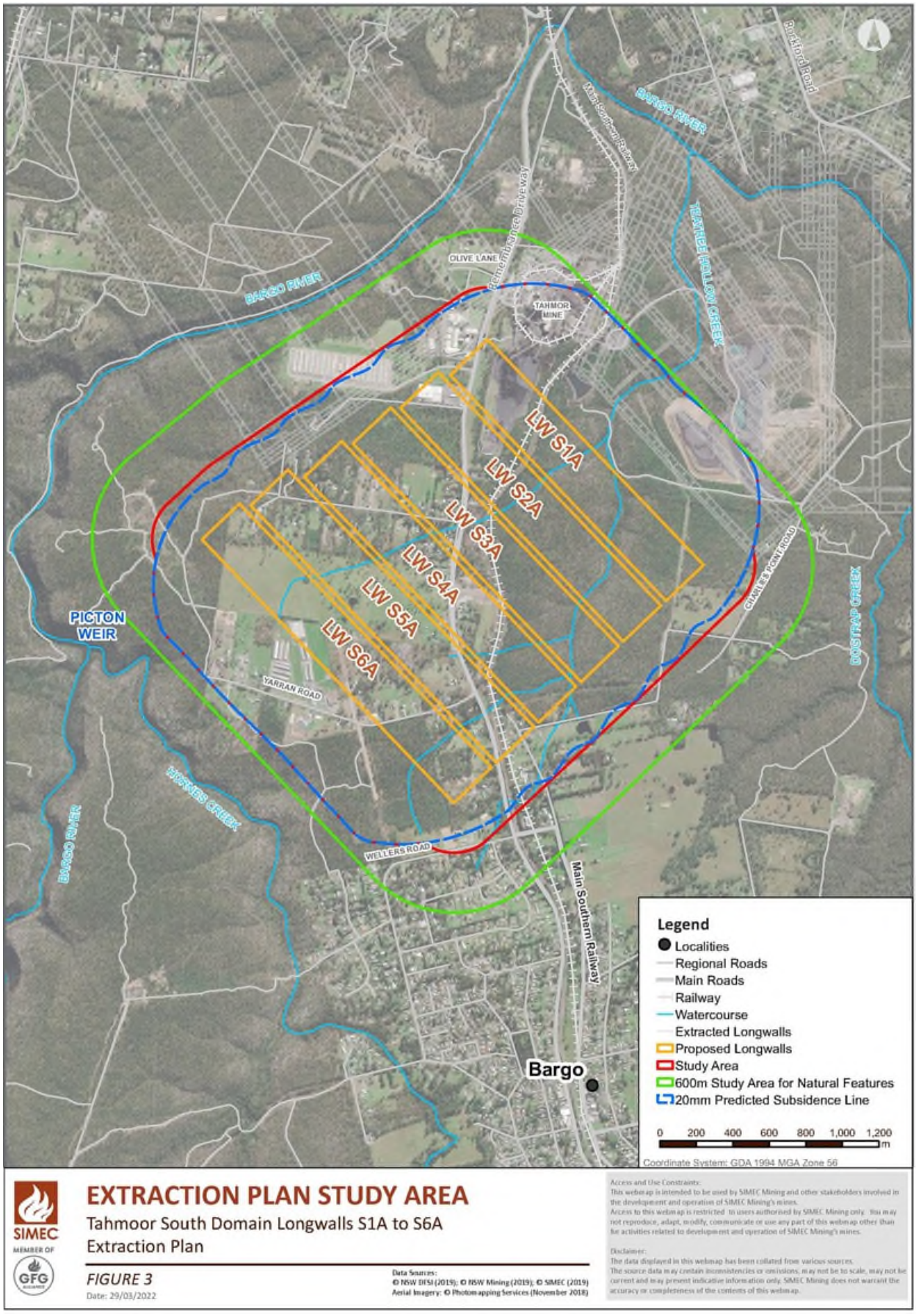


Figure 1-2 LW S1A-S6A Extraction Plan Study Area (source: LW S1A-S6A Extraction Plan)

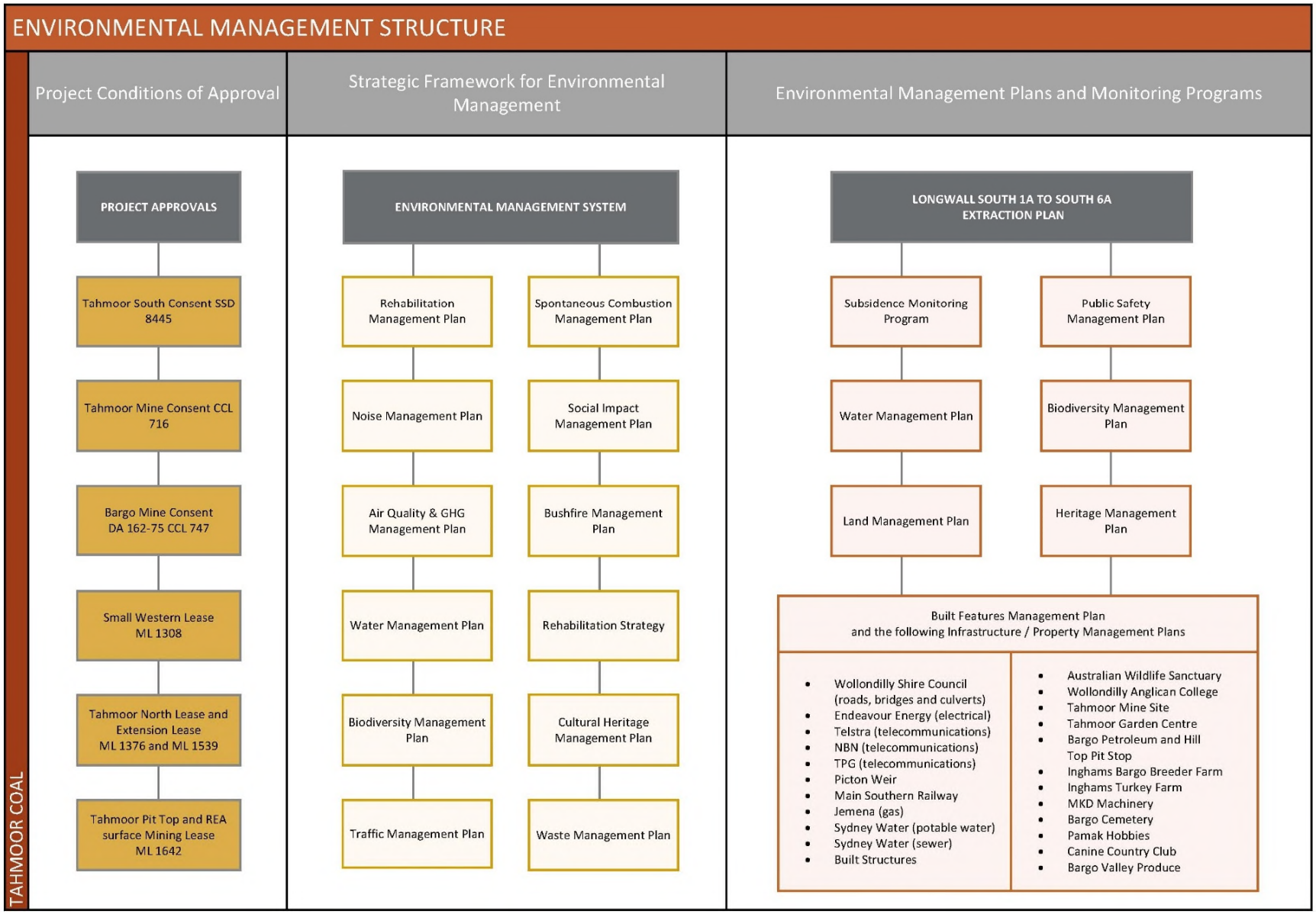


Figure 1-3 Overview of Environmental Management Structure for Tahmoor Coal (source: LW S1A-S6A Extraction Plan)

2 Summary of Environmental Monitoring Results

2.1 Subsidence Monitoring

During the reporting period, the LW S1A-S6A Subsidence Monitoring Program have been implemented to monitor subsidence impacts within the Study Area. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-1**. The Subsidence Monitoring Program includes twenty (20) Global Navigation Satellite System (GNSS) units measuring absolute horizontal and vertical positions in real time installed directly above and adjacent to LW S1A-S6A.

A summary of all surveys and inspections completed during the reporting period is provided in MSEC1304 LW S1A Subsidence Monitoring Report 7 (refer **Appendix A**). A weekly review of the subsidence survey results was completed by Tahmoor Coal and MSEC during the extraction period.

Extraction of LW S1A commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022.

Table 2-1 summarises the maximum observed ground movements within the active subsidence zone at the start and end of this reporting period. During the reporting period, a maximum of 200 mm of vertical subsidence relating to the extraction of LW S1A was recorded at the GNSS unit Site S01.

Table 2-1 Subsidence Monitoring Observations for the start and end of this Reporting Period (source: MSEC report, Appendix A)

	MSEC1304 LW S1A Subsidence Monitoring Report 7	
Monitoring Period	26 December 2022 to 1 January 2023	
Progress of extraction	LW S1A extraction - 545 metres on 1 January 2023	
Observed Ground Movement Parameters	**Maximum Observed Total**	**Location**
Subsidence (mm)	200	GNSS unit Site S01
Tilt (mm/m)	0.1	V-Line & Charlies Point Road
Hogging Curvature (km^{-1})	0.01	Charlies Point Road
Sagging Curvature (km^{-1})	-0.01	V-Line & Charlies Point Road
Tensile Strain (mm/m)	0.3	Charlies Point Road
Compressive Strain (mm/m)	0.3	Charlies Point Road

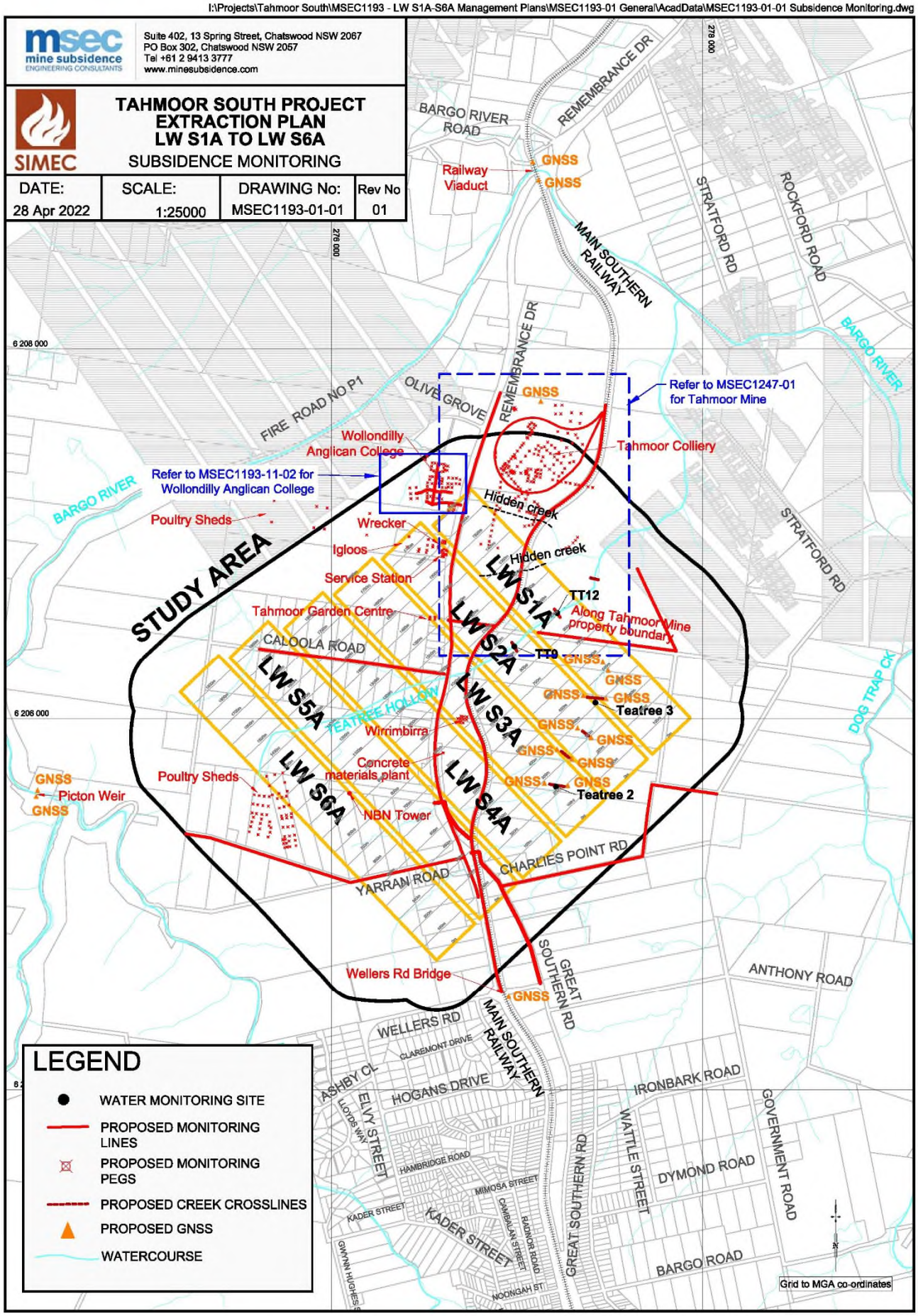


Figure 2-1 *LW S1A-S6A Subsidence Monitoring Program (source: LW S1A-S6A Subsidence Monitoring Program)*

2.1.1 Ground Survey Results

Monthly survey of pegs along the Tahmoor Mine Boundary Survey Line (V Line) has commenced, with very minor changes observed from the survey completed on 12 December 2022.

2.1.2 GNSS Unit Results

The development of subsidence at the two GNSS units (Sites S01 and S02) above the commencing end and along the centreline of LW S1A are illustrated in **Figure 2-2**. This figure shows that mining-induced movements are developing at the GNSS units, with maximum measured subsidence of approximately 200 mm. Subsidence is currently developing within the predictions, with magnitude of subsidence similar to observed above previously extracted Longwall 22. In comparison, observed subsidence above previously extracted first panel LW West 1 was substantially less than prediction.

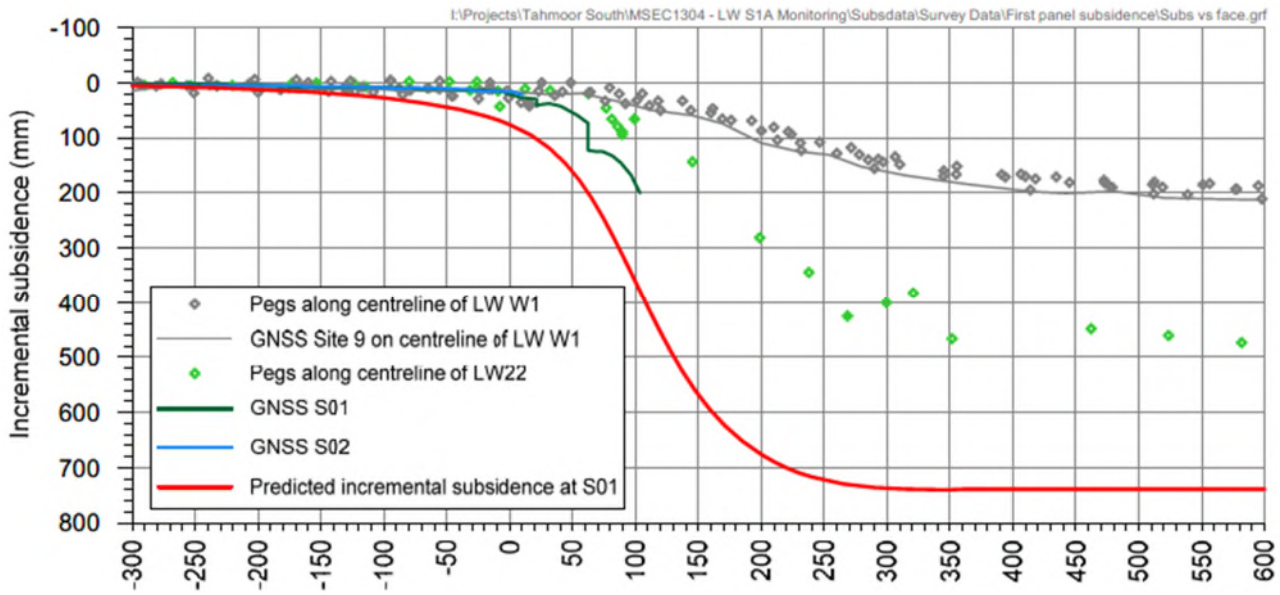


Figure 2-2 Development of observed subsidence along LW S1A (source: MSEC, Subsidence Monitoring Report 7, Appendix A)

Changes in horizontal distances between paired GNSS units that are stationed close together on opposite sides of Teatree Hollow and Teatree Hollow Tributary (also known as 'Wirrimbirra Creek') are illustrated in **Figure 2-3**. This figure shows that small changes are developing between Sites 01 and 02, and Sites 03 and 04 across Wirrimbirra Creek. Minor changes are also currently observed between other pairs of GNSS units.

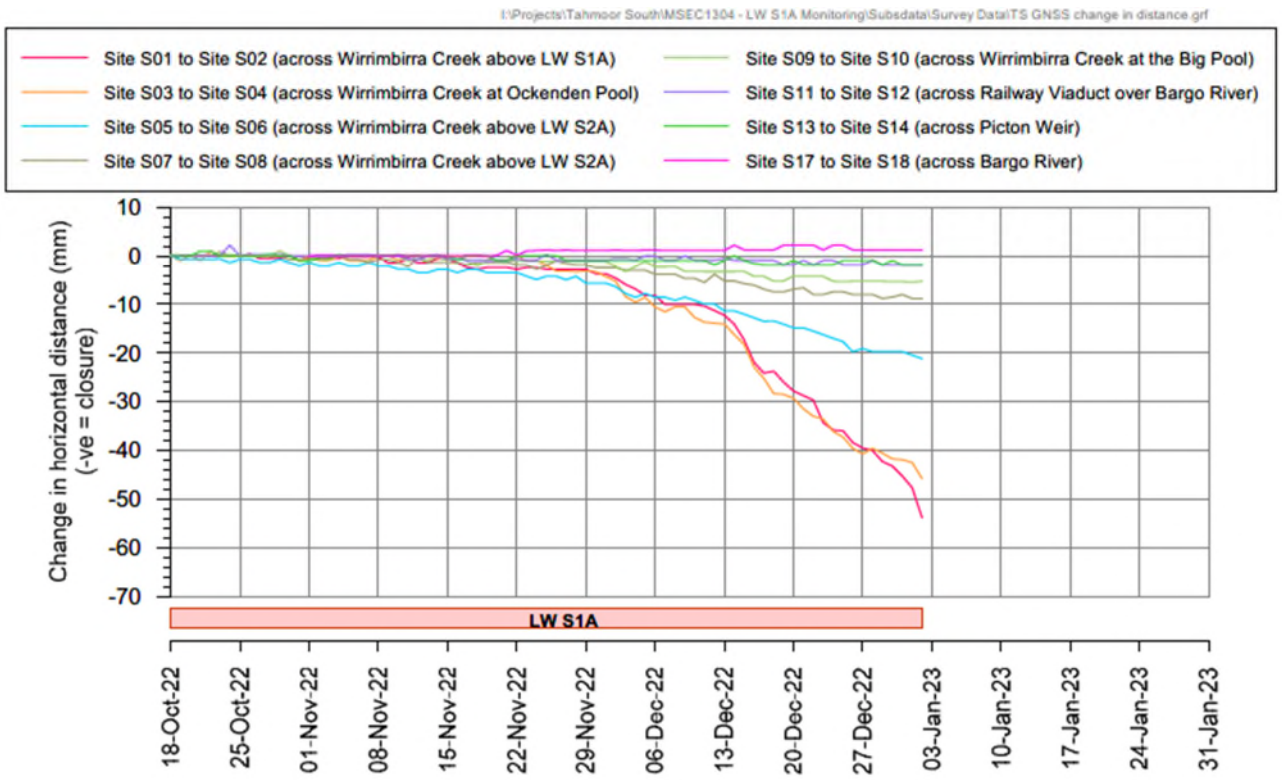


Figure 2-3 Observed changes in horizontal distances between GNSS units during LW S1A extraction (source: MSEC, Subsidence Monitoring Report 7, Appendix A).

2.2 Surface Water Monitoring

The LW S1A-S6A Water Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on surface water in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Water Management Plan has been implemented to monitor surface water:

- Flow, pool water level and surface water quality monitored for Teatree Hollow, Teatree Hollow tributary ('Wirrimbirra Creek'), Bargo River, and Bargo River Tributary – monthly monitoring data reviewed and reported by ATC Williams on a monthly basis (refer to **Appendix B**); and
- Creek monitoring for physical features and natural behaviour of pools, as well as channel stability, sedimentation and erosion – visual inspections and reporting by Brienan Environment and Safety completed on a monthly basis (reports available on request).

The following sections summarise the observations made during the reporting period for each surface water category. Performance against all Surface Water Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2**.

2.2.1 Pool Water Level

Surface water level data has been recorded at the pool monitoring sites on Teatree Hollow, Teatree Hollow Tributary (also known as Wirrimbirra Creek), Bargo River, and Bargo River Tributary as shown in **Figure 2-5**. Continuous surface water level data and manual monthly water level measurements have been recorded at seven monitoring sites on Teatree Hollow (and tributary) and six monitoring sites on Bargo River (and tributary). Sites on Teatree Hollow and Bargo River are shown in **Figure 2-5**.

During the reporting period, water levels at monitoring sites on Teatree Hollow and Bargo River (and their tributaries) remained above baseline minimum levels, with the exception of:

- Monitoring site TT7 – the water level declined below the baseline minimum level from 23 December 2022, however remained above the trigger level;
- Monitoring site TT9 – the water level declined below the baseline minimum level from 23 November 2022 and below the trigger level from 27 to 30 December 2022 – refer to **Section 3.2.1** for further discussion;
- Monitoring site TT13 – the water level declined below the baseline minimum level from 22 December 2022, however remained above the trigger level;
- Monitoring site BR16 – the water level declined below the baseline minimum level from 10 to 30 December 2022;
- Monitoring site BR17 – the water level declined below the baseline minimum level from 6 to 30 December 2022, however remained above the trigger level; and
- Monitoring site BR18 – the water level declined below the baseline minimum level from 10 to 30 December 2022, however remained above the trigger level.

Charts illustrating monitored pool water level hydrographs for pools on Teatree Hollow and Bargo River (and their tributaries) are presented in the Surface Water Monitoring Report (refer to **Appendix B**).

2.2.2 Physical Features and Natural Behaviour

Visual and photographic surveys for subsidence impacts on creeks have been completed monthly for monitoring pools and reaches in Teatree Hollow and Teatree Hollow tributary within the active subsidence zone of LW S1A. The purpose of these surveys is to note whether change has occurred to pool level, drainage or overland flow, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify rock bar and/or stream base cracking, changes in overland connected flow, gas release, turbidity or increased iron precipitation. Creek monitoring locations for physical features and natural behaviour are illustrated on **Figure 2-6**.

During this reporting period, there were no observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity, as compared with baseline conditions.

2.2.3 Channel Stability, Sedimentation and Erosion

Visual and photographic surveys for subsidence impacts on creeks have been completed monthly for morphology and channel stability monitoring site in Teatree Hollow and Teatree Hollow tributary within the active subsidence zone of LW S1A, with the exception of headwater sites which are completed on an annual basis. The purpose of these surveys is to note whether change has occurred to channel stability, erosion and sedimentation, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify any visual changes in knickpoint development and channel morphology. Creek monitoring locations for channel stability, sedimentation and erosion are illustrated on **Figure 2-7**.

During this reporting period, only one channel morphology site, CM7, was located within the active subsidence zone of LW S1A. There was no observed increase in cracking or shearing, no reduction in overland connective flow and no additional iron seeps beyond what was identified during the baseline survey of CM7.

2.2.4 Surface Water Quality

Surface water quality data has been recorded at the following sites (refer to **Figure 2-5**):

- Teatree Hollow:
  - Reference site: TT1-QRLa;
  - Potential impact sites: TT2--QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, and TT14-QLa;
- Bargo River:
  - Reference site: BR16-QLa; and
  - Potential impact sites: BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR16-QLa, BR17-QLa and BR18-QLa.

Water quality data consisted of constituents which are considered to be primary indicators of mining includes. These constituents include pH, electrical conductivity (EC), and specific dissolved metals (aluminium, copper, iron, manganese, nickel and zinc).

A summary of observations for the reporting period is provided in **Table 2-2**. Charts illustrating water quality results for monitored pools in Teatree Hollow and Bargo River are presented in Appendix C of the Surface Water Review report (refer to **Appendix B**).

The water quality characteristics of monitoring sites following commencement of mining LW S1A have been largely consistent with baseline conditions and / or consistent with reference site conditions. During the reporting period, the following sites recorded an exceedance of the Site Specific Guideline Values (SSGVs) for specific constituents:

- TT7, TT12 and TT14 – exceedance for electrical conductivity in December 2022;
- TT7 – exceedance for dissolved aluminium in November and December 2022;
- TT14 – exceedance for dissolved aluminium in December 2022;
- BR12 – exceedance for dissolved iron in November and December 2022;
- BR13 – exceedance for dissolved iron in December 2022; and
- TT12 and TT14 – exceedance for dissolved iron in November 2022.

However, as the exceedances of SSGVs has not persisted for greater than three months, there is negligible evidence of an influence of mining LW S1A on surface water quality in Teatree Hollow or Bargo River (and their tributaries).

Table 2-2 Summary of Notable Results for Key Water Quality Parameters for the Reporting Period

Parameter	Bargo River	Teatree Hollow
pH	• Near neutral pH recorded at the majority of the sites. • Slightly acidic pH conditions recorded at BR6-QLa in November and December 2022 and at BR3-QLa in December 2022. • pH recorded at all sites generally consistent baseline conditions.	• Near neutral pH conditions for the majority of the sites. • Slightly acidic pH conditions recorded at TT1-QRLa, TT3-QRLa and TT9-QRLa in December 2022.
Electrical Conductivity	• Field EC values consistent with baseline values at all sites (less than 350 µS/cm at all sites).	• Field EC values consistent with baseline values at all sites for the duration of the review period. • Slight exceedance of SSGV recorded at TT7-QRLa, TT12-QLa and TT14-QLa in December 2022.

Parameter	Bargo River	Teatree Hollow
Dissolved Aluminium	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations. • Dissolved aluminium concentrations remained below the SSGV for BR12-QRLa and BR13-QRLa.	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations. • Slight exceedance of SSGV recorded at TT7-QRLa in November and December 2022. • Slight exceedance of SSGV recorded at TT14-QLa in December 2022.
Dissolved Copper	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period.	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period.
Dissolved Iron	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations. • Dissolved iron concentrations recorded at BR12-QRLa exceeded the SSGV in November and December 2022. • Dissolved iron concentration recorded at BR13-QRLa exceeded the SSGV in December 2022.	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations. • Dissolved iron concentration recorded at TT12-QLa slightly exceeded the SSGV in November 2022. • Dissolved iron concentration recorded at TT14-QLa slightly exceeded the SSGV in November 2022.
Dissolved Manganese	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values.	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values.
Dissolved Nickel	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values.	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values.
Dissolved Zinc	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values.	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values.

2.2.5 Recommendations and Actions

2.2.5.1 Current Surface Water Monitoring Recommendations

As discussed in the Surface Water Review for October to December 2022 (**Appendix B**), it is recommended that ongoing review of surface monitoring data is continued to be undertaken in accordance with the LW S1A-S6A Water Management Plan.

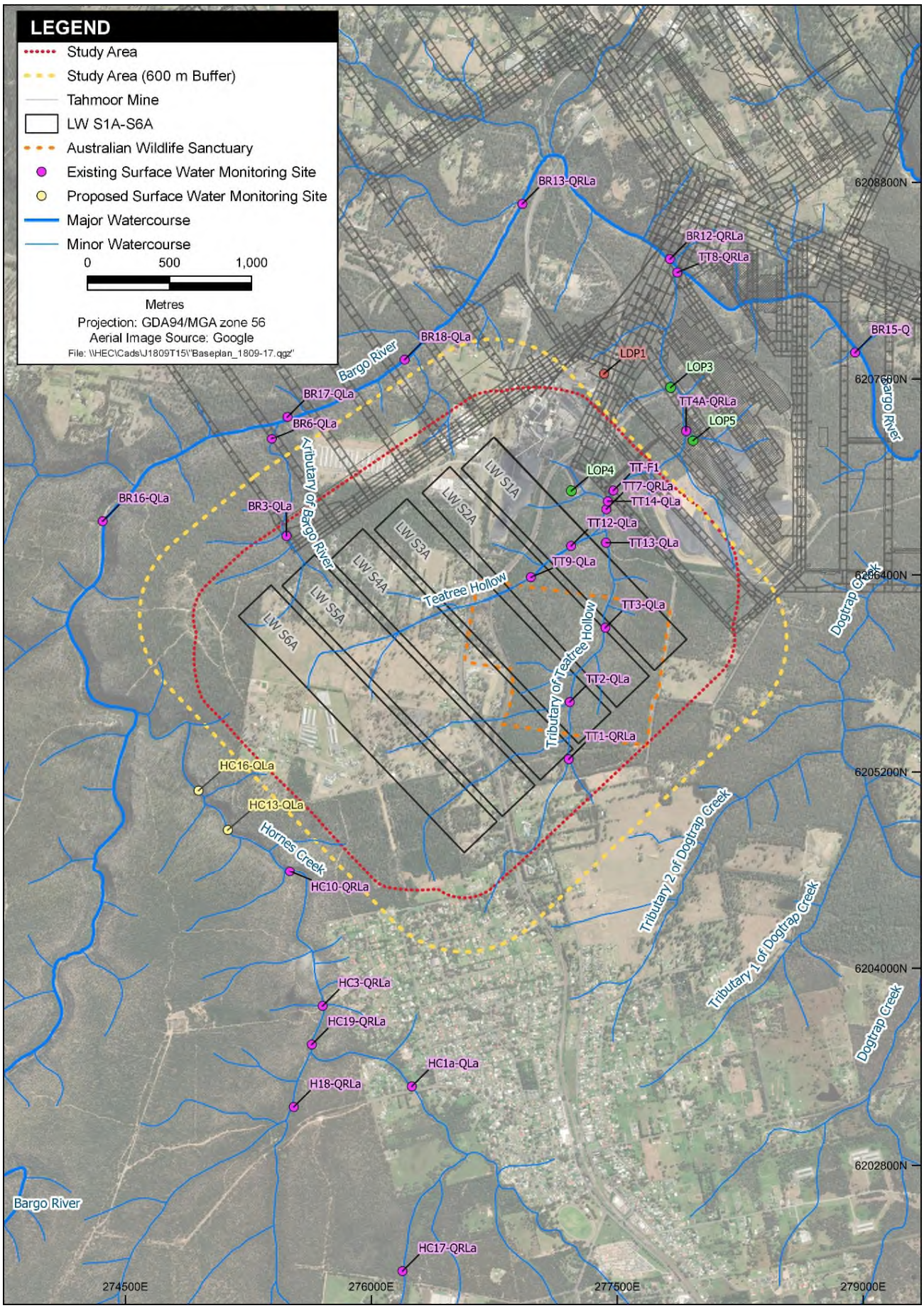


Figure 2-4 LW S1A-S6A Surface Water Monitoring Sites Specific to LW S1A-S6A (source: LW S1A-S6A Water Management Plan)

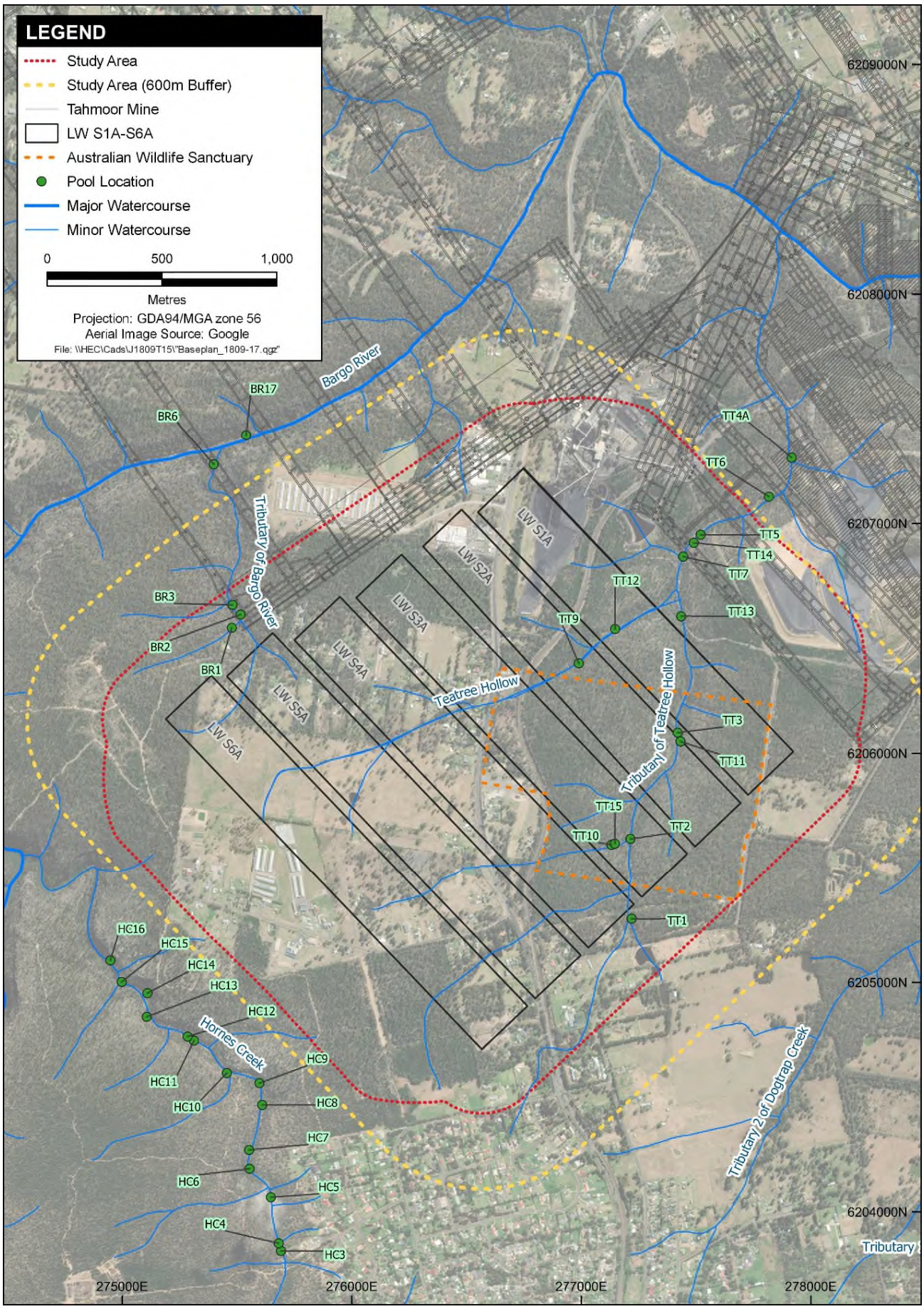


Figure 2-5 *LW S1A-S6A Pool Visual Inspection Sites (source: LW S1A-S6A Water Management Plan)*

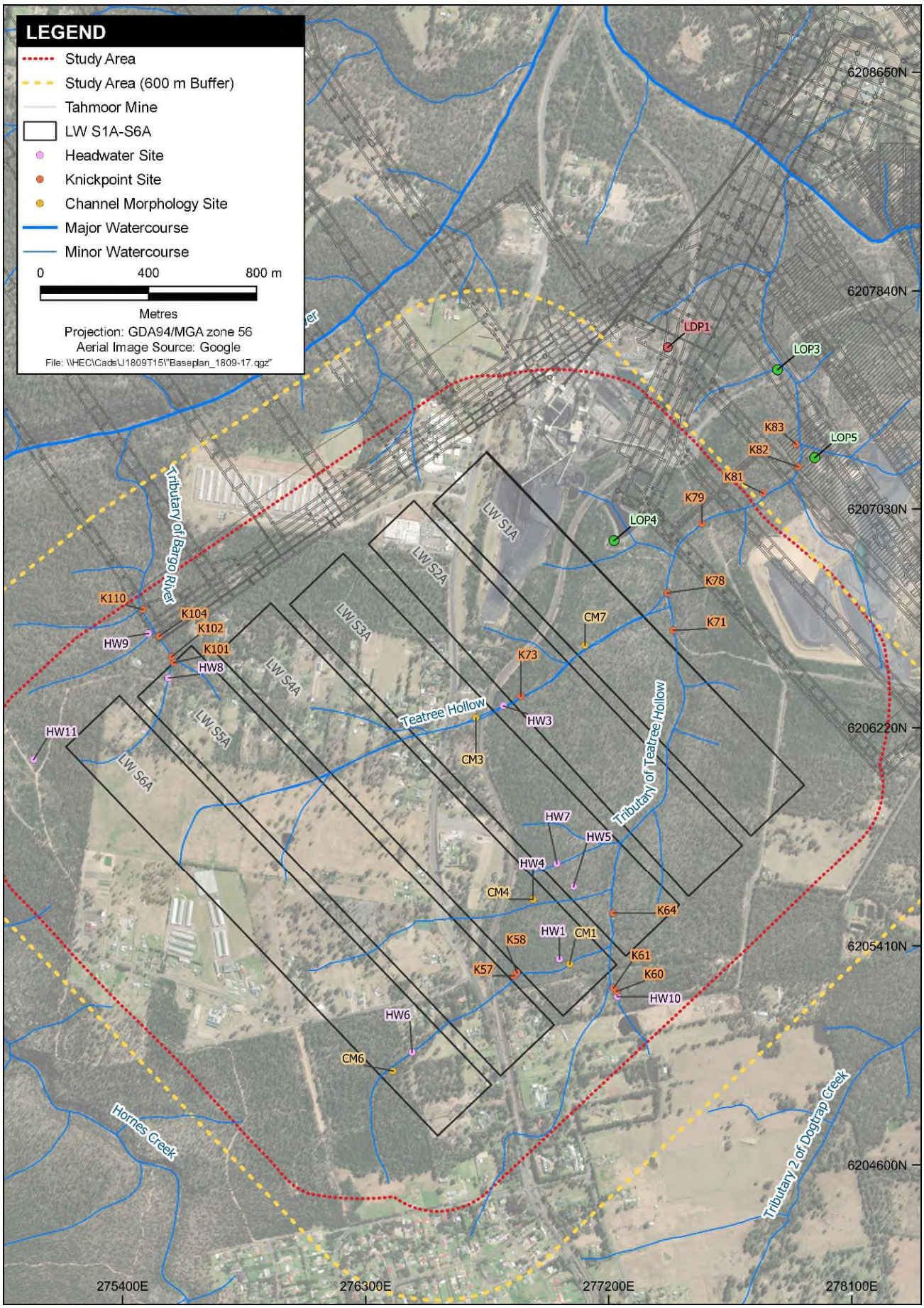


Figure 2-6 *LW S1A-S6A Morphology and Channel Stability Monitoring Sites (source: LW S1A-S6A Water Management Plan)*

2.3 Groundwater Monitoring

The LW S1A-S6A Water Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on groundwater in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Water Management Plan has been implemented to monitor groundwater:

- Shallow groundwater levels, quality and pressures, and deep groundwater levels / pressures – monthly monitoring data reviewed and reported by SLR on a monthly basis (reported in **Appendix C**); and
- Mine water intake – data for this reporting period reviewed and reported by SLR (refer to **Appendix C**).

The following sections summarise the observations made during the reporting period for each groundwater category. Performance against all Groundwater Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.3.1 Groundwater Bore Levels

The Tahmoor South Monitoring Network comprises both open standpipes (OSP) and Vibrating Wire Piezometers (VWPs). The standpipe piezometers can be used for monitoring water levels manually or with an automated datalogger (installed in 10 sites to date), as well as for collection of water samples for groundwater quality monitoring purposes. The VWPs are grouted and therefore can only be used for monitoring groundwater pressures, but do allow for multiple instruments to be installed at different depths within a single borehole.

Table 3 in the SLR Groundwater Report (**Appendix C**) summarises the Tahmoor South Groundwater Monitoring Network, and the locations of groundwater monitoring bores is provided in **Figure 2-7**.

Given it is only three months since commencement of extraction, it is difficult to characterise 'trends' in water levels, and as such a general discussion is provided without conclusions drawn to 'trends' in groundwater levels yet. Further, the climatic conditions experienced in 2022 were quite disparate from long-term average conditions which is likely to have impacted shallow groundwater levels. Further data is required to establish trends and attribute to extraction operations.

Further detail on groundwater level results, including graphs showing progressive groundwater levels, are provided in the SLR Groundwater Report (refer to **Appendix C**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.2**.

2.3.1.1 Shallow OSPs bores

Plots showing the groundwater levels in the Shallow OSPs are provided in the SLR Groundwater Report (**Appendix C**). P54a and P54b have been dry since commencement of groundwater monitoring.

There was some decline in groundwater levels observed in P55a, P55c and P56c in December 2022. However, given the below average rainfall experienced in November and December, and significantly higher than long-term average rainfall prior to this, the decline may be a response to these varying climatic conditions. Further data is required to establish a trend.

2.3.1.2 Private bores

Plots showing the groundwater levels in the private bores are provided in the SLR Groundwater Report (**Appendix C**). There was some decline in groundwater levels observed in GW104659 in December 2022. However, given the below average rainfall experienced in November and December, and significantly higher than long-term average rainfall prior to this, the decline may be a response to these varying climatic conditions. Further data is required to establish a trend.

2.3.1.3 Shallow VWPs (sensors <200 metres)

Groundwater pressures at TBC032 HBSS 131m declined by approximately 6 metres through November and December 2022 (refer to hydrographs provided in the SLR Groundwater Report in **Appendix C**). A depressurisation of 4 metres was observed over the same period in TBC 032 HBSS 95m. The two deepest sensors in TBC032 (BHCS 181m and BGSS 200m) also presented depressurisations of 5.8 and 5.5 metres respectively. Interestingly, the mid-point sensor, HBSS 168m recorded a depressurisation of approximately 2 metres over the same period.

Shallow sensors at site TBC027 recorded a groundwater depressurisation ranging from 1.3m to 2.6m during the reporting period, being greatest in HBSS-132m (2.6m) and lowest in BGSS-198m (0.3m). The groundwater depressurisation started in mid-late November 2022.

The shallow sensors at TBC09 and TBC018 recorded no significant changes in groundwater pressure.

2.3.1.4 Deep VWPs (sensors >200 metres)

The deep VWPs predominantly indicated minimal depressurisation over the reporting period (refer to hydrographs provided in the SLR Groundwater Report in **Appendix C**). Given the short period of depressurisation, conclusions regarding trends are not suitable at this time. The majority of sensors are aligning with the predicted depressurisation predicted via the groundwater modelling.

2.3.2 Mine Water Intake

Tahmoor Coal has a Groundwater Licence (WAL 36442) to extract 1642 ML/year of groundwater make from underground.

The inferred water make (groundwater that has seeped into the mine from the strata) is calculated from the difference between total mine inflows and total mine outflows. This calculation is assisted by input from flow meters installed on fresh water supply lines that pump water into the mine (mine inflow from Sydney Water supply to underground workings), and flow meters on three pipelines that extract water from underground (mine outflow). In addition, mine inflow and outflow also includes a measurement of water that enters and exits the mine through other means such as moisture in air vented in and out of the mine (water in vented air), and moisture in coal extracted from the mine.

Water make calculations provide an indication of the groundwater pumped out of the total Tahmoor Mine underground workings, which include water make from the Western Domain.

SLR completed an analysis of water make for Tahmoor Mine recorded between 1 January 2009 to 31 December 2022 (**Appendix D**). During this period, observed inflows to Tahmoor Mine have been ranging between 2 to 6 ML/d.

The reporting period October to December 2022 falls within the water year calendar 2022-23. The observed cumulative groundwater make for the water 2022-23 is 546 ML and remains below the groundwater entitlement of 1,642 ML per annum (i.e. water year) as of December 2022. This is below the water licence on a pro-rata basis.

2.3.3 Groundwater Quality

Groundwater quality has been monitored monthly in the OSPs (monitoring network and private bores) since the commencement of extraction.

Table 3 in the SLR Groundwater Report (**Appendix C**) summarises the Tahmoor South Groundwater Monitoring Network, and the locations of groundwater monitoring bores is provided in **Figure 2-7**.

As per the groundwater level data, the limited record during extraction coupled with the highly variable climatic conditions make it illogical to define trends in the quality and ascertain their relationship to extraction or not.

Further detail on groundwater quality results, including graphs showing progressive groundwater quality results, are provided in the SLR Groundwater Report (refer to **Appendix C**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.2**.

2.3.3.1 Electrical conductivity and pH

The pH and EC across all bores show some level of fluctuation with no apparent trends across the full record.

A very high pH (greater than 12) was recorded at the following bores in October 2022, which suggest either an issue with the bore construction (e.g. grout contamination) or an error in pH measurements. These results were:

- P51B (pH = 14.22)
- P56B (pH = 12.22)
- P56C (pH = 15.12)
- GW104659 (pH = 13.15)

Further monitoring in November and December 2022 showed that the pH returned within baseline levels.

2.3.3.2 Metal concentrations

Metals across all bores showed some variations, most likely attributable to climatic conditions and not extraction. As of December 2022, it is quite difficult to assess short-term increases in metal concentrations as seen during the reporting period is mining related. Further monitoring data is required to assess and confirm trends.

2.3.4 Recommendations and Actions

2.3.4.1 Current Groundwater Monitoring Recommendations

As discussed in the Groundwater Review for October to December 2022 (**Appendix C**), the following groundwater recommendations were made for this reporting period by SLR:

- Update of the LW S1A-S6A Water Management Plan to incorporate revision of the TARPs;
- In the next Six Monthly Subsidence Impact Report, review the baseline data in conjunction with the additional data collected to that point. If no impact from mining has been identified, consider incorporating the additional data points into the 'baseline' period and recalculate the triggers to capture natural variability of the system; and
- Install and commence monitoring at P50, and consequently replace P51 with this new bore as an early warning bore in TARP WMP13.

Progress of these recommendations will be provided in the next Six Monthly Subsidence Impact Assessment for the Tahmoor South Domain.

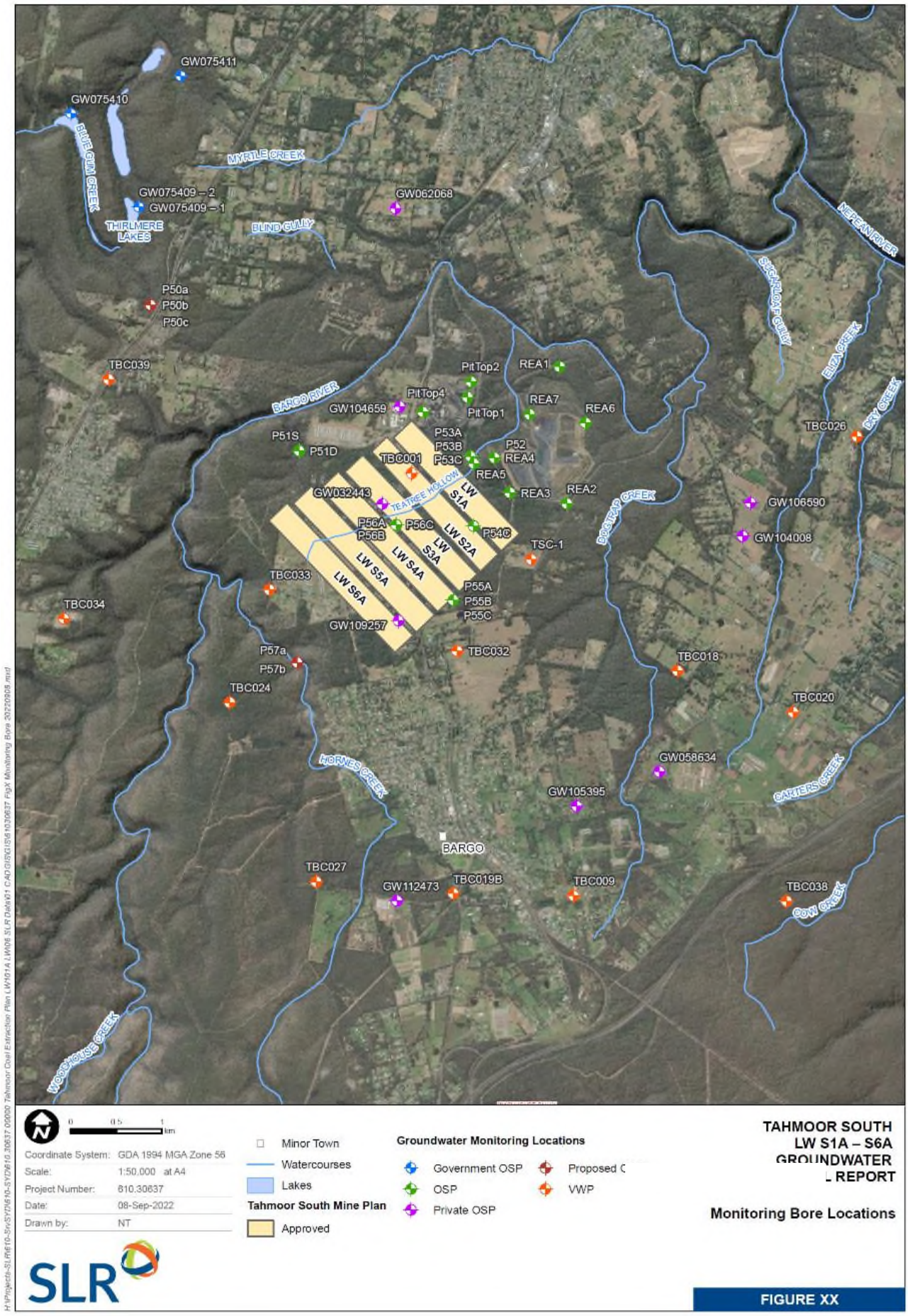


Figure 2-7 LW S1A-S6A Groundwater Monitoring Site (source: LW S1A-S6A Water Management Plan)

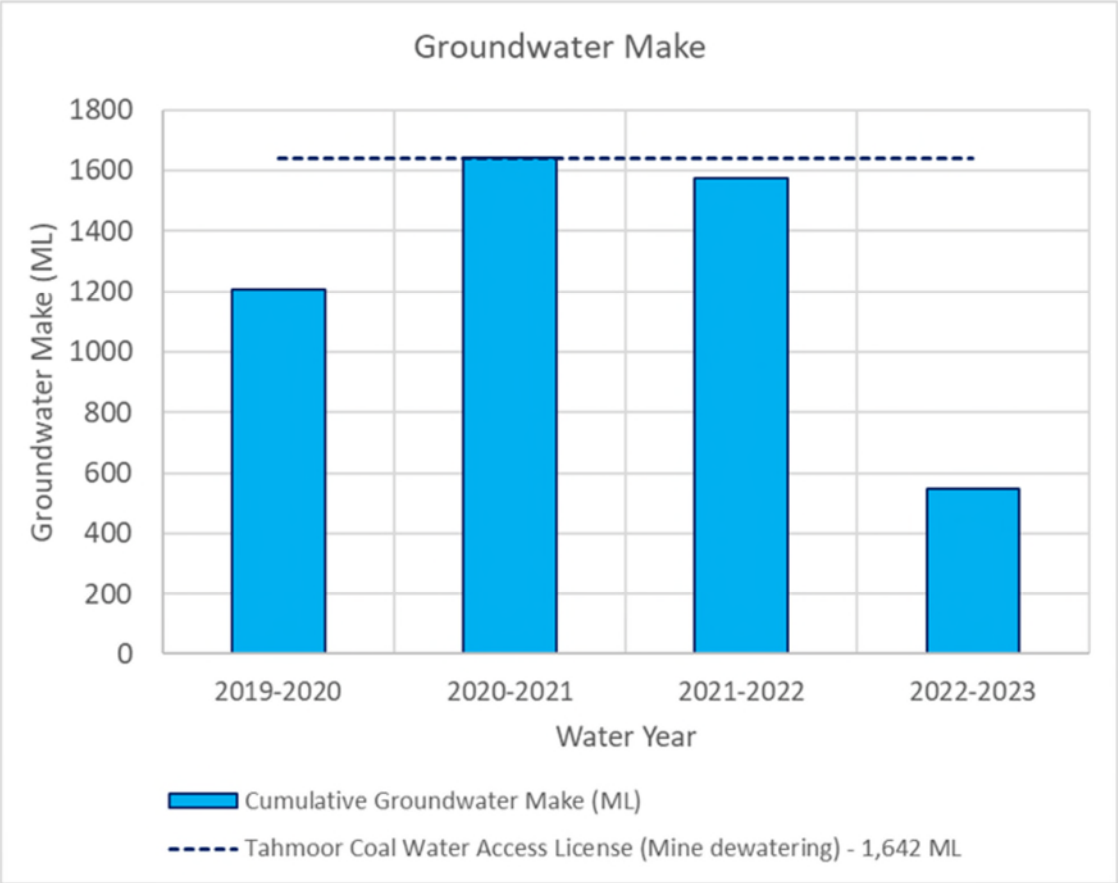


Figure 2-8 Groundwater Make per Water Year (financial year) from 2019/20 to 2022/23 (source SLR, Groundwater Monitoring Report, Appendix C). Note: 2022-2023 data is for 6 months, and not the full water year.

2.4 Land Monitoring

The LW S1A-S6A Land Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on cliffs, natural steep slopes, farm dams, agricultural land in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Land Management Plan has been implemented to monitor the following landscape features:

- Cliffs – visual inspection at the completion of mining by a geotechnical engineer (Cliff BC1 after LW S6A, Cliff BC2 after LW S3A, S4A, S5A and S6A). No visual inspections have been required during this reporting period;
- Natural steep slopes – monthly visual inspection during active subsidence period by a geotechnical engineer. This monitoring and reporting is completed by Douglas Partners (available on request);
- Farm dams – dam embankment integrity and water level observation every week during active subsidence, and every month the active subsidence period by a geotechnical consultant. This monitoring is completed by Building Inspection Services on a weekly basis, and Douglas Partners on a monthly basis, and reported in their reports (available on request); and
- Agricultural land – weekly inspections along local roads and farm dams, and visual inspection at the completion of each longwall for land within the predicted limit of subsidence for each longwall. This monitoring is covered by the farm dams inspections discussed above and built features monitoring discussed in **Section 2.7.2**. No post-longwall visual inspections have been required during this reporting period.

The following sections summarise the observations made during the reporting period for each land category. Performance against all Land Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.4.1 Cliffs

The locations of cliffs (BC1 and BC2) within the LW S1A-S6A Study Area are illustrated in **Figure 2-9**.

During the reporting period, no visual inspections of cliffs has been required according to the LW S1A-S6A Land Management Plan.

2.4.2 Natural Steep Slopes

The locations of natural steep slopes within the LW S1A-S6A Study Area are illustrated in **Figure 2-9**.

During the reporting period, visual and photographic surveys of natural steep slopes were completed monthly for features within the LW S1A active subsidence zone. No visual observations or cracks, localised ground bulging, buckling or shearing was observed at natural steep slopes.

2.4.3 Farm Dams

The location of dams within the LW S1A-S6A Study Area are illustrated in **Figure 2-10**.

During the reporting period, visual and photographic surveys for subsidence impacts on dams were completed on a weekly and monthly basis of dams within the LW S1A active subsidence zone.

A visual inspection of FD-1 on 9 December 2022 found no issues, however the water level has dropped since the previous inspection due to drier weather conditions. No significant changes were observed on 30 December 2022. The small dam is holding a small volume of water following recent rainfall.

2.4.4 Agricultural Land

Agricultural land identified within the LW S1A-S6A Study Area are illustrated on **Figure 2-11**.

Inspections points were set up prior to the commencement of LW S1A mining to provide vantage of agricultural land within the LW S1A-S6A Study Area. The purpose of the surveys is to note whether change has occurred to agricultural land, and to assist in determining if any change can be attributed to mining impacts. Surveys noted the presence of erosion, condition of boundary and internal fencing components, paddock gate condition, out-building condition, paddock dam condition, presence of any surface slumping or cracking, and the presence of vegetation dieback.

During the reporting period, visual and photographic surveys of agricultural land have been completed as part of inspections for local roads, which are discussed in **Section 2.7.2**. No post-longwall visual inspections were required during this reporting period.

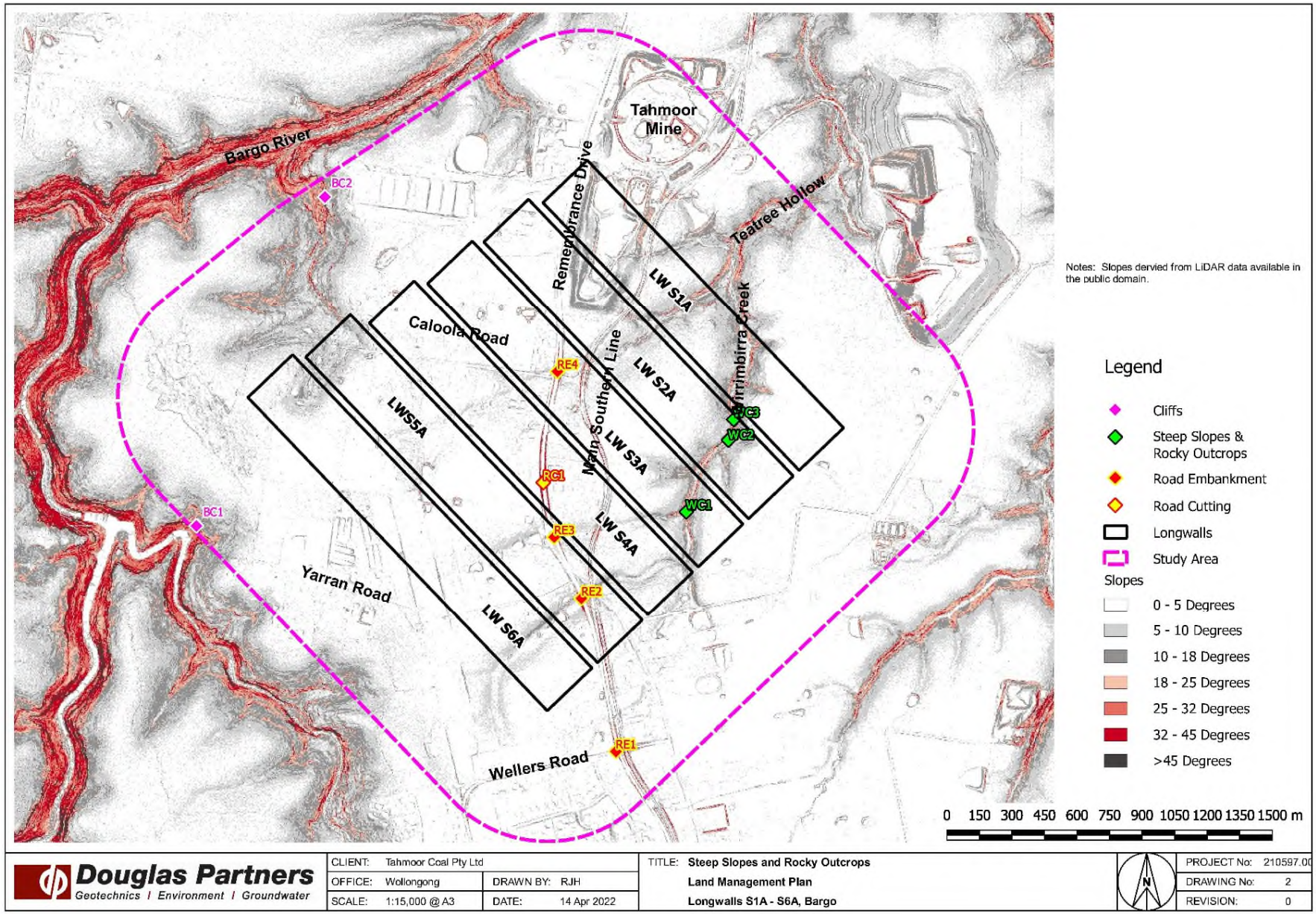


Figure 2-9 Cliffs and natural steep slopes within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

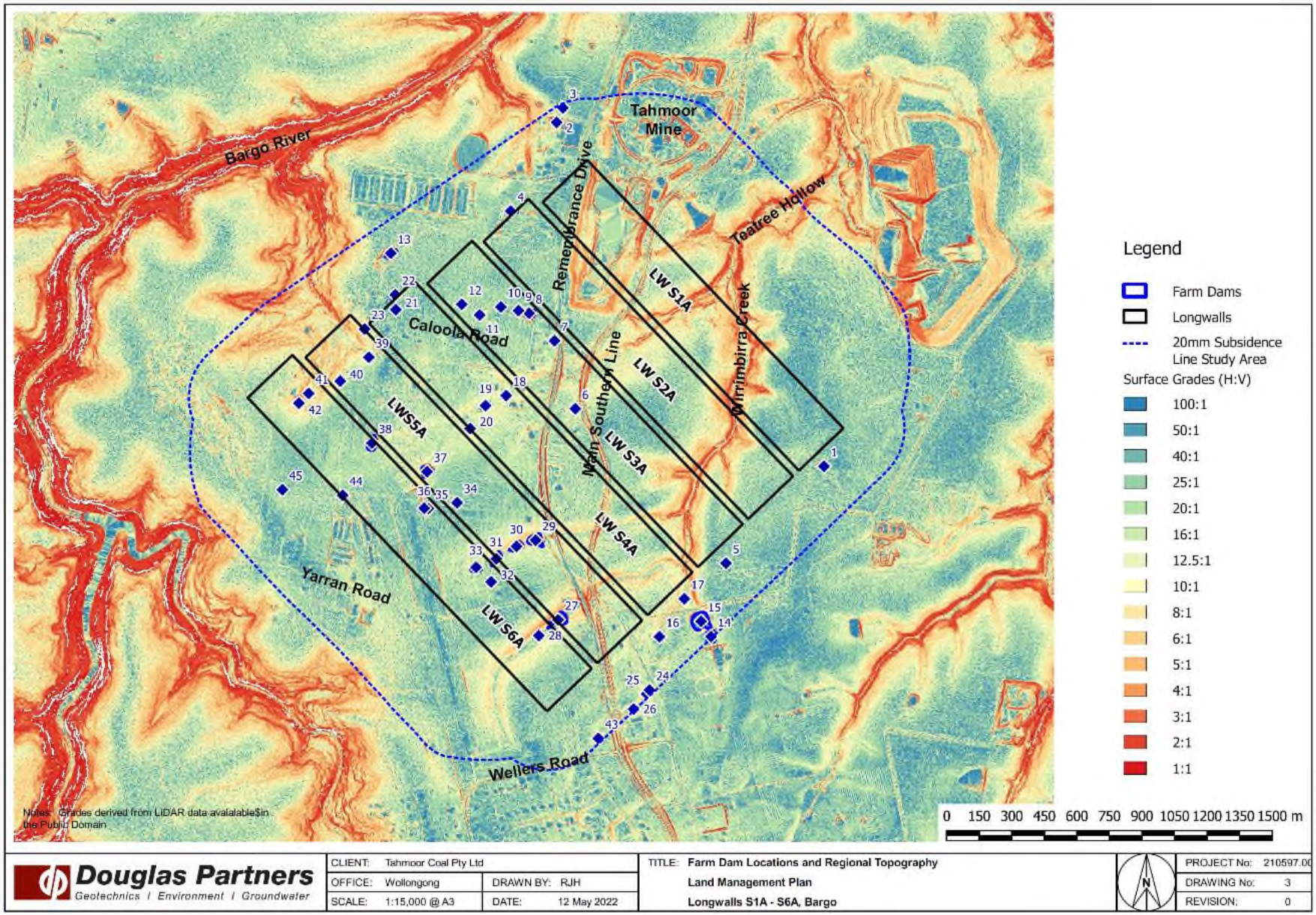


Figure 2-10 Dams within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

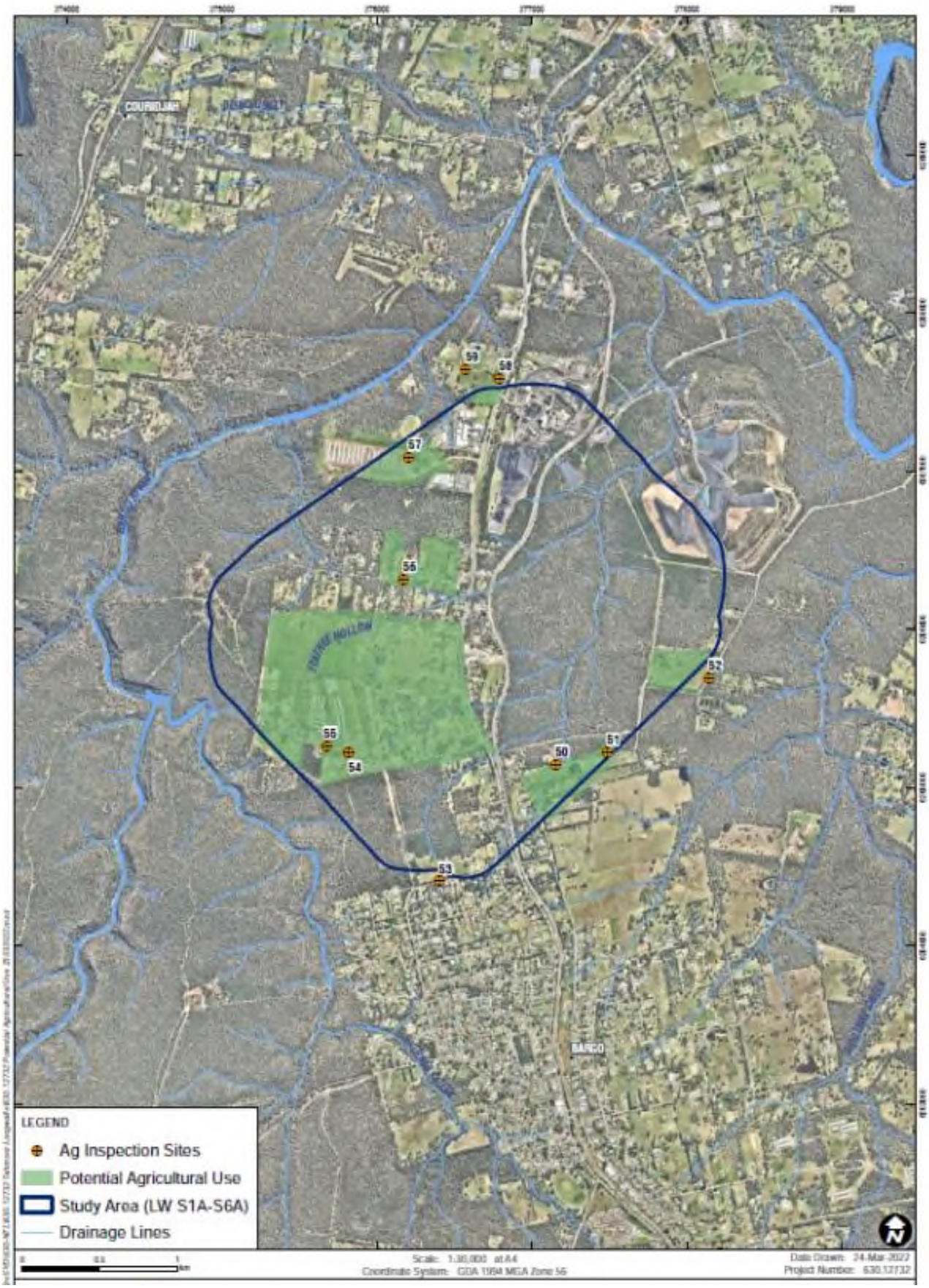


Figure 2-11 Agricultural land and inspection sites within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

2.5 Biodiversity Monitoring

The LW S1A-S6A Biodiversity Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on aquatic and terrestrial flora and fauna in accordance with Condition C8 of SSD 8445.

During the reporting period, the LW S1A-S6A Biodiversity Management Plan has been implemented to monitor ecology in the Study Area, as outlined below:

- Aquatic ecology – Bi-annual (Spring and Autumn) monitoring. During this reporting period, this monitoring was completed monitoring during Spring 2022 by Niche Environment and Heritage (Niche, 2023a); and
- Terrestrial ecology – Bi-annual (Spring and Autumn) monitoring. During this reporting period, this monitoring was completed monitoring during Spring 2022 by Niche Environment and Heritage (Niche, 2023b).

The following sections summarise the observations made during the reporting period for aquatic and terrestrial ecology. Performance against all Biodiversity Management Plan TARPs (BMP1-4) for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.5.1 Aquatic Ecology

The aquatic ecology monitoring program for LW S1A-S6A has been designed to monitor subsidence-induced impacts on aquatic ecology. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Aquatic habitat assessment of geomorphology, channel diversity, bank stability, riparian vegetation and adjacent land use, water quality, macrophytes and local impacts and land use practices in accordance with the Australian River Assessment System (AUSRIVAS);
- Macroinvertebrate survey:
    - AUSRIVAS macroinvertebrate sampling; and
    - Quantitative benthic macroinvertebrate monitoring program.

The aquatic ecology monitoring program is primarily focused on macroinvertebrate monitoring regimes including AUSRIVAS and quantitative using Before After Control Impact (BACI) design.

2.5.1.1 Spring 2022 Monitoring Results

Aquatic monitoring for spring 2022 was conducted by Niche Environment and Heritage from 17 – 22 November 2022. A total of eight locations were sampled within Teatree Hollow, Hornes Creek and Moore Creek comprising four impact sites (TTH12, TTH13, TTH16, TTH17) and four control sites (HC7, HC8, MC14, MC15). The locations of monitoring sites are illustrated in **Figure 2-12**.

The following results were observed for this monitoring period (Niche, 2023a):

- Elevated water levels were observed across the monitoring sites in spring 2022;
- Increased riparian vegetation growth has occurred since the 2019 bushfires;
- Water quality readings were generally consistent across the monitoring sites with low turbidity and electrical conductivity levels, and high dissolved oxygen levels recorded. Results were indicative of the elevated flow levels and continuous rainfall inputs;
- No indicators of any acute or chronic water quality issues were identified in the spring 2022 water quality data;
- A continued slight increase in AUSRIVAS stream health scores have been observed since spring 2021;

- AUSRIVAS scores, SIGNAL2 and EPT were low at both potential impact and control streams but comparable between the site treatments, suggesting that background conditions are under natural environmental stress;
- Quantitative macroinvertebrate assemblage data showed some significant spatial differences across the impact sites in spring 2022. The variation was found to be influenced by Leptophlebiidae, Baetidae and Chironomidae macroinvertebrate families. It is considered likely that these spatial differences have been driven by the significant environmental conditions (elevated rainfall) in spring 2022; and
- The quantitative data will be considered in detail in autumn 2023 to confirm whether fine scale differences observed in spring 2022 are part of natural variability or indicative of long-term changes.

There was slight improvement in water quality and stream health scores in spring 2022. These changes are likely attributed to increase flows over the period, leading to increased habitat availability. A continuation of trends observed in autumn 2022. The variation in water quality, and stream health is expected in response to changing environment conditions, particularly intermittent waterways that experience extreme fluctuations in aquatic habitat availability and quality.

2.5.2 Terrestrial Ecology

The terrestrial ecology monitoring program for LW S1A-S6A has been designed to monitor subsidence-induced impacts on terrestrial ecology including riparian vegetation and amphibian monitoring.

The terrestrial ecology monitoring program uses a Before After Control Impact (BACI) design to identify ecological change within the Study Area as a result of mine subsidence by permitting comparisons of population trends between control and impact areas, before and after the impact. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Floristic surveys within established vegetation monitoring plots for riparian vegetation, Threatened Ecological Communities (TEC), and threatened flora species;
- Amphibian monitoring along established transects:
    - Spotlighting;
    - Call provocation;
    - Listening for diagnostic frog calls; and
    - Tadpole identification.

2.5.2.1 Spring 2022 Monitoring Results for Riparian Vegetation

Riparian vegetation monitoring for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. A total of six locations were sampled for riparian vegetation, including three impact sites (i01, i02, and i03) and three control sites (c04, c05 and c06).

The following results were observed for this monitoring period for riparian vegetation (Niche, 2023b):

- According to the Fire Extent Severity Mapping (FESM) mapping, all riparian Sites were burnt in the 2019/2020 bushfires and were within a 'Moderate' to 'Extreme' severity burnt class, where all stratum layers were severely burnt to canopy height. Many species and communities will take years to recover, particularly those not adapted to fire or impacted by prolonged drought or other threatening processes;
- Dominant species in terms of percent cover for Spring 2022 riparian plots include *Pteridium esculentum*, *Acacia decurrens*, *A. mearnsii* (particularly dominant in Spring at impact Site 3), *Desmodium rhytidophyllum*, *Banksia spinulosa* and *B. serrata*. Most dominant exotic species included *Desmodium intortum*, *Lonicera japonica*, and *Cyperus eragrostis*;

- Across all sampling seasons, native species richness appears to be decreasing at riparian control Sites, while native cover at future impact Sites is relatively stable (only fluctuating slightly across seasons);
- During the Spring 2020, 2021 and 2022 riparian monitoring, the average floristic cover at the impact Sites was much higher compared with the control Sites in both native and exotic species, whereas native vegetation cover across impact and control Sites during Autumn monitoring appears to be similar. This suggests that seasonality is currently very influential on the degree of vegetation cover across impact sites;
- The six riparian plots, across sampling seasons (Spring 2020 to Spring 2022) had a Vegetation Integrity (VI) score between 23.6 (impact Site 3, Spring 2020) to 59.1 (impact Site 1, Spring 2021) (low to moderate condition). VI scores between Autumn 2022 and Spring 2022 have decreased slightly at impact Sites 1, 2, 3 and control Sites 4 and 5. The reduction in VI score is attributed to reduced structural condition, and increased exotic species, which is likely due to the significant flooding observed earlier in 2022;
- Catchment-scale drivers of change (flooding and prolonged rainfall events) were observed at Sites that had been previously impacted by bushfires (2019/2020 bushfires). Key influences observed in Spring 2022 including moderate to severe flooding (March and July 2022), human disturbance, particularly weeds and altered flow regimes as a result of elevated rainfall conditions; and
- The current dataset has indicated that the control and impact Sites are sufficiently similar (riparian vegetation and TEC [type and condition class]) to be suitable for long-term monitoring.

2.5.2.2 Spring 2022 Monitoring Results for Threatened Ecological Communities

Monitoring of TEC vegetation for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. TEC monitoring was conducted at six sites including three impact sites (TEC4, TEC5 and TEC6) and three control sites (TEC1, TEC2 and TEC3). The locations of monitoring sites are illustrated in **Figure 2-14**.

TEC monitoring focused on Shale Sandstone Transition Forest in the Sydney Basin Bioregion (listed as Critically Endangered under the *Biodiversity Conservation Act 2016*) which is in moderate to high condition within the monitoring plots.

TEC monitoring for Spring 2022 indicated that TEC remnants within the Tahmoor South Study Area were in moderate to high condition across control and impact Sites. The current dataset has indicated that the TEC control and impact Sites are sufficiently similar to be suitable for long-term monitoring.

2.5.2.3 Spring 2022 Monitoring Results for Threatened Flora Species

Monitoring of threatened flora species for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. Threatened flora species were monitored at six plot sites in areas with known threatened flora records, including three impact sites (TF4, TF5 and TF6) and three control sites (TF1, TF2 and TF3). The locations of monitoring sites are illustrated in **Figure 2-14**.

The threatened flora monitoring was established in September 2022, and the baseline number of threatened individuals at each site was recorded within a fixed 10 x 10 m plot (prior to the commencement of mining) at each monitoring site. A subsequent round of monitoring was undertaken in November 2022 (after the commencement of mining), and therefore the Spring 2022 round of threatened flora monitoring is represented by both baseline and post-mining monitoring surveys.

The six plots were designed to monitor a subset of individuals of the following species, Brown Pomaderris (*Pomaderris brunnea*), Bargo Geebung (*Persoonia bargoensis*), and small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*).

During Spring 2022 monitoring, the highest number of individuals was identified at control Site TF3 (mean count of 211.5 of Small-flowered Grevillea), followed by control Site TF1 (mean count of 197.0 of Brown Pomaderris), and impact Site TF6 (mean count of 159.5 of Small-flowered Grevillea).

Monitoring to date has indicated that the control and impact Sites are sufficiently similar (species and abundance) to be suitable for long-term monitoring.

2.5.2.4 Spring 2022 Monitoring Results for Amphibian Monitoring

Amphibian monitoring for spring 2022 was conducted by Niche Environment and Heritage on 26 October, 1 and 2 November 2022. A total of six locations were sampled for riparian vegetation, including three impact sites (i01, i02, and i03) and three control sites (c04, c05 and c06). The locations of monitoring sites are illustrated in **Figure 2-13**.

Amphibian monitoring focused on the identification of two threatened frog species – the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophryne australis*).

The following results were observed for this monitoring period (Niche, 2023b):

- Frog detection rates were variable across Spring monitoring events. The two species driving this variation were Common Eastern Froglet (*Crinia signifera*) and Stony Creek Frog (*Litoria lesueurii*). At the time of Spring 2022 monitoring, there were consecutive months of substantially above average monthly rainfall totals, including a notable flooding event in March and July 2022;
- A total of three frog species were detected across the Spring 2022 monitoring event, which represents a reduced level of species detection that is observed across both control and impact monitoring sites in comparison to previous baseline surveys. This may be attributable to the recent flooding event in March and July 2022, which altered microhabitats within the streams. Amphibian species diversity (e.g., tree frogs) are likely to increase with time after flooding and as flow conditions return to more nominal levels and habitats are restored and reworked;
- The targeted threatened frog species appears not to be present in the Study Area. While the study area contains superficially suitable habitat, it is possible that these species would no longer be able to survive in the area due to number of factors such as:
    - Absence of suitable non-breeding habitat for Giant Burrowing Frog at most monitoring Sites (due to removal of groundcover from fire, heavy weed encroachment and erosion);
    - Increased urban encroachment resulting in habitat removal, altered hydrological flows, water quality and nutrient loads; and
    - Potential predation pressures from two introduced predators: Eastern Gambusia (*Gambusia holbrooki*) and the Yabby (*Cherax destructor*), both of which were detected at all Sites.

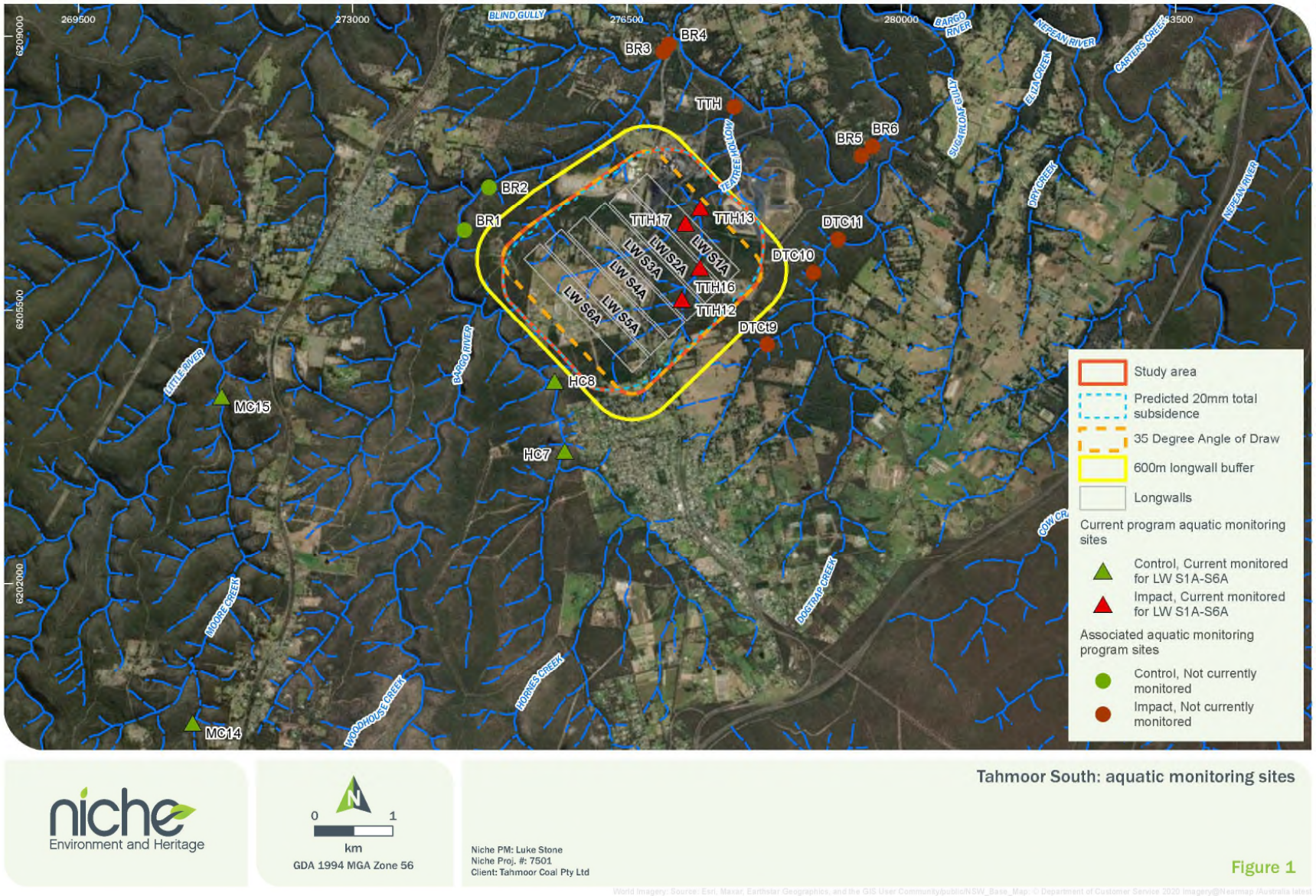


Figure 2-12 LW S1A-S6A Aquatic Ecology Monitoring Locations (source: Niche, 2023a)

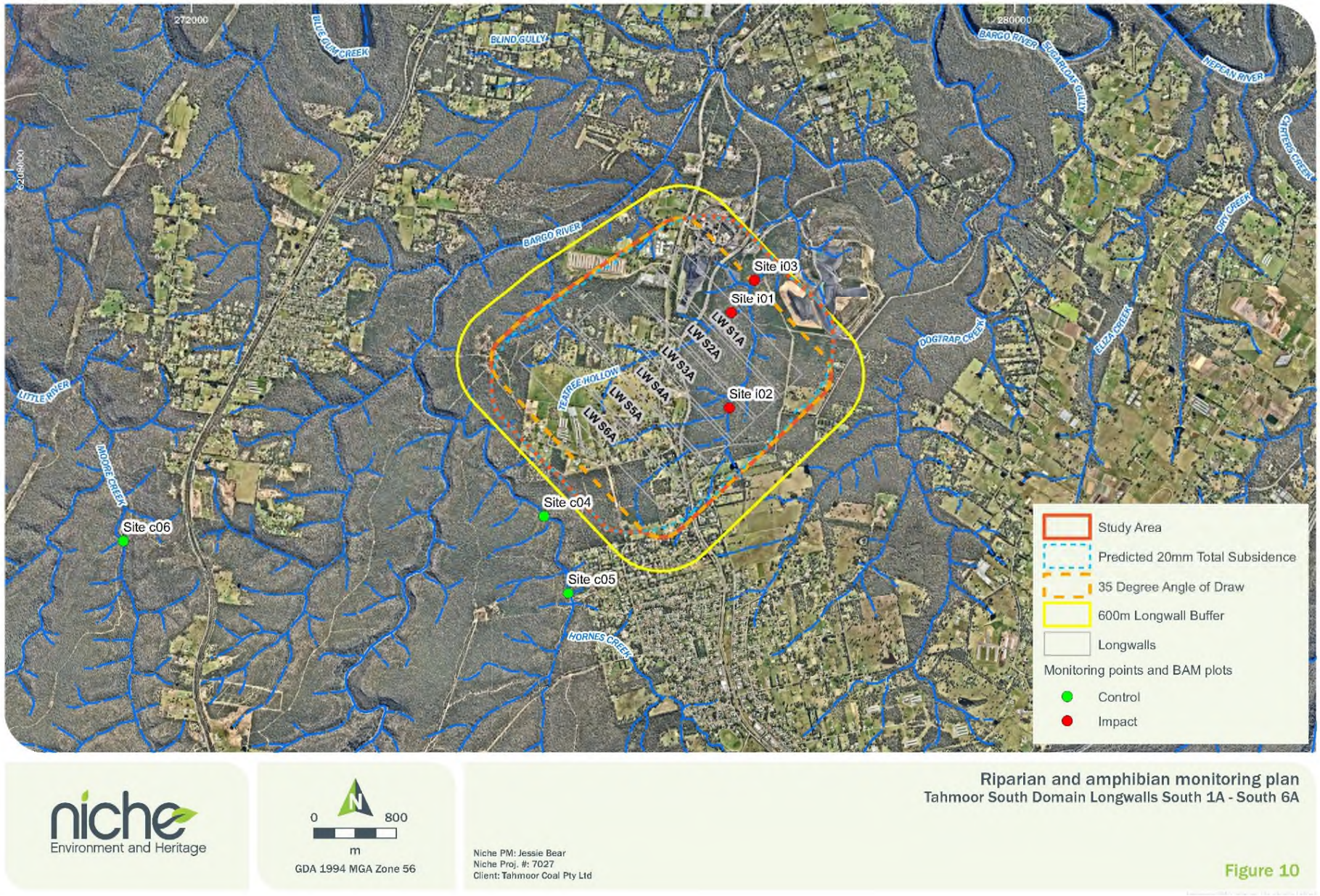


Figure 2-13 LW S1A-S6A Riparian Vegetation and Amphibian Monitoring Locations (source: LW S1A-S6A Biodiversity Management Plan)

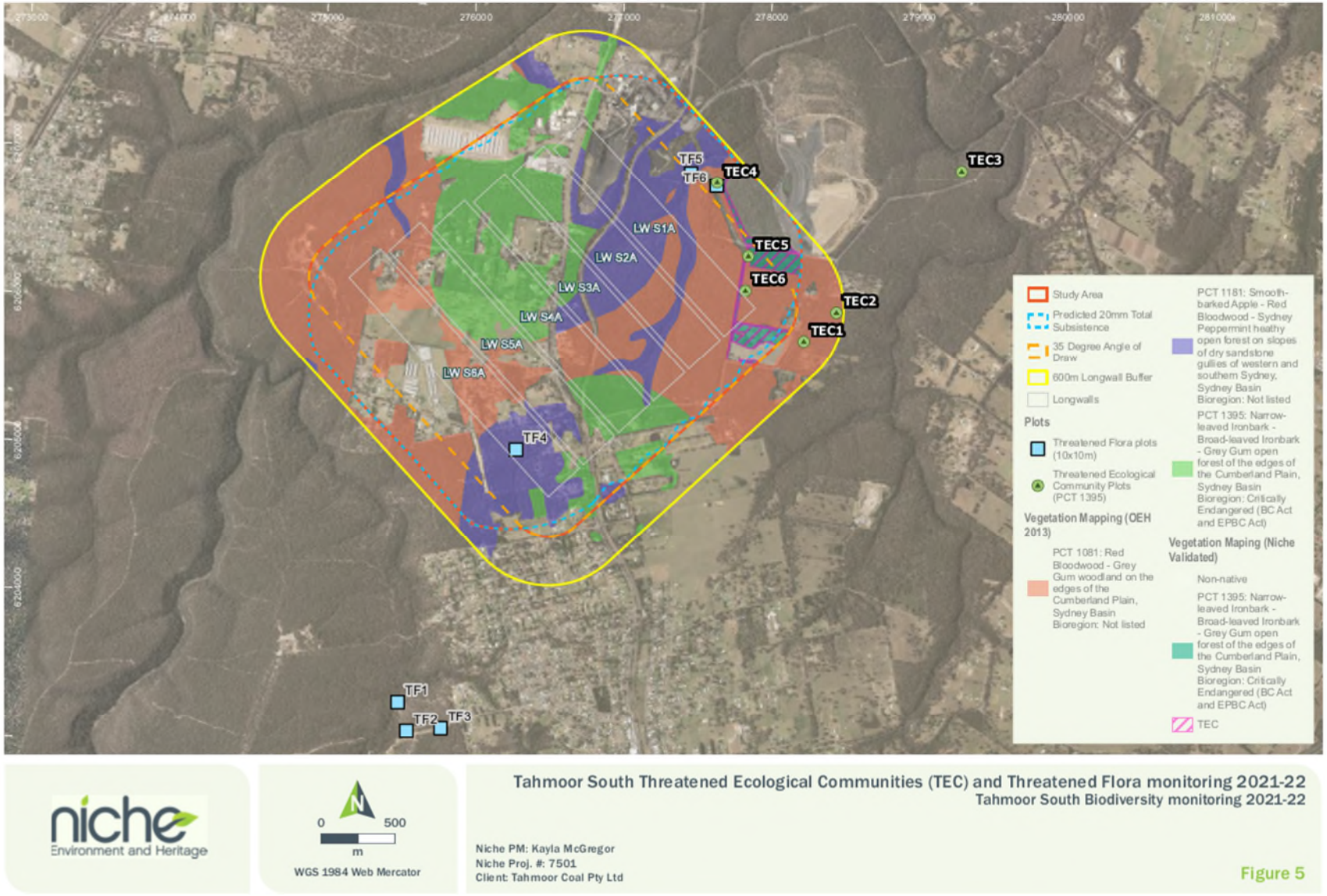


Figure 2-14 LW S1A-S6A Threatened Ecological Community and Threatened Flora Monitoring Locations (source: Niche, 2023b)

2.6 Heritage Monitoring

The LW S1A-S6A Heritage Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on Aboriginal heritage and historical heritage sites and values in accordance with Condition C8 of SSD 8445.

The following sections summarise the observations made during the reporting period for Aboriginal and historical heritage items. Performance against all Heritage Management Plan TARPs (HMP1 and HMP2) for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.6.1 Aboriginal Heritage

During this reporting period, the LW S1A-S6A Heritage Management Plan has been implemented to monitor subsidence impacts on the rockshelter Teatree Hollow 2013.1 (AHIMS 52-2-4471). The Aboriginal heritage monitoring of this rockshelter requires the following monitoring during and post-mining:

- Fortnightly visual inspection of the rockshelter (monitoring overall rockshelter stability) during periods of active subsidence for LW S1A, S2A, S3A and S4A, to be completed from a safe distance. This monitoring is completed by Building Inspection Services and Douglas Partners on an alternative monthly schedule, and reported in their monthly reports (available on request);
- Monitoring of GNSS units / survey lines in proximity to the rockshelter, reviewed on a monthly basis during periods of active subsidence for LW S1A, S2A, S3A and S4A. This monitoring is summarised in the weekly MSEC Subsidence Reports (refer to **Appendix A** for referenced reports); and
- Visual inspection by archaeologist with RAPs at the completion of LW S1A, S2A, S3A and S4A. No visual inspections have been required during this reporting period.

It is noted that the artefact scatter Remebrance Drive 2013.1 (AHIMS 52-2-3968) and isolated find TC14-2-19 (AHIMS 48-2-0275) were also assessed in the LW S1A-S6A Heritage Management Plan, however no pre-mining, during mining or post-mining monitoring is required for these sites.

During the reporting period, very minor ground movements have been measured by GNSS units S03 and S04 located on either side of Wirrimbirra Creek (in vicinity of the rockshelter site) (**Appendix A**). In addition, no visual impacts have been observed at the rockshelter site during the reporting period.

2.6.2 Historical Heritage

During this reporting period, the LW S1A-S6A Heritage Management Plan was implemented to monitor subsidence impacts for the following historical heritage items:

- Wirrimbirra Sanctuary (Australian Wildlife Sanctuary):
    - Various monitoring as per the Australian Wildlife Sanctuary Management Plan - This monitoring is summarised into a Weekly Subsidence Status Report by MSEC (available on request); and
    - Visual inspection by a heritage consultant at the completion of LW S5A - No visual inspections have been required during this reporting period.
- Bargo Railway Bridge North (Wellers Road Overbridge) and Bargo Railway Viaduct:
    - Various monitoring as per the Main Southern Railway Management Plan - This monitoring is summarised into a Weekly Subsidence Status Report by MSEC (available on request); and
    - Visual inspection by a heritage consultant at the completion of LW S6A - No visual inspections have been required during this reporting period.

- Bargo Cemetery:
    - Various monitoring as per the Bargo Cemetery Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required; and
    - Visual inspection by a heritage consultant at the completion of LW S6A - No visual inspections have been required during this reporting period.
- Picton Weir
    - Various monitoring as per the Picton Weir Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required.
- Tahmoor Colliery (Tahmoor Mine Site):
    - Various monitoring as per the Tahmoor Mine Site Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required.
- Great Southern Road (partial):
    - Various monitoring as per the Main Southern Railway Management Plan - This monitoring is summarised in the weekly MSEC Subsidence Reports (refer to **Appendix A** for referenced reports).

During the reporting period, no impacts to historical heritage items were reported in relation to LW S1A mining.

Main Southern Railway features (including the Wellers Road Overbridge and Bargo Railway Viaduct) are discussed further in **Section 2.7.1**, local roads in **Section 2.7.2**, Tahmoor Mine Site in **Section 2.7.8**, Australian Wildlife Sanctuary in **Section 2.7.9**, Bargo Cemetery in **Section 2.7.12**, and Picton Weir in **Section 2.7.13**.

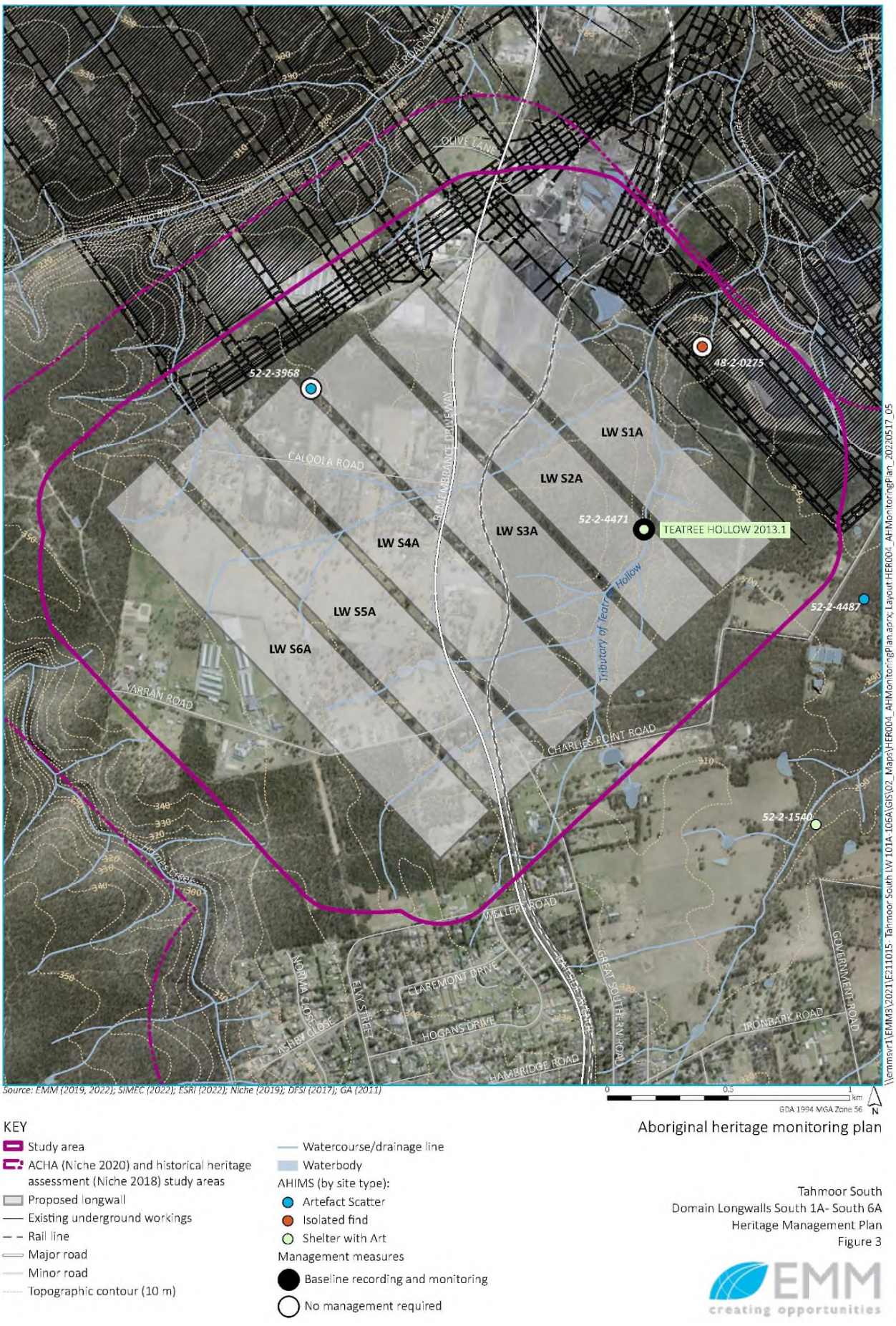


Figure 2-15 Aboriginal Heritage Monitoring Sites in the LW S1A-S6A Study Area (Source LW S1A-S6A Heritage Management Plan)

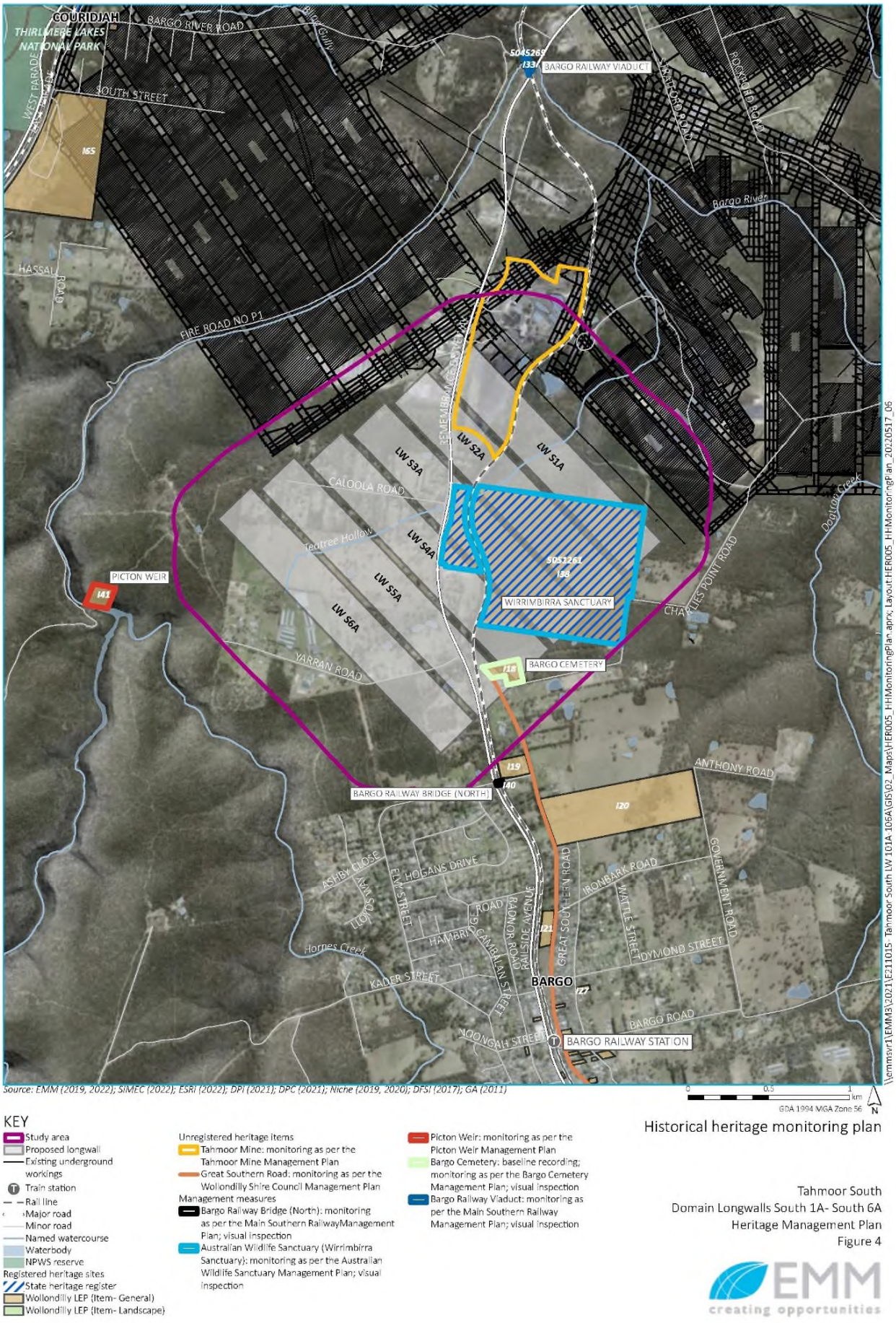


Figure 2-16 Historical Heritage Sites in the LW S1A-S6A Study Area and Surrounds (Source LW S1A-S6A Heritage Management Plan)

2.7 Built Features Monitoring

The LW S1A-S6A Built Features Management Plan and associated sub-plans were prepared to manage the potential environmental consequences of LW S1A-S6A extraction on built features in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Subsidence Monitoring Program was implemented to monitor subsidence impacts on infrastructure owned by Wollondilly Shire Council (roads, bridges and culverts), ARTC (rail infrastructure), Sydney Water (potable water infrastructure and sewer infrastructure), Endeavour Energy (electrical infrastructure), Jemena (gas infrastructure), Telstra (telecommunications infrastructure), NBN (telecommunications infrastructure), TPG (telecommunications infrastructure) and private property owners. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-1**.

A weekly review of the subsidence survey results during the reporting period has been completed by MSEC during mining of LW S1A (referred documents provided in **Appendix A**). In addition, weekly reports by MSEC are prepared for specific built features including the Main Southern Railway, Tahmoor Mine Site, and Australian Wildlife Sanctuary.

The following sections summarise the observations made during the reporting period for built features. Performance against all built features TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.7.1 Main Southern Railway

The first Subsidence Management Status Report for the Main Southern Railway has been prepared (covering the commencement of LW S1A mining to 24 January 2023).

During the reporting period, no safety incidents or delays to rail operations were reported. In addition, all survey measurements were very minor and no issues were reported.

2.7.2 Local Roads

There are no local roads located above the commencing end of LW S1A.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December 2022.

Surveys of Rockford Road Bridge and Arina Road Bridge were conducted on 6 December 2022, with observed changes within survey tolerance.

A visual inspection along local roads, Arina Road Bridge and Rockford Road bridge on 23 December 2022 found no issues. Some potholes on Charlies Point Road were patched between 16 and 23 December 2022. Another visual inspection along local roads on 30 December 2022 found no issues.

2.7.3 Potable Water Infrastructure

No potable water infrastructure is located above the commencing end of LW S1A.

2.7.4 Sewer Infrastructure

No sewer infrastructure is located above the commencing end of LW S1A.

2.7.5 Gas Infrastructure

No gas infrastructure is located above the commencing end of LW S1A.

2.7.6 Electrical Infrastructure

An 11 kV powerline is located above the commencing end of LW S1A along Charlies Point Road. Ground surveys of critical power poles are being conducted when poles are within the active subsidence zone.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December 2022.

A visual inspection on 30 December 2022 found no issues.

2.7.7 Telecommunications Infrastructure

No telecommunications infrastructure is located above the commencing end of LW S1A.

2.7.8 Tahmoor Mine Site

The Tahmoor Mine Site is not located above the commencing end of LW S1A.

2.7.9 Australian Wildlife Sanctuary

Weekly Subsidence Status Reports have been prepared for the Australian Wildlife Sanctuary, which summarises monitoring and inspections results from relevant GNSS units, ground survey (Tahmoor Mine Boundary line (V line)), survey and visual inspections of Main Southern Railway, local streets, structures; and natural features observations.

During the reporting period, there were no triggers under the Australian Wildlife Sanctuary Management Plan.

2.7.10 Built Structures

There are no built structures located above the commencing end of LW S1A.

2.7.11 Farm Dams

A summary of observations of farm dams is provided in **Section 2.4.3**.

2.7.12 Bargo Cemetery

This location is not located above the commencing end of LW S1A.

2.7.13 Picton Weir

This built feature is not located above the commencing end of LW S1A.

2.8 Public Safety Monitoring

The LW S1A-S6A Public Safety Management Plan was prepared to manage the potential consequences as a result of LW S1A-S6A extraction on public safety within the Study Area in accordance with Condition C8 of SSD 8445.

As noted in **Section 1.3.3** of this report, management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan. Monitoring of cliffs, natural steep slopes and other landscape features has been conducted for the reporting period in accordance with the LW S1A-S6A Land Management Plan (refer to **Section 2.4** for a summary of monitoring results). In addition, monitoring of built features has been conducted for the reporting period in accordance with the LW S1A-S6A Built Features Management Plan (refer to **Section 2.7** for a summary of monitoring results).

No subsidence impacts were identified during the reporting period that were considered to pose a risk to public safety.

3 Overview of Impacts and Actions

3.1 Summary of Impacts

This section provides a comprehensive summary of all impacts during the reporting period, including a revised characterisation according to the relevant TARPs (if required).

A full list of TARPs for environmental features that are applicable is provided in Appendix B of the LW S1A-S6A Extraction Plan.

A summary of monitoring results for relevant TARPs is provided in **Table 2-3**.

Table 3-1 Summary of TARP Triggers for October to December 2022

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
Water Management Plan	WMP1	Stream Water Quality for all Watercourses within the Subsidence Area	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.
	WMP2	Stream Water Quality for other Watercourses (Bargo River and Hornes Creek)	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.
	WMP3	Pool Water Level for all Watercourses within the Subsidence Area	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	LEVEL 1 TRIGGERED[1] The recorded water level declined by greater than 10 centimetres (cm) below the recorded baseline minimum level at TT9 (and the same did not occur at the reference site(s)).
	WMP4	Pool Water Level for other Watercourses (Bargo River and Hornes Creek)	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).
	WMP5	Physical Features and Natural Behaviour of Watercourses within the Subsidence Area	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.
	WMP6	Physical Features and Natural Behaviour of Pools for other Watercourses (Bargo River and Hornes Creek)	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.
	WMP7	Channel Stability, Sedimentation and Erosion	No further development of soft knickpoints or increased erosion of headwater streams.	No further development of soft knickpoints or increased erosion of headwater streams.	No further development of soft knickpoints or increased erosion of headwater streams.
	WMP8	Shallow Groundwater Level (Open Standpipes and Private Bores)	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.
	WMP9	Shallow Groundwater Pressure (VWP Sensors < 200 m Depth) – original TARP	ORIGINAL TARP* Normal Condition[2] for all monitoring bores.	REVISED TARP* Normal Condition[4] for all monitoring bores.	ORIGINAL TARP* Normal Condition[2] for all monitoring bores.	REVISED TARP* Normal Condition[4] for all monitoring bores.	ORIGINAL TARP* Level 2 TARP Trigger[3] for TBC032 – HBSS-131m intake.	REVISED TARP* Normal Condition[4] for all monitoring bores.
	WMP10	Groundwater Level / Pressure Deep VWPs (> 200 m Depth excluding Monitoring the Bulli Coal Seam)	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC09 (BGSS–322m), TBC09 (BGSS-343m), TBC018 (BGSS-282m), TBC018 (BGSS-366m), TBC18 (BUSM-404m), TBC20 (WBCS-397m), TBC20 (BGSS-375m), TBC26 (BUSM-432m), TBC32 (BGSS-237m), TBC32 (BGSS-294m).	REVISED TARP* Normal condition[6] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC09 (WWCO-391m), TBC09 (WO-397m), TBC18 (W0-432m), TBC020 (211m), TBC32 (BGSS-200m), TBC39 (BGSS-299m); and all triggered in October 2022.	REVISED TARP* Normal condition[6] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC020 (293m) and all triggered in October and November 2022.	REVISED TARP* Normal condition[6] for all monitoring bores.

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022		November 2022		December 2022	
	WMP11	Groundwater Quality (Open Standpipes and Private Bores)	NA – Monitoring data for this month collected prior to commencement of mining.		ORIGINAL TARP* Level 1 TARP trigger[7] for P53B (pH upper), GW112473 (EC and pH lower), P52 (EC), P53A (EC), P55A (EC), numerous heavy metals P51B, P52, P53A, P53B, P53C, P55A, P55B, P55C, P56B, P56C, GW062068, GW104008, GW105395, GW109257 and GW112473.	REVISED TARP* Normal condition[8] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[7] for P55A (EC) and numerous heavy metals at P51B, P52, P53A, P53B, P55A, P55B, P55C, P56B, P56C, GW062068, GW104008, GW104323, GW104659, GW105395, GW109257 and GW112473.	REVISED TARP* Normal condition[8] for all monitoring bores.
	WMP12	Groundwater – Surface Water Interaction	Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.		Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.		Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.	
	WMP13	Groundwater Bores Monitoring for Thirlmere Lakes	ORIGINAL TARP* Normal condition[9] for all "early warning" bores listed in TARP.	REVISED TARP* Normal condition[11] for all "early warning" bores listed in the TARP.	ORIGINAL TARP* Level 1 TARP trigger[10] for P51B (groundwater quality) and GW062068 (groundwater quality).	REVISED TARP* Normal condition[11] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[10] for P51B (groundwater quality), GW062068 (groundwater quality), and GW104659 (groundwater quality).	REVISED TARP* Normal condition[11] for all monitoring bores.
Land Management Plan	LMP1	Cliffs	NA – No monitoring is required.		NA – No monitoring is required.		NA – No monitoring is required.	
	LMP2	Natural Steep Slope (excluding Constructed Steep Slopes associated with Roads, Railway and the Tahmoor Mine Site)	NA – No monitoring is required as features are no within the active subsidence zone.		No observations of surface cracking, or localised ground bulging, buckling or shearing.		No observations of surface cracking, or localised ground bulging, buckling or shearing.	
	LMP3	Farm Dams	NA – No monitoring is required as features are no within the active subsidence zone.		No observations of cracks developing within dam embankments.		No observations of cracks developing within dam embankments.	
	LMP4	Agricultural Land	No changes to agricultural land observed.		No changes to agricultural land observed.		No changes to agricultural land observed.	
Biodiversity Management Plan	BMP1	Aquatic Habitat and Macroinvertebrate Indicators (Stream Health)	Visual monitoring indicates aquatic pool habitat parameters are similar to baseline observations at aquatic ecology monitoring sites, and AUSRIVAS score equal to or greater than Band C.		Visual monitoring indicates aquatic pool habitat parameters are similar to baseline observations at aquatic ecology monitoring sites, and AUSRIVAS score equal to or greater than Band C.		NA – Monitoring next required in Autumn 2023.	
	BMP2	Amphibian Populations	Amphibian populations are stable and habitat parameters are predominantly within a reasonable range of baseline data.		Amphibian populations are stable and habitat parameters are predominantly within a reasonable range of baseline data.		NA – Monitoring next required in Autumn 2023.	
	BMP3	Riparian Vegetation	Riparian vegetation parameters are predominantly within a reasonable range of baselines data, and monitoring indicates native vegetation cover is within a reasonable range of baseline data.		Riparian vegetation parameters are predominantly within a reasonable range of baselines data, and monitoring indicates native vegetation cover is within a reasonable range of baseline data.		NA – Monitoring next required in Autumn 2023.	
	BMP4	Threatened Species, Threatened Populations and Endangered Ecological Communities	TEC parameters are within a reasonable range of average baseline data and targeted threatened flora species numbers are stable.		TEC parameters are within a reasonable range of average baseline data and targeted threatened flora species numbers are stable.		NA – Monitoring next required in Autumn 2023.	

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
Heritage Management Plan	HMP1	Aboriginal Cultural Heritage Sites – Teatree Hollow 2013.1	No detectable environmental consequences observed.	No detectable environmental consequences observed.	No detectable environmental consequences observed.
	HMP2	Historical Heritage Items - Wirrimbirra Sanctuary (Australian Wildlife Sanctuary) - Bargo Cemetery - Bargo Railway Bridge North (Wellers Road Overbridge) - Picton Wier - Tahmoor Colliery (Tahmoor Mine Site) - Bargo Railway Viaduct - Great Southern Road (partial)	No detectable environmental consequences observed.	No detectable environmental consequences observed.	No detectable environmental consequences observed.
Built Features Management Plan	1. Main Southern Railway Management Plan	Main Southern Railway Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	2. Wellers Road Overbridge Management Plan	Wellers Road Overbridge	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.
	3. Wollondilly Shire Council Management Plan	Public roads, bridges and culverts	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	4. Sydney Water Potable Water Management Plan	Potable Water Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	5. Sydney Water Sewer Management Plan	Sewerage Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	6. Jemena Management Plan	Gas Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	7. Endeavour Energy Management Plan	Electricity Infrastructure	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	8. Telstra Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	9. NBN Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	10. TPG Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	11. Built Structures Management Plan	Public amenities, private structures and farm dams	NA – No structures located above the commencing end of LW S1A.	NA – No structures located above the commencing end of LW S1A.	NA – No structures located above the commencing end of LW S1A.
	12. Bargo Cemetery Management Plan	Bargo Cemetery (Heritage Site)	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	13. Wollondilly Anglican College Management Plan	Wollondilly Anglican College	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	14. Tahmoor Mine Site Management Plan	Tahmoor Mine Site	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	15. Australian Wildlife Sanctuary Management Plan	Australian Wildlife Sanctuary	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	16. Picton Weir Management Plan	Picton Weir	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
	17. 3030 Remembrance Drive Management Plan	Bargo Petroleum and Hill Top Pit Stop	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	18. Inghams Bargo Chicken Breeder Production Complex Management Plan	Inghams Bargo Breeder Farm	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	19. Inghams Bargo Turkey Farm Management Plan	Inghams Bargo Turkey Farm	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	20. Tahmoor Garden Centre Management Plan	Tahmoor Garden Centre	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	21. MKD Machinery Management Plan	MKD Machinery	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	22. Bargo Valley Produce Management Plan	Bargo Valley Produce	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	23. Canine Country Club Management Plan	Canine Country Club	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	24. Pamak Hobbies Management Plan	Pamak Hobbies	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.

Notes:

NR – Monitoring not required this month.

NA – Monitoring data not available as monitoring not completed this month or reporting not yet available.

* As discussed further in **Section 3.2.2**, a review of TARPs WMP9, WMP10, WMP11 and WMP13 was required due to multiple triggers in October to December 2022 from short term fluctuations in parameters demonstrated that the TARP triggers were too sensitive. Re-assessment of groundwater data against the revised TARPs was completed following this review process. This table presents the TARP triggers in accordance with the original TARPs and the revised TARPs. Further discussion of these TARP triggers and the TARP review process is provided in **Section 3.2.2** and the Groundwater Report (**Appendix C)**.

[1] TARP WMP3 Level 1 Trigger (LW S1A-S6A Water Management Plan): The recorded water level has declined by greater than 10 centimetres (cm) below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) and the same has not occurred at the at the reference site(s).

[2] Original TARP WMP9 Normal Condition (LW S1A-S6A Water Management Plan): No recorded mining induced change at VWP depth, or greater than 5 m water level reduction in VWP intakes following the commencement of extraction for a period less than six months.

[3] Original TARP WMP9 Level 2 Trigger (LW S1A-S6A Water Management Plan): Water level declines below the calculated Level 2 trigger – being the average of Level 1 (the '5 m drawdown'1) and Level 3 (the 'maximum modelled drawdown') – following the commencement of extraction for a period of greater than six consecutive months AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[4] Revised TARP WMP9 Normal Condition (refer to Appendix C): No observable mining induced change at VWP intakes OR Greater than 5 m water level reduction in VWP intakes following the commencement of extraction for a period of less than six months.

[5] Original TARP WMP10 Level 1 Trigger (LW S1A-S6A Water Management Plan): Recorded drawdown is within 30 m of modelled predicted drawdown, for a period less than 6 months.

[6] Revised TARP WMP10 Normal Condition (refer to Appendix C): Observed data does not exceed modelled predicted drawdown by greater than 30 metres OR observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for less than three consecutive months.

[7] Original TARP WMP11 Level 1 Trigger (LW S1A-S6A Water Management Plan): Recorded salinity and/or metals or pH outside of defined trigger levels for 3 consecutive months or less. The effect does not persist after a significant rainfall recharge event AND a similar trend or response is noted at other monitored bores or private groundwater bores.

[8] Revised TARP WMP11 Normal Condition (refer to Appendix C): No observable changes in salinity, pH or metals outside of the baseline variability AND Observed salinity and/or metals or pH outside of defined trigger levels for less than 3 consecutive months.

[9] Original TARP WMP13 Normal Condition (LW S1A-S6A Water Management Plan): Groundwater level and water quality remain consistent with baseline variability and/or pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.

[10] Original TARP WMP13 Level 1 Trigger (LW S1A-S6A Water Management Plan): Level 1 trigger of TARP WMP8 for a minimum of two "early warning" bores OR Level 1 trigger of TARP WMP11 for a minimum of two "early warning" bores.

[11] Revised TARP WMP13 Normal Condition (refer to Appendix C): Groundwater level and water quality remain consistent with baseline variability and/or pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.

3.2 Summary of Actions and Responses

During the reporting period, there was five (5) environmental aspects that were associated with a TARP triggers. This section provides a summary of actions resulting from triggers being met in the TARPs, as well as the progress and success of any remediation actions.

3.2.1 Pool Water Level TARP – Level 1 Trigger for Pool Water Level Reduction

3.2.1.1 Background

The following TARP trigger for TARP WMP3 occurred during the current reporting period for water level (refer **Appendix B**):

- Monitoring Site TT9-QLa – Level 1 TARP trigger occurred from 27 to 30 December 2022.

As illustrated in **Figure 3-1**, the recorded water level at monitoring site TT9 declined by greater than 10 cm below the recorded baseline minimum level for the period 27 to 30 December 2022. During and following a rainfall event in late December 2022, the water level rose and was recorded above the baseline minimum as of 10 January 2022 (extent of available water level data for this assessment).

It is noted that only 2 months of baseline water level data are available for monitoring site TT9-Qla.

A suitable reference site location for Teatree Hollow, upstream of potential mining related influences, is not available. An alternative reference site, TT1-QRLa, is located upstream of LW S4A on the Teatree Hollow tributary (known as Wirrimbirra Creek). At this reference site, the water level did not decline below the baseline minimum during the period 27 to 30 December 2022.

Therefore, in accordance with the LW S1A-S6A Water Management Plan, a level 1 trigger in relation to pool water level decline at monitoring site TT9 has been derived during this reporting period.

Further discussion of this trigger is provided in the Surface Water Review report (refer **Appendix B**).

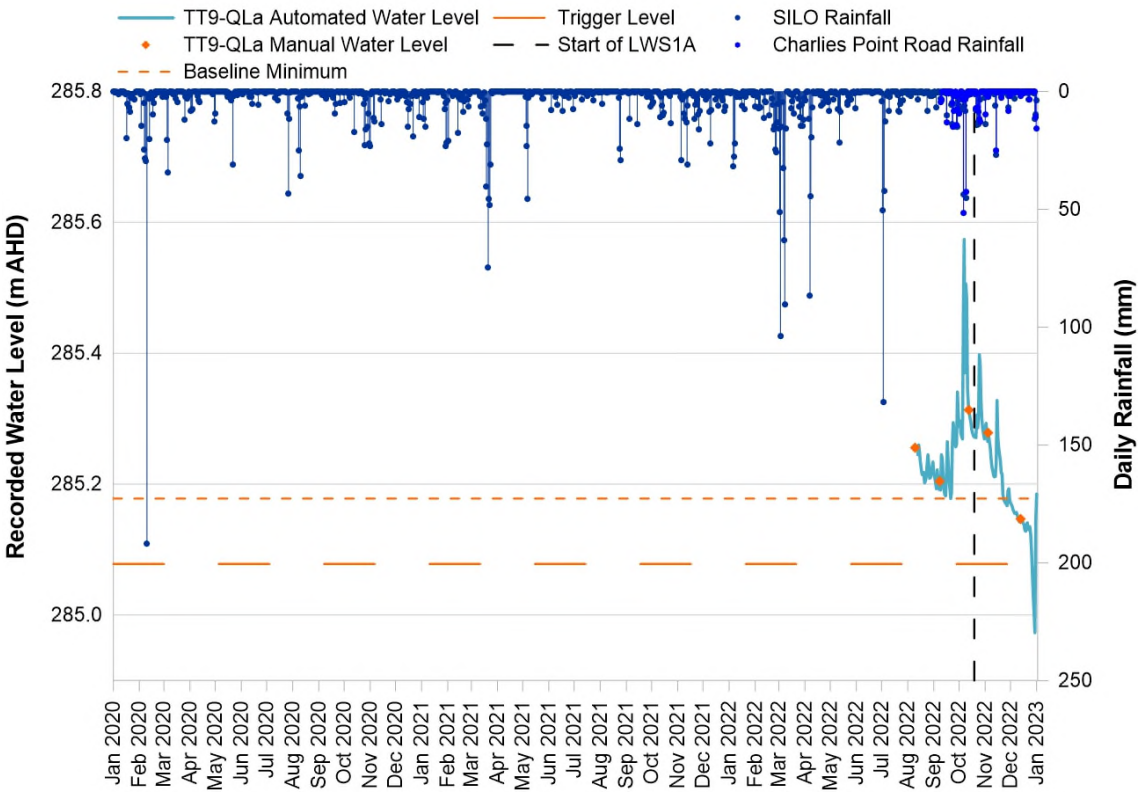


Figure 3-1 TT9-QLa Water Level Data

3.2.1.2 Actions and Responses Completed

Table 3-2 outlines the actions and responses that are required to be completed in accordance with a Level 1 TARP trigger for pool water level (TARP WMP3), as well as how these actions and responses have been addressed.

Table 3-2 Actions and Responses for Level 1 TARP Trigger for Pool Water Level Reduction

Action / Response	Tahmoor Coal response
Actions	
Continue monitoring and review of data as per monitoring program	Monthly monitoring and review of data is ongoing according to the monitoring program.
Review water level trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions	Completed in the Surface Water Review report (**Appendix B**). This assessment noted that similar very slight declines were recorded at monitoring sites TT3-QLa, TT2-QLa, TT7-QLa, and TT12-QLa. However, the decline in water level at these monitoring sites did not exceed 10 cm below the associated recorded baseline minimum level. It was noted that the baseline monitoring period for TT7-QLa and TT3-QLa commenced in early 2020, whereas the baseline monitoring period for TT9-QLa commenced in August 2022. Based on the available monitoring data, it is considered that the hydrological characteristics of TT9-QLa are similar to that of TT&-QLa. As such, there is potential that the water level at monitoring site TT9-Qla declined to a similar level historically to that which was recorded in late December 2022.
Review streamflow data recorded at TT-F1 and conduct streamflow reduction assessment;	Completed in the Surface Water Review report (**Appendix B**). Challenges in the construction of the v-notch weir on Teatree Hollow (TT-F1) were encountered such that further construction works were required in late 2022 to early 2023. Therefore, as the streamflow monitoring data for TT-F1 was influenced by the weir construction works for the duration of the review period and was not reflective of natural conditions, a streamflow reduction assessment has not been undertaken.
Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater level monitoring results) necessary to inform assessment.	Completed in the Surface Water Review report (**Appendix B**). A review of subsidence monitoring results indicated that, as mining of LW S1A had only progressed 630 metres (approximately 400 m to the east of TT9-QLa), it was considered unlikely that pool TT9 had been impacted by mining of LW S1A. A visual inspection of pool TT9 conducted on 17 January 2023 did not identify any environmental consequences from mining, such as evidence of fractures, impacts to pool water level, overland connected flows, iron staining or gas release. A review of groundwater monitoring data from the closes groundwater monitoring site P56 indicated that a notable decline in groundwater level was recorded in the Hawkesbury Sandstone (equating to approximately 3.4 m decline since the start of LW S1A mining). This indicates that there is potential that a decline in baseline contribution to Teatree Hollow occurred from October to December 2022, which may have had a minor contribution to the overall recorded decline in water level at TT9-QLa.

Action / Response	Tahmoor Coal response
Responses	
Report trigger exceedance to DPE and key stakeholders	Trigger exceedance notification provided to DPE on 28 February 2023, and the Tahmoor Colliery Community Consultative Committee on 2 March 2023.
Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review	Completed as part of this report.

3.2.1.3 Proposed Actions and Responses

From the completion of actions and responses (as discussed in Table 3-2), it is concluded that the water level decline at monitoring site TT9-QLa for the period 27 to 30 December 2022 is considered to be related to the prevailing climatic conditions and likely unrelated to mining influences. Therefore, this TARP trigger is not considered to be an environmental consequence of mining, and the results remain within predictions in accordance with the LW S1A-S6A Water Management Plan. Proposed Actions and Responses

Water level data recorded at monitoring site TT9-QLa will continue to be recorded and reviewed in accordance with the LW S1A-S6A Water Management Plan. If additional monitoring data indicates continued decline in water level at monitoring site TT9-QLa, further assessment and actions will be taken in accordance with the LW S1A-S6A Water Management Plan.

The current monitoring program will continue in accordance with the LW S1A-S6A Water Management Plan. The next update will be provided as part of the next Six Monthly Subsidence Impact Assessment report, to be provided to DPE by 30 September 2023.

3.2.2 Groundwater TARP triggers

3.2.2.1 Background

During the reporting period, a number of TARP triggers occurred in accordance with the following groundwater TARPs:

- TARP WMP9 Shallow Groundwater Pressure (VWP Sensors < 200 m Depth): Potential Level 2 for TBC032 HBSS recorded at 131m in December 2022;
- TARP WMP10 Groundwater Level / Pressure Deep VWPs (> 200 m Depth excluding Bulli Coal Seam): Level 1 triggered since October 2022 for TBC09 (BGSS – 322m), TBC09 (BGSS-343m), TBC018 (BGSS-282m), TBC018 (BGSS-366m), TBC18 (BUSM-404m), TBC20 (WBCS-397m), TBC20 (BGSS-375m), TBC26 (BUSM-432m), TBC32 (BGSS-237m), TBC32 (BGSS-294m); since November 2022 for TBC09 (WWCO-391m), TBC09 (WO-397m), TBC18 (W0-432m), TBC020 (211m), TBC32 (BGSS-200m), TBC39 (BGSS-299m); December 2022 for TBC020 (293m);
- TARP WMP11 Groundwater Quality (Open Standpipes and Private Bores): Level 1 triggered for P53B (pH upper), GW112473 (EC and pH lower), P52 (EC), P53A (EC) for November; P55A (EC) for November and December; numerous exceedances of heavy metals (Fe, MN, Cu, Pb, Zn, Ni, Al, As, Li, Ba, Sr) at P51B, P52, P53A-C, P55A-C, P56B-C, GW062068, GW104008, GW104323, GW104659, GW105395, GW109257 and GW112473 in November and December 2022; and
- TARP WMP13 Groundwater Bores Monitoring for Thirlmere Lakes: Level 1 triggered due to Level 1 triggers of TARP WMP11 for “early warning” bores P51B (Al, As), GW062068 (Fe, Cu, Zn, Ni), and GW104659 (Mn, Al, Li, Ba) recorded in November and December 2022.

Regarding the TARP WMP9 trigger, the decline in observed groundwater levels below the TARP Level 2 at TBC032-HBSS 131m could be related to climate or mining of LW S1A. However the wording in the current TARP has no timeframe associated with the change in groundwater levels.

Regarding the TARP WMP11 triggers (and consequently the WMP13 triggers), the TARP Level 1 triggers for groundwater quality were not likely to be mining related but rather due to climate related events. All triggers for pH, EC and metal concentrations were short term exceedances (less than three months) that were likely due to natural fluctuation in groundwater conditions following above average rainfall in October and November 2022. The trigger level was calculated using a short baseline period which could have resulted in a conservative trigger level.

Regarding the TARP WMP10 triggers, it was noted that secondary extraction of the new mining domain commenced on 18 October 2022 and the Level 1 TARP trigger triggered shortly thereafter. Therefore Level 1 triggers in October 2022 appear to be very conservative. In addition, the TARPs did not allow for any level of variation below the modelled drawdown.

3.2.2.2 Actions and Responses Completed

Groundwater TARP triggers for October to December 2022 were notified to DPE via the Planning Portal on 28 February 2022.

Upon review of the TARP triggers, it was identified that these TARP were not representative of incurred variations to the system that required further analysis as per the objectives of the TARPs. This was primarily due to the temporal scales in many of the TARP trigger descriptions being either incorrect, insufficient or lacking. Without an appropriate temporal scale, isolated fluctuations and seasonal variations were resulting in triggers to the TARPs, which was unrepresentative of trends that would indicate potential environmental consequences from longwall extraction.

Further, where modelled drawdown was relied upon to define trigger levels, insufficient allowance was given for the known and accepted level of accuracy with modelled drawdowns (i.e. an exceedance of 20 cm beyond modelled drawdown would trigger a Level 1, although this can be considered within the bounds of the model results and not representative of trends of exceedance of model outputs).

The TARPs in question were therefore revised. A marked-up version of the original TARPs showing changes is provided in Appendix F of the Groundwater Report (**Appendix C**), and the reasoning behind each TARP change is provided in **Table 3-3.**

Following the revision of the TARPs, a re-assessment of the data against the TARPs was completed and there were no residual TARP triggers for this reporting period.

Table 3-3 Reasoning for Revision of Groundwater TARPs

TARP	Proposed Changes	Reasoning
WMP9	Normal Conditions – additions of second dot point 'greater than 5 metre water level reduction in VWP intakes following the commencement of extraction for a period of less than 6 months' Level 1 – addition of wording 'for a period of greater than 6 months' Level 2 – addition of wording 'for a period of greater than 6 months' Level 3 – addition of wording 'for a period of greater than 6 months'	The current wording has no timeframe associated with the change in groundwater levels. Addition of a temporal scale provides greater clarity around trends in the water level (i.e. if only one month exceeds trigger but then we see a recovery it is unlikely due to mining impacts). A minimum of six months allows for trend analysis prior to enacting the TARP. Section 6.1.2.2 of the GTR* states: "Regionally, climatic variations have been observed to cause reductions in water levels of up to 5 m in shallow (< 200 m depth) VWPs. Therefore, a water level reduction of greater than 5 m for shallow VWP loggers for a period beyond 6 months is considered to be a possible indicator of greater than predicted impacts to groundwater (even if greater drawdown was predicted, the concept is to use this magnitude of drawdown as an early warning)." This approach was successfully adopted in the Western Domain Water Management Plan and TARPs. This informs the temporal scale of 6 months for inclusion into the TARP.

TARP	Proposed Changes	Reasoning
WMP10	Normal Conditions – update wording to reflect that within 30 metres of modelled drawdown is considered 'normal conditions', or if drawdown exceeds modelled impacts by greater than 30 metres for a period of less than three months. Level 1 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than three consecutive months. Level 2 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than six consecutive months. Level 3 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than twelve consecutive months.	The current trigger levels has NO level of variation below modelled drawdown which is too sensitive. The revision also adds a temporal scale in order to determine trends rather than triggers from isolated fluctuations. For example: Level 1: initially stated '*within 30 metres of predicted drawdown for a period of less than six months*'. If exceedance beyond model drawdown is by 2 cm for one month this would trigger Level 1. However, this is considered to be within the bounds of the model accuracy and not representative of a trend and therefore does not warrant a trigger. IAPUM feedback stated: *"For the trigger level wording:* *- the normal condition should be more clearly stated as 'observed levels are within (some measurable value – 10m?) of predicted impacts',* *- for each of the levels 1,. 2 and 3 start with the words observed drawdown exceeds…' "* The 'normal' condition should allow for some reasonable variation from predicted impacts (not 'does not exceed' as is current). It is believed, in consideration of the overall level of predicted depressurisation, 30 metres beyond model predictions may be cause for review. Historically, the 30 metres has proven to be a successful and reasonable measure when utilised in the Western Domain WMP and TARPs. Within 30 metres of the modelled predicted drawdown should be considered 'normal conditions'. Given the point accuracy of the groundwater model at each point, using a value of less than 30 metres here is considered unreasonable, with review undertaken at the model review every three years. Additionally, if predicted impacts are exceeded by greater than 30 metres but for a period of less than 3 months, this is not considered representative of a trend and is still within 'normal conditions'. To enact various TARP Levels, the temporal scale over which we observe this variation from modelled drawdown will be instated. This is a logical and realistic approach to identify potential exceedances in impact via extraction to the groundwater system. Wording edited from 'for a period of' to 'consecutive months' for consistency and clarity across the TARPs.
WMP11	Level 1 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'* Level 2 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'* Level 3 – edit temporal scale from 3 to 6 months of consecutive breach of trigger.	The current wording does not include a timeframe associated with changes in water quality. Propose inclusion of a temporal scale to the TARP levels in order to determine trends rather than typical fluctuations in water quality. Without a temporal scale, isolated fluctuations are triggering TARPs which are unrepresentative of any trends associated with potential response to longwall extraction.

TARP	Proposed Changes	Reasoning
WMP13	Instate P50 as an early warning bore (as soon as commissioned), to replace P51. Rewording associated with GW075409–1, GW075409–2, GW075410, GW075411 to clarify that these are part of the broader monitoring network, however are not trigger bores.	Due to land access issues the location of P51 required alteration and is now located above LWS5A and is not considered a suitable early warning bore. As the TARP currently reads, the Thirlmere Lakes Bores (GW075409–1, GW075409–2, GW075410, GW075411) would require specific trigger levels as part of GWMP8 and WMP11. However, given their distal proximity to the mine development and the purpose of WMP8 and WMP11, inclusion of these bores is considered inappropriate. It is proposed that the most suitable approach to identifying potential impacts to the Lakes is to use the 'early warning bores' to enact the trigger, which will then subsequently review the Thirlmere Lakes bores for potential impacts. The wording in the TARP has been amended to reflect this approach.

3.2.2.3 Proposed Actions and Responses

The LW S1A-S6A Water Management Plan and associated documents will be updated and submitted to DPE via the Planning Portal to reflect the changes made to the groundwater TARPs (following the submission of the Annual Review and this Six Monthly Subsidence Impact Report).

4 Assessment of Environmental Performance

4.1 Environmental Performance Measures and Indicators

The following development consents include subsidence impact performance measures as conditions for the extraction of LW S1A-S6A:

- SSD 8445:
  - Performance Measures – Natural and heritage features: Condition C1 (Table 7); and
  - Performance Measures – Built Features: Condition C5 (Table 8).

The subsidence impact performance measures were adopted as part of the LW S1A-S6A Extraction Plan and associated management plans. To assist in defining the performance measures, each measure has been assigned subsidence performance indicator(s) and addressed in relevant TARPs.

These performance measures and indicators are provided in **Table 4-1**, as well as an assessment of performance in accordance with the TARPs (as discussed previously in **Table 3-3** and **Section 3.2**.

Table 4-1 Assessment of Environmental Performance

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Water Resources				
All watercourses within the Subsidence Area	• No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.	Exceedance of the impact assessment criteria, as defined in the relevant Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.	TARP WMP1, WMP3 and WMP5.	**No**
Other watercourses	• Negligible environmental consequences including beyond those predicted in the EIS, including: - Negligible diversion of flows or changes in the natural drainage behaviour of pools; - Negligible decline in baseline channel stability; - Negligible gas releases and iron staining; and - Negligible increase in water turbidity.	The performance measure will be considered to be exceeded if a Level 3 TARP is triggered in relation to water level decline and/or water quality changes and the investigation outcomes indicate a mining related impact based on monitoring data for sites in Hornes Creek and the Bargo River. Performance indicators in relation to channel stability are not proposed as soft knickpoints have not been mapped in Hornes Creek or the Bargo River.	TARP WMP2, WMP4 and WMP6.	**No**
GDEs including Thirlmere Lakes	• Negligible impacts including: - Negligible change in groundwater levels; and - Negligible change in groundwater quality.	The performance measure will be considered to be exceeded if a Level 3 TARP is triggered and the investigation outcomes indicate a mining related impact based on monitoring data for the Thirlmere Lakes.	TARP WMP13.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Land				
Any cliff located directly above longwalls	• Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of the cliff within any longwall mining domain)	This performance measure is not relevant to this Extraction Plan, as there are no cliffs located directly above LW S1A-S6A.	None, not applicable to LW S1A-S6A.	Not applicable.
Any cliff within Subsidence Area beyond the extent of longwalls	• Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within Subsidence Area)	This performance measure will be considered to be triggered if more than 0.5% of the total face area of the cliffs within the 600 m Environmental Features Study Area is impacted by mining (i.e. by occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing).	TARP LMP1.	**No**
All land within the Subsidence Area	• No greater subsidence impacts or environmental consequences than predicted in the EIS	This performance measure will be considered to be triggered if mining results in mine subsidence-induced slope instability, which would be a greater subsidence impact or consequence than predicted in the EIS.	TARP LMP2.	**No**
All land outside the Subsidence Area	• Negligible subsidence impacts or environmental consequences	This performance measure is not relevant to this Extraction Plan, as there are no steep slopes identified within the 600 m Environmental Features Study Area, other than the three steep slopes located within the Subsidence Area and already assessment in accordance with the 'All land within the Subsidence Area' performance measure.	None, not applicable to LW S1A-S6A.	Not applicable.

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Biodiversity				
Threatened species, threatened populations, or endangered ecological communities	• No greater subsidence impacts or environmental consequences than predicted in the EIS. • Negligible impacts on threatened species, populations or communities due to remediation of subsidence cracking.	This performance measure will be triggered if subsidence impacts cannot be remediated in a manner that restores habitat of threatened species, threatened populations, or endangered ecological communities.	TARP BMP4.	**No**
GDEs including Thirlmere Lakes	• Negligible impacts including: - Negligible change in groundwater levels; and - Negligible change in groundwater quality	The performance measure will be considered to be exceeded if the groundwater levels or groundwater quality decline below Level 3 (in the relevant groundwater TARP triggers for water level and water quality – TARP WMP8 or WMP11) following the commencement of extraction, and the investigation outcomes indicate a mining related impact based on monitoring data for riparian vegetation.	TARP BMP3.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Heritage sites				
Aboriginal cultural heritage sites listed in Appendix 4	• No greater subsidence impacts or loss of heritage values than predicted in the EIS.	**TC14-2-19** (Isolated find): No performance indicators are currently established as impacts are predicted to be negligible.	None, not applicable to LW S1A-S6A.	Not applicable.
		Remembrance Drive 2013.1 (open camp site): No performance indicators are currently established as impacts are predicted to be negligible.	None, not applicable to LW S1A-S6A.	Not applicable.
		Teatree Hollow 2013.1 (rockshelter with art and deposit): This performance indicator will be considered to be triggered if more than 10% of rockshelters (i.e. more than two) in the Tahmoor South Domain (including A and B series longwalls) are impacted by: • Subsidence monitoring identifies obvious perceptible change, e.g. rockfall, cracking, or toppling within rockshelters; and • These subsidence impacts result in impacts to the heritage values of the site, e.g. cracking or spalling of the art work panels or, elsewhere in the shelter, cracking or spalling greater than naturally caused examples in the rockshelter. This performance measure cannot be exceeded during the extraction of the A series longwalls, even if the above-mentioned performance indicators are fully triggered for Teatree Hollow 2013.1. Such impacts would not exceed the 10% threshold of impacts to the 19 total rockshelters in the longwalls A and B Study Area.	TARP HMP1.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Heritage sites				
Historical heritage sites listed in Appendix 4	• No greater subsidence impacts or loss of heritage values than predicted in the EIS.	This performance indicator will be considered to be triggered if subsidence impacts cannot be repaired in a manner that preserves the heritage value of the historical heritage items. This performance indicator is applicable to the following historical heritage items: • Wirrimbirra Sanctuary (Australian Wildlife Sanctuary); • Bargo Cemetery; • Bargo Railway Bridge North (Wellers Road Overbridge); • Picton Weir; • Tahmoor Colliery (Tahmoor Mine Site); • Great Southern Road (partial); and • Bargo Railway Viaduct.	TARP HMP2.	**No**
Mine workings				
First workings	• To remain long term stable and non-subsiding.	None allocated.	None – ongoing assessment in accordance with mine design.	**No**
Second workings	• To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.	None allocated.	None – ongoing assessment in accordance with LW S1A-S6A Extraction Plan mine plan.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Public Infrastructure				
Key public infrastructure: • Main Southern Railway • Remembrance Drive • M31 Motorway • Moomba to Sydney Gas Pipeline • Gorodok Ethane Pipeline • Bargo Waste Management Centre	• Always safe and serviceable • Damage that does not affect safety or serviceability must be fully repairable, and must be fully investigated and repaired at the cost of the Applicant	None allocated.	Addessed in TARPs contained in the Main Southern Railway Management Plan and Wollondilly Shire Council Management Plan. It is noted that the Bargo Waste Management Centre, M31 Motorway, Moomba to Sydney Gas Pipeline, and the Gorodok Ethane Pipelines are not located within the Study Area of this Extraction Plan.	**No**
• All other public infrastructure including roads, culverts, bridges, viaducts, water supply pipelines, sewerage mains, gas pipelines, electrical and telecommunication infrastructure and survey control marks.	• Always safe • Serviceability should be maintained wherever practicable • Loss of serviceability must be fully compensated • Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant	None allocated.	Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Other Built Features				
• Public amenities including schools, churches and community centres • Industrial, commercial and business premises • Bargo Cemetery • Wirrimbirra Sanctuary • Privately-owned residences • Other privately-owned built features and improvements, including petrol stations, sheds, garages, farm dams, tanks, swimming pools, tennis courts, roads, tracks and fences	• Always safe • Serviceability should be maintained wherever practicable • Loss of serviceability must be fully compensated • Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant.	**Farm dams**: This performance measure will be considered to be triggered if mining results in damage to a farm dam such that the dam is not safe and serviceable and/or any damages cannot be fully repairable and/or compensated.	TARP LMP3.	**No**
		All other features: None allocated.	Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**
Public Safety				
• Public safety	• Negligible additional risk	This performance measure will be considered to be triggered if subsidence monitoring identifies a mining induced hazard to the public that cannot be controlled or managed.	Assessed indirectly through TARP LMP1, LMP2, LMP3. Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**

5 Document Information

5.1 References

Department of Planning and Environment (DPE) (2015), Draft Guidelines for the Preparation of Extraction Plans V5.

Niche (2023a), Tahmoor South, Aquatic Monitoring Report Spring 2022, report to Tahmoor Coal, 28 February 2023.

Niche (2023b), Tahmoor Mine South, Terrestrial Ecology Monitoring Report: Spring 2022, report to Tahmoor Coal, 14 February 2023.

Tahmoor Coal Documents:

- Extraction Plan LW S1A-S6A Extraction Plan Main Document, TAH-HSEC-00360
- Extraction Plan LW S1A-S6A Water Management Plan, TAH-HSEC-00361
- Extraction Plan LW S1A-S6A Land Management Plan, TAH-HSEC-00362
- Extraction Plan LW S1A-S6A Biodiversity Management Plan, TAH-HSEC-00363
- Extraction Plan LW S1A-S6A Heritage Management Plan, TAH-HSEC-00364
- Extraction Plan LW S1A-S6A Built Features Management Plan, TAH-HSEC-00366
- Extraction Plan LW S1A-S6A Public Safety Management Plan, TAH-HSEC-00365
- Extraction Plan LW S1A-S6A Subsidence Monitoring Program, TAH-HSEC-00367

5.2 Glossary of Terms

Terms references to this document are provided below in **Table 5-1**.

Table 5-1 Glossary of Terms

Term	Definition
Active Subsidence Zone	The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front of the active longwall face and 450 m behind the active longwall face or following 500 m of longwall extraction.
Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence).
Built features	Includes any building or work erected or constructed on land, including dwellings and infrastructure such as a formed road, street, path, walk, or driveway; any pipeline, water sewer, telephone, gas or other infrastructure service main.
Cliff	A continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (>63.4°).
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of mm, is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.

Term	Definition
Curvature	Second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of 1/km (km-1), but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually in km. Curvature can be either hogging (i.e. convex) or sagging (e.g. concave).
Longwall	A system of mining coal in which the seam is extracted on a broad front or long face using a coal shearer and the roof is supported by hydraulic roof supports.
Reporting period	18 October 2022 to 31 December 2022.
Run of mine (ROM)	Raw coal production. The unprocessed mined coal that is conveyed to the CPP. ROM may consist of coal and rock.
Steep slope	An area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°).
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Study Area	Study Area as defined in the LW S1A-S6A Extraction Plan.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of mm. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Subsidence impacts	The physical changes or damage to the fabric or structure of the ground, its surface and environmental features, or built structures that are caused by the subsidence effects. These impacts considerations can include tensile and shear cracking of the rock mass, localised buckling of strata, bed separation, rock falls, collapse of overhangs, failure of pillars, failure of pillar floors, dilation, slumping and also include subsidence depressions or troughs.
Subsidence consequences	The knock-on results of subsidence impacts, i.e. any change in the amenity or function of a natural feature or built structure that arises from subsidence impacts. Consequence considerations include public safety, loss of flows, reduction in water quality, damage to artwork, flooding, draining of aquifers, the environment, community, land use, loss of profits, surface improvements and infrastructure. Consequences related to environmental features are referred to as environmental consequences.
Tilt	The change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the first derivative of

Term	Definition
	the subsidence profile. Tilt is usually expressed in units of mm/m. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 %, or 1 in 1000.

5.3 Abbreviations

Abbreviations used in this document are provided below in **Table 5-2**.

Table 5-2 Abbreviations

Abbreviation	Definition
AHIMS	Aboriginal Heritage Information System
ARTC	Australian Rail Track Corporation
AUSRIVAS	The Australian River Assessment System
BACI	Before After Control Impact design
BGSS	Bargo Sandstone
BIS	Building Inspection Service
CTF	Cease to flow
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
EC	Electrical conductivity
EPA	NSW Environment Protection Authority
EPT	Ephemeroptera Plecoptera Trichoptera scores
GFG	GFG Alliance
GNSS	Global Navigation Satellite System units
HBSS	Hawkesbury Sandstone
Km	Kilometres
LW S1A	Longwall South 1A
LW S2A	Longwall South 2A
LW S3A	Longwall South 3A
LW S4A	Longwall South 4A
LW S5A	Longwall South 5A
LW S6A	Longwall South 6A
LW S1A-S6A	Longwall South 1A to South 6A
m	metres
mbgl	Metres below ground level
mg/L	Milligrams per litre
ML	Mining Lease
mm	millimetre
MSEC	Mine Subsidence Engineering Consultants
MSR	Main Southern Railway
NRAR	NSW Industry – Land & Water – Natural Resources Access Regulator – East
NSW	New South Wales

Abbreviation	Definition
OE	Observed expected score
OSP	Open Standpipe Piezometers
pH	pH units
SSGVs	Site Specific Guideline Values
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TfNSW	Transport for NSW
VMP	Vibrating Wire Piezometer

5.4 Document Distribution

This report and associated documents have been distributed according to **Table 5-3**.

Table 5-3 Distribution List for Six Monthly Subsidence Impact Report

Agency	Contact Person	Position	Electronic Copy
DPE	(Planning Portal)	(Planning Portal)	(https://www.planningportal.nsw.gov.au/major-projects)
	Jessie Evans	Director – Resource Assessments	Jessie.evans@planning.nsw.gov.au
	Gabrielle Allan	Team Leader	Gabrielle.Allan@planning.nsw.gov.au
DPE - Resources Regulator (Subsidence)	(General email)	(General email)	subsidence.monitoring@planning.nsw.gov.au nswresourcesregulator@service-now.com
	Ray Ramage	Mine Safety Officer - Subsidence	ray.ramage@planning.nsw.gov.au
DRNSW – Mining Exploration and Geoscience	(General email)	(General email)	resource.operations@planning.nsw.gov.au
DRNSW – Resources Regulator – Mining Act Inspectorate	(General email)	(General email)	nswresourcesregulator@service-now.com
	Greg Kininmonth	Manager Environmental Operations (Southern)	greg.kininmonth@planning.nsw.gov.au
Wollondilly Shire Council	(General email)	(General email)	council@wollondilly.nsw.gov.au
	David Henry	Acting Team Leader Environmental Services	david.henry@wollondilly.nsw.gov.au
Subsidence Advisory NSW	(General email)	(General email)	subsidencetechnical@customerservice.nsw.gov.au
	John Johnston	Technical Manager	John.Johnston@customerservice.nsw.gov.au
NRAR	(General email)	(General email)	nrar.servicedesk@dpie.nsw.gov.au

Agency	Contact Person	Position	Electronic Copy
	Guy Ohandja	Manager Compliance Monitoring & Audit	guy.ohandja@nrar.nsw.gov.au
EPA	(General email)	(General email)	epa.illawarra@epa.nsw.gov.au
	Andrew Couldridge	Senior Operations Officer - Metropolitan Illawarra	andrew.couldridge@epa.nsw.gov.au
Commonwealth Department of Climate Change, Energy, the Environment and Water	(General email)	(General email)	epbcmonitoring@dcceew.gov.au
TCCCC Committee Members	Documents sent to TCCCC Committee Members at private email addresses.		

Appendix A – Subsidence Monitoring Report

Appendix B – Surface Water Monitoring Report

Appendix C – Groundwater Monitoring Report

SIMEC

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APPENDIX 12

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Date	Arrival	Departure	Total Tonnes railed
Sun-02-01-22	20:47	23:30	3364
Sun-02-01-22	23:39	1:40	3282
Mon-03-01-22	8:24	10:40	3381
Mon-03-01-22	11:20	14:00	3393
Mon-03-01-22	21:21	23:30	3340
Tue-04-01-22	8:24	10:40	3344
Tue-04-01-22	11:14	13:54	3331
Tue-04-01-22	23:52	1:35	3292
Wed-05-01-22	8:29	10:40	3345
Wed-05-01-22	11:08	14:10	3275
Wed-05-01-22	21:21	23:30	3276
Thu-06-01-22	8:24	10:40	3393
Thu-06-01-22	11:20	14:00	3371
Thu-06-01-22	21:21	23:30	3324
Thu-06-01-22	23:47	1:40	3318
Fri-07-01-22	8:17	10:40	3357
Fri-07-01-22	11:43	14:10	3568
Sun-09-01-22	19:58	20:35	3702
Sun-09-01-22	23:45	1:35	3499
Mon-10-01-22	8:24	10:40	3547
Mon-10-01-22	11:01	14:10	3308
Mon-10-01-22	21:21	23:30	3453
Mon-10-01-22	23:52	1:40	3362
Tue-11-01-22	8:24	10:40	3375
Tue-11-01-22	21:21	23:30	3408
Tue-11-01-22	23:47	1:40	3358
Wed-12-01-22	8:24	10:40	2720
Wed-12-01-22	11:20	14:00	3329
Wed-12-01-22	21:21	23:30	2482
Thu-13-01-22	8:24	10:40	3220
Thu-13-01-22	11:05	14:10	3400
Thu-13-01-22	21:21	23:30	3407
Thu-13-01-22	23:47	1:40	3381
Fri-14-01-22	8:24	10:40	3340
Fri-14-01-22	11:20	14:00	3337
Sun-16-01-22	20:47	23:30	3337
Sun-16-01-22	23:47	1:40	2400
Mon-17-01-22	8:24	10:40	2508
Mon-17-01-22	11:14	13:54	3288
Mon-17-01-22	21:26	23:29	3322
Mon-17-01-22	23:52	1:39	3346
Tue-18-01-22	8:29	10:40	3335
Tue-18-01-22	11:14	13:54	3332
Tue-18-01-22	21:28	23:29	3358
Tue-18-01-22	23:52	1:40	3305
Wed-19-01-22	8:24	10:40	3215
Wed-19-01-22	11:04	14:10	3244
Wed-19-01-22	21:21	23:30	3273
Wed-19-01-22	23:52	1:40	3319
Thu-20-01-22	8:24	10:40	3265
Thu-20-01-22	11:20	14:00	3257
Thu-20-01-22	21:26	23:30	3343
Thu-20-01-22	23:47	1:40	3321
Fri-21-01-22	8:29	10:40	3344
Fri-21-01-22	11:20	14:00	3343
Mon-24-01-22	11:04	14:10	3263
Mon-24-01-22	21:21	23:30	3309
Mon-24-01-22	23:47	1:40	3051
Tue-25-01-22	11:04	14:10	3214
Tue-25-01-22	21:26	23:29	3333
Tue-25-01-22	23:52	1:39	3344
Wed-26-01-22	8:29	10:40	3324
Wed-26-01-22	11:33	14:10	3164
Wed-26-01-22	21:11	23:30	3337
Wed-26-01-22	23:52	1:40	3348
Thu-27-01-22	8:26	10:40	3276
Thu-27-01-22	11:39	14:00	3246
Thu-27-01-22	21:26	23:29	3373
Thu-27-01-22	23:52	1:39	3342
Fri-28-01-22	8:29	10:40	3194
Fri-28-01-22	11:14	13:54	3223
Mon-31-01-22	21:26	23:20	3340
Mon-31-01-22	23:52	1:30	3353
Tue-01-02-22	8:29	10:40	3279
Tue-01-02-22	11:14	13:54	3198
Tue-01-02-22	21:26	23:25	3326
Tue-01-02-22	23:52	1:35	3352
Wed-02-02-22	8:29	10:40	3367

Date	Arrival	Departure	Total Tonnes railed
Mon-20-06-22	7:12	9:20	3378
Mon-20-06-22	12:46	15:33	3303
Mon-20-06-22	22:07	23:45	3477
Tue-21-06-22	12:38	15:04	3262
Tue-21-06-22	15:16	17:45	3365
Wed-22-06-22	6:33	9:21	3433
Wed-22-06-22	20:12	22:35	3433
Thu-23-06-22	13:59	17:00	3207
Fri-24-06-22	5:49	10:55	3442
Fri-24-06-22	22:45	1:10	3418
Sat-25-06-22	14:05	17:09	3376
Sun-26-06-22	5:49	8:55	3220
Sun-26-06-22	13:05	15:30	3327
Sun-26-06-22	19:31	22:40	3458
Mon-27-06-22	14:04	16:55	3438
Tue-28-06-22	5:51	8:15	3354
Tue-28-06-22	20:54	23:33	3403
Wed-29-06-22	13:21	15:04	3281
Wed-29-06-22	15:15	17:31	3390
Thu-30-06-22	6:25	9:20	3251
Thu-30-06-22	20:26	22:20	3396
Fri-01-07-22	15:41	17:35	3387
Wed-06-07-22	12:59	16:55	3200
Wed-06-07-22	20:18	22:33	3375
Thu-07-07-22	14:17	16:55	3214
Fri-08-07-22	7:18	9:20	3404
Fri-08-07-22	20:17	22:20	3486
Sat-09-07-22	14:05	17:08	3428
Sun-10-07-22	6:17	8:30	3393
Sun-10-07-22	20:08	22:20	3442
Mon-11-07-22	14:05	16:32	3228
Tue-12-07-22	5:51	8:19	3417
Tue-12-07-22	20:28	22:32	3421
Wed-13-07-22	12:10	14:56	3354
Wed-13-07-22	15:10	17:40	3233
Thu-14-07-22	6:32	8:20	3412
Thu-14-07-22	19:58	22:25	3477
Fri-15-07-22	14:09	16:35	3375
Sat-16-07-22	5:48	8:30	3149
Sat-16-07-22	20:28	22:25	3377
Sun-17-07-22	15:16	17:30	3292
Mon-18-07-22	6:17	8:30	3281
Mon-18-07-22	20:17	22:30	3300
Tue-19-07-22	14:17	16:30	3337
Wed-20-07-22	6:03	8:41	3408
Wed-20-07-22	20:32	22:35	3470
Thu-21-07-22	13:56	17:00	3196
Fri-22-07-22	5:51	8:30	3386
Sat-23-07-22	12:36	15:06	3306
Sat-23-07-22	15:38	17:15	3443
Sun-24-07-22	5:50	8:30	3410
Sun-24-07-22	12:24	15:05	3254
Sun-24-07-22	20:07	22:30	3444
Mon-25-07-22	14:46	17:40	3343
Tue-26-07-22	5:50	9:15	3329
Tue-26-07-22	19:58	23:10	3271
Wed-27-07-22	11:40	14:10	3260
Wed-27-07-22	15:37	17:40	3395
Thu-28-07-22	7:59	10:11	3399
Thu-28-07-22	20:01	21:45	3438
Fri-29-07-22	13:22	17:30	3406
Sat-30-07-22	6:17	8:30	3382
Sat-30-07-22	20:17	22:30	3366
Sun-31-07-22	11:40	14:10	3250
Sun-31-07-22	13:47	16:00	3403
Mon-01-08-22	6:17	8:30	3369
Mon-01-08-22	20:21	23:10	3446
Tue-02-08-22	15:15	17:40	3269
Wed-03-08-22	5:52	9:20	3372
Wed-03-08-22	22:59	0:45	3352
Thu-04-08-22	14:47	16:55	3224
Fri-05-08-22	7:15	9:20	3352
Fri-05-08-22	20:19	22:30	3348
Sat-06-08-22	14:12	17:10	3366
Sun-07-08-22	5:42	8:20	3376
Sun-07-08-22	11:40	14:10	3231
Sun-07-08-22	20:12	22:25	3365
Mon-08-08-22	14:14	16:55	3235

Wed-02-02-22	11:40	14:00	3351
Wed-02-02-22	21:11	23:20	3466
Wed-02-02-22	23:52	1:35	3355
Thu-03-02-22	8:26	10:40	3270
Thu-03-02-22	11:39	14:00	3447
Thu-03-02-22	21:26	23:25	3311
Thu-03-02-22	23:52	1:35	3466
Fri-04-02-22	8:29	10:40	3374
Fri-04-02-22	11:14	13:54	3331
Sun-06-02-22	11:32	15:00	3433
Sun-06-02-22	20:52	23:25	3402
Sun-06-02-22	23:47	1:35	3438
Mon-07-02-22	8:29	10:40	3305
Mon-07-02-22	11:22	13:54	3233
Mon-07-02-22	21:26	23:25	3373
Mon-07-02-22	23:52	1:35	3357
Tue-08-02-22	8:29	10:40	3292
Tue-08-02-22	11:14	14:00	3258
Tue-08-02-22	21:26	23:30	3261
Tue-08-02-22	23:52	1:40	3273
Wed-09-02-22	8:29	10:40	3326
Wed-09-02-22	21:11	23:25	3367
Wed-09-02-22	23:52	1:35	3345
Thu-10-02-22	8:24	10:40	3233
Thu-10-02-22	11:20	14:00	3174
Thu-10-02-22	21:26	23:25	3327
Fri-11-02-22	8:29	10:40	3390
Fri-11-02-22	11:14	13:54	3344
Sun-13-02-22	9:21	14:10	3141
Sun-13-02-22	20:52	23:25	3360
Sun-13-02-22	23:44	1:35	3344
Mon-14-02-22	8:29	10:40	3301
Mon-14-02-22	11:20	14:00	3246
Mon-14-02-22	21:26	23:25	3360
Tue-15-02-22	8:29	10:40	3420
Tue-15-02-22	11:15	13:55	3369
Tue-15-02-22	23:52	1:35	3393
Wed-16-02-22	8:29	10:40	3174
Wed-16-02-22	11:03	14:10	3164
Wed-16-02-22	21:11	13:55	3505
Thu-17-02-22	8:26	10:40	3372
Thu-17-02-22	21:26	23:25	3278
Fri-18-02-22	8:29	10:40	3265
Fri-18-02-22	11:15	13:55	3268
Mon-21-02-22	6:43	10:33	3217
Mon-21-02-22	11:17	13:54	3175
Mon-21-02-22	21:26	23:25	3332
Tue-22-02-22	8:29	10:40	3403
Tue-22-02-22	21:26	23:25	3439
Wed-23-02-22	8:29	10:40	3463
Wed-23-02-22	11:02	14:10	3479
Thu-24-02-22	8:26	10:40	3460
Fri-25-02-22	8:29	10:40	3271
Sun-27-02-22	20:52	23:30	3459
Mon-28-02-22	6:12	10:40	3422
Mon-28-02-22	11:20	14:00	3384
Mon-28-02-22	21:26	23:25	3291
Tue-01-03-22	8:29	10:40	3345
Tue-01-03-22	21:26	23:25	3426
Wed-02-03-22	8:29	16:30	3468
Sat-05-03-22	8:26	11:15	3346
Sat-05-03-22	20:52	23:10	3375
Sun-06-03-22	11:36	14:10	3278
Sun-06-03-22	20:52	23:25	3448
Wed-16-03-22	13:41	15:30	3215
Thu-17-03-22	8:28	9:35	3222
Thu-17-03-22	12:08	15:05	3361
Fri-18-03-22	7:08	9:30	3135
Fri-18-03-22	22:00	23:59	3260
Sat-19-03-22	7:30	9:30	3219
Sat-19-03-22	22:00	23:59	3278
Sun-20-03-22	12:30	14:30	3315
Sun-20-03-22	21:30	23:15	3249
Tue-22-03-22	12:16	15:30	3188
Wed-23-03-22	13:22	16:01	3280
Thu-24-03-22	21:36	23:33	3505
Thu-24-03-22	12:13	15:10	3323
Fri-25-03-22	15:38	17:35	3245
Sat-26-03-22	4:17	6:14	3355
Sun-27-03-22	20:03	22:03	3236
Mon-28-03-22	14:23	16:23	3427
Tue-29-03-22	6:17	9:15	3419

Tue-09-08-22	5:49	9:20	3326
Tue-09-08-22	20:29	22:23	3405
Wed-10-08-22	12:43	15:15	3212
Wed-10-08-22	15:44	18:46	3167
Thu-11-08-22	6:21	9:20	3401
Thu-11-08-22	20:26	22:47	3354
Fri-12-08-22	14:12	16:55	3404
Mon-15-08-22	6:00	10:55	3293
Mon-15-08-22	23:23	1:10	3336
Tue-16-08-22	15:08	17:25	3352
Wed-17-08-22	12:43	15:15	3304
Wed-17-08-22	20:17	22:43	3239
Thu-18-08-22	14:02	16:20	3295
Fri-19-08-22	6:19	9:16	3252
Fri-19-08-22	21:38	23:55	3236
Sat-20-08-22	14:03	16:52	3216
Sun-21-08-22	5:38	8:50	3186
Sun-21-08-22	12:43	15:15	3155
Sun-21-08-22	19:23	21:46	3192
Fri-26-08-22	14:18	16:35	3208
Sun-28-08-22	15:12	17:20	3275
Mon-29-08-22	12:43	15:15	3275
Thu-01-09-22	6:19	8:50	3074
Fri-02-09-22	0:11	7:10	3147
Mon-05-09-22	12:09	14:50	3178
Mon-05-09-22	15:40	17:40	3160
Tue-06-09-22	11:12	17:40	3304
Wed-07-09-22	12:52	15:15	3240
Wed-07-09-22	16:21	18:45	3285
Thu-08-09-22	15:07	18:10	3175
Mon-12-09-22	15:21	18:45	3222
Tue-13-09-22	15:20	17:30	3045
Wed-14-09-22	12:53	15:15	3336
Wed-14-09-22	16:21	21:40	3240
Thu-15-09-22	16:19	18:41	3215
Fri-16-09-22	14:48	17:34	3285
Sat-17-09-22	14:28	17:50	3220
Sun-18-09-22	15:26	17:50	3249
Mon-19-09-22	15:26	17:50	3255
Tue-20-09-22	15:05	17:32	3206
Wed-21-09-22	11:40	15:10	3252
Wed-21-09-22	16:21	18:42	3282
Thu-22-09-22	18:09	20:22	3375
Fri-23-09-22	16:37	20:57	3422
Sat-24-09-22	6:24	9:05	3361
Sun-25-09-22	12:35	15:05	3384
Sun-25-09-22	15:25	17:00	3387
Mon-26-09-22	14:31	17:00	3327
Tue-27-09-22	15:09	17:00	3392
Wed-28-09-22	12:52	15:10	3269
Tue-04-10-22	5:50	9:20	3454
Wed-05-10-22	8:29	10:40	3415
Wed-05-10-22	11:32	14:10	3409
Fri-07-10-22	8:29	10:40	3512
Sun-09-10-22	11:34	14:10	3440
Mon-10-10-22	8:24	10:40	3510
Mon-10-10-22	21:26	23:30	3426
Tue-11-10-22	9:30	12:00	2045
Wed-12-10-22	8:29	10:40	3339
Wed-12-10-22	11:36	14:10	3326
Sat-15-10-22	20:52	23:30	3396
Sun-16-10-22	8:26	11:20	3165
Tue-18-10-22	8:24	10:40	3254
Wed-19-10-22	8:29	10:40	2988
Wed-19-10-22	11:02	14:10	3323
Fri-21-10-22	8:29	10:40	3470
Fri-21-10-22	21:11	23:20	3440
Sat-22-10-22	20:47	23:30	3510
Sun-23-10-22	8:00	11:20	3419
Sun-23-10-22	20:47	23:30	3421
Mon-24-10-22	13:24	16:55	3441
Tue-25-10-22	15:11	17:00	3408
Wed-26-10-22	11:01	14:10	3292
Wed-26-10-22	15:10	16:50	3393
Thu-27-10-22	15:12	17:30	3367
Sun-30-10-22	11:51	14:10	3256
Mon-31-10-22	17:31	21:40	3242
Tue-01-11-22	12:52	17:00	3300
Wed-02-11-22	7:18	9:20	3220
Wed-02-11-22	11:07	14:10	3300
Thu-03-11-22	4:22	8:00	3450
Fri-04-11-22	4:15	16:50	3370

Wed-30-03-22	7:08	9:15	3421
Thu-31-03-22	7:08	9:15	3283
Thu-31-03-22	12:52	16:00	3273
Fri-01-04-22	7:00	9:00	3187
Sun-03-04-22	11:30	14:10	3196
Mon-04-04-22	7:00	9:00	3163
Mon-04-04-22	11:30	14:10	3120
Mon-25-04-22	15:01	17:00	3229
Tue-26-04-22	7:15	9:15	3194
Tue-26-04-22	22:14	0:35	3226
Wed-27-04-22	11:30	14:30	3250
Wed-27-04-22	15:45	17:35	3220
Thu-28-04-22	6:20	8:46	3212
Thu-28-04-22	21:39	23:35	3311
Fri-29-04-22	15:14	16:55	3195
Sat-30-04-22	5:42	8:10	3323
Sat-30-04-22	20:36	22:50	3325
Sun-01-05-22	10:19	11:54	3072
Sun-01-05-22	13:46	15:50	3317
Sun-01-05-22	23:28	1:35	3241
Mon-02-05-22	17:08	18:45	3147
Tue-03-05-22	7:13	9:00	3187
Tue-03-05-22	22:08	23:25	3194
Wed-04-05-22	12:56	15:20	3262
Thu-05-05-22	20:58	22:43	3344
Mon-09-05-22	7:00	9:00	3225
Mon-09-05-22	21:00	23:00	3295
Tue-10-05-22	21:00	23:00	3185
Wed-11-05-22	8:44	11:13	3170
Wed-11-05-22	16:57	19:23	3393
Thu-12-05-22	15:05	17:30	3291
Mon-16-05-22	4:55	8:50	3420
Mon-16-05-22	21:44	23:25	3372
Tue-17-05-22	13:48	16:50	3340
Wed-18-05-22	7:23	9:15	3245
Wed-18-05-22	13:04	17:31	3410
Wed-18-05-22	21:24	22:45	3357
Thu-19-05-22	14:12	16:55	3325
Fri-20-05-22	7:08	9:00	3226
Mon-23-05-22	7:00	9:00	3353
Mon-23-05-22	21:40	23:25	3434
Wed-25-05-22	7:40	9:15	3290
Wed-25-05-22	12:47	15:10	3415
Wed-25-05-22	21:39	23:30	3362
Thu-26-05-22	15:08	17:25	3361
Fri-27-05-22	7:08	9:15	3203
Sat-28-05-22	10:36	12:36	3393
Sat-28-05-22	13:53	16:52	3428
Sat-28-05-22	22:55	0:45	3349
Sun-29-05-22	11:30	13:30	3291
Sun-29-05-22	14:00	17:00	3149
Mon-30-05-22	8:05	10:30	3267
Mon-30-05-22	21:40	0:30	3417
Wed-01-06-22	12:50	15:20	3460
Fri-03-06-22	7:00	9:00	3438
Fri-03-06-22	21:00	23:00	3455
Sat-04-06-22	9:43	12:00	3431
Sun-05-06-22	2:34	4:00	3366
Sun-05-06-22	15:06	16:56	3455
Mon-06-06-22	4:45	6:41	3354
Mon-06-06-22	21:41	23:30	3404
Tue-07-06-22	12:44	14:12	3340
Wed-08-06-22	5:51	9:20	3334
Wed-08-06-22	12:25	15:05	3475
Wed-08-06-22	21:37	23:55	3705
Thu-09-06-22	14:03	16:30	3327
Fri-10-06-22	6:17	9:15	3386
Fri-10-06-22	22:12	0:40	3363
Sat-11-06-22	13:42	15:55	3383
Sun-12-06-22	5:47	8:00	3380
Mon-13-06-22	6:17	9:15	3140
Tue-14-06-22	6:19	9:40	3387
Tue-14-06-22	21:41	23:25	3368
Wed-15-06-22	13:22	15:04	3251
Wed-15-06-22	15:16	17:25	3190
Thu-16-06-22	6:21	9:20	3316
Thu-16-06-22	21:40	23:45	3378
Fri-17-06-22	13:24	16:57	3494
Sat-18-06-22	5:46	7:59	3514
Sat-18-06-22	19:33	21:55	3481
Sun-19-06-22	13:47	16:00	3404

Sat-05-11-22	9:05	16:50	3288
Sun-06-11-22	11:40	14:10	3291
Sun-06-11-22	14:22	17:00	3500
Mon-07-11-22	14:03	17:00	3295
Tue-08-11-22	11:21	17:00	3229
Wed-09-11-22	11:39	14:10	3107
Wed-09-11-22	14:32	17:40	3085
Thu-10-11-22	13:21	17:35	3305
Thu-10-11-22	21:26	23:25	3266
Mon-14-11-22	6:34	10:40	3310
Mon-14-11-22	21:26	23:25	3331
Tue-15-11-22	8:29	10:40	3206
Tue-15-11-22	11:14	13:54	3230
Tue-15-11-22	21:26	23:25	3390
Tue-15-11-22	23:52	1:30	3382
Wed-16-11-22	8:29	10:40	3379
Wed-16-11-22	11:13	14:10	3283
Wed-16-11-22	21:11	23:20	3363
Wed-16-11-22	23:52	1:35	3322
Thu-17-11-22	8:26	10:40	3303
Thu-17-11-22	11:39	14:00	3303
Thu-17-11-22	21:26	23:25	3294
Sun-20-11-22	8:00	11:20	3358
Mon-21-11-22	8:29	10:40	3300
Mon-21-11-22	21:26	23:25	3272
Tue-22-11-22	8:29	10:40	3178
Tue-22-11-22	21:26	23:25	3296
Wed-23-11-22	8:29	10:40	3347
Wed-23-11-22	21:11	23:20	3350
Sat-26-11-22	20:52	23:25	3283
Sun-27-11-22	8:26	11:15	3428
Sun-27-11-22	20:52	23:25	3328
Thu-01-12-22	8:26	10:40	3228
Thu-01-12-22	11:34	14:10	3198
Thu-01-12-22	23:52	1:39	3337
Fri-02-12-22	11:14	13:54	3353
Sat-03-12-22	3:45	6:30	3322
Sat-03-12-22	21:33	1:10	3350
Sun-04-12-22	13:28	16:00	3215
Wed-07-12-22	8:29	10:40	3173
Wed-07-12-22	11:08	14:10	3306
Wed-07-12-22	21:11	23:20	3330
Thu-08-12-22	8:26	10:40	3118
Sat-10-12-22	8:19	11:15	3196
Sat-10-12-22	20:52	23:25	3350
Sun-11-12-22	8:26	11:15	3212
Sun-11-12-22	11:35	14:10	3318
Sun-11-12-22	20:52	23:25	3274
Mon-12-12-22	8:29	10:40	3279
Mon-12-12-22	21:23	23:25	3333
Tue-13-12-22	8:29	10:40	3378
Tue-13-12-22	21:26	23:25	3343
Wed-14-12-22	8:29	10:40	3192
Wed-14-12-22	12:13	15:33	3271
Wed-14-12-22	21:11	23:20	3389
Thu-15-12-22	8:26	10:40	3309
Thu-15-12-22	21:26	23:29	3274
Fri-16-12-22	8:29	10:40	3390
Fri-16-12-22	11:14	13:54	3365
Sat-17-12-22	8:19	11:12	3351
Sat-17-12-22	11:33	12:23	3343
Sat-17-12-22	20:52	23:29	3221
Sun-18-12-22	8:26	11:15	3287
Sun-18-12-22	11:20	14:00	3294
Sun-18-12-22	20:52	23:25	3387
Mon-19-12-22	8:29	10:40	3338
Mon-19-12-22	21:26	23:25	3458
Tue-20-12-22	8:29	10:40	3342
Tue-20-12-22	11:14	13:54	3216
Tue-20-12-22	21:26	23:25	3343
Wed-21-12-22	8:29	10:40	3171
Wed-21-12-22	11:08	14:10	3312
Wed-21-12-22	21:11	23:20	3372
Thu-22-12-22	8:26	10:40	3357
Thu-22-12-22	21:26	23:25	3384
Fri-23-12-22	8:29	10:40	3362
Fri-23-12-22	21:11	23:20	3429
Sat-24-12-22	8:26	11:15	3345
Tue-27-12-22	11:10	14:00	3320
Tue-27-12-22	18:57	23:25	3451
Wed-28-12-22	8:29	10:40	3427
Wed-28-12-22	11:08	14:00	2994

Wed-28-12-22	21:11	23:20	3312
Thu-29-12-22	11:45	14:07	3330
Thu-29-12-22	21:26	23:25	3490

SIMEC

MEMBER OF GFG ALLIANCE

APPENDIX 13

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Stone Bin Data
Tonnes Trucked to the Reject Emplacement Area
Truck immediately returns after delivery to REA

Date	Time	Tonnes trucked
3/01/2022	10:06:00 AM	6
4/01/2022	9:00:00 AM	8
4/01/2022	12:08:00 PM	8
4/01/2022	3:20:00 PM	6
5/01/2022	7:53:00 AM	8
7/01/2022	8:17:00 AM	5
7/01/2022	12:02:00 PM	10
7/01/2022	1:59:00 PM	3
8/01/2022	7:33:00 AM	8
8/01/2022	2:08:00 PM	9
10/01/2022	7:30:00 AM	8
10/01/2022	8:23:00 AM	9
10/01/2022	1:28:00 PM	10
11/01/2022	2:35:00 PM	9
12/01/2022	8:58:00 AM	7
12/01/2022	12:52:00 PM	6
12/01/2022	3:30:00 PM	4
13/01/2022	1:48:00 PM	8
13/01/2022	2:55:00 PM	4
13/01/2022	7:30:00 AM	5
13/01/2022	2:56:00 PM	4
17/01/2022	7:04:00 AM	7
17/01/2022	11:15:00 AM	9
18/01/2022	2:48:00 PM	8
19/01/2022	8:08:00 AM	9
21/01/2022	8:06:00 AM	6
21/01/2022	10:32:00 AM	6
21/01/2022	1:52:00 PM	3
22/01/2022	8:02:00 AM	8
22/01/2022	2:18:00 PM	7
22/01/2022	2:56:00 PM	6
22/01/2022	3:25:00 PM	3
24/01/2022	7:26:00 AM	8
24/01/2022	11:49:00 AM	8
24/01/2022	3:18:00 PM	6
25/01/2022	10:14:00 AM	10
25/01/2022	2:41:00 PM	3
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28/01/2022	7:08:00 AM	10
29/01/2022	7:05:00 AM	8
29/01/2022	12:14:00 PM	8
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4/02/2022	12:54:00 PM	9
5/02/2022	1:53:00 PM	4
10/02/2022	1:44:00 PM	10
11/02/2022	7:36:00 AM	9
12/02/2022	7:34:00 AM	8
12/02/2022	2:16:00 PM	7
14/02/2022	7:28:00 AM	9
14/02/2022	10:39:00 AM	6

Date	Time	Tonnes trucked
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4/07/2022	9:00:00 AM	8
4/07/2022	12:08:00 PM	8
4/07/2022	3:20:00 PM	6
5/07/2022	7:53:00 AM	8
6/07/2022	3:03:00 PM	10
7/07/2022	8:17:00 AM	5
7/07/2022	12:02:00 PM	10
7/07/2022	1:59:00 PM	3
8/07/2022	7:33:00 AM	8
8/07/2022	2:08:00 PM	9
9/07/2022	10:52:00 AM	6
9/07/2022	3:16:00 PM	8
11/07/2022	8:23:00 AM	9
11/07/2022	1:28:00 PM	10
11/07/2022	2:35:00 PM	9
12/07/2022	8:58:00 AM	7
12/07/2022	12:52:00 PM	6
12/07/2022	3:30:00 PM	4
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16/07/2022	2:56:00 PM	4
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19/07/2022	11:15:00 AM	9
20/07/2022	2:48:00 PM	8
21/07/2022	8:06:00 AM	6
21/07/2022	10:32:00 AM	6
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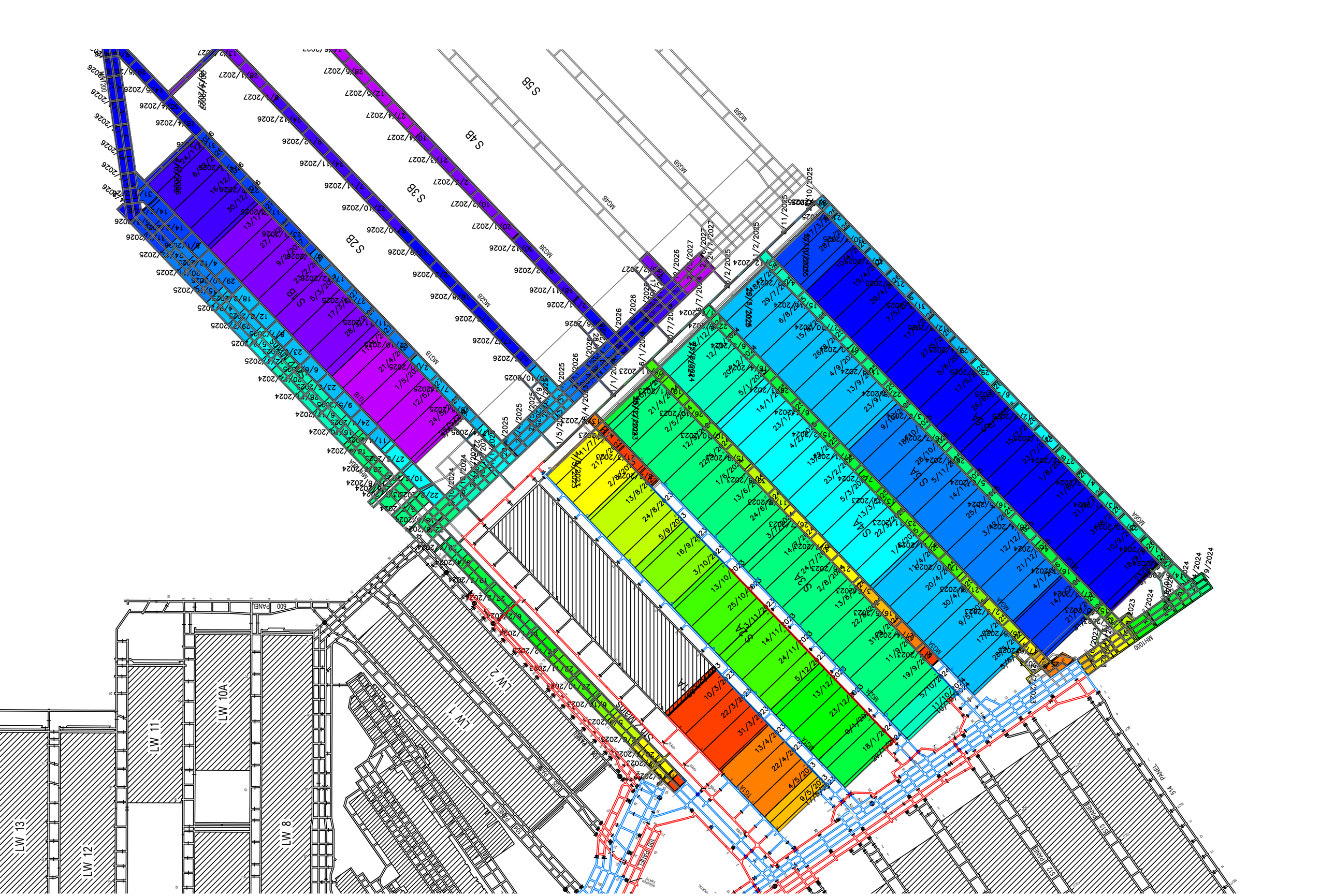
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28/12/2023	7:07:00 AM	6
30/12/2023	7:04:00 AM	7
30/12/2023	1:52:00 PM	3

SIMEC

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APPENDIX 14

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LW 13
LW 12
LW 11
LW 10A
LW 8
LW 2
LW 1
S2B
S3B
S4B
S5B

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APPENDIX 15

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4.2 Trigger Criteria

TARPs have been developed based on the groundwater management program outlined in the Groundwater Technical Report LW W3-W4 (SLR, 2021) and the WMP (Tahmoor Coal, 2021), and describe necessary responses for exceedances in groundwater quality and groundwater level triggers at open standpipe 'P' bores, as well as exceedance of groundwater pressure triggers developed for VWPs. The approved trigger criteria for shallow and deep groundwater levels are summarised and presented in Table 5. Appendix B1 details the latest approved impact assessment trigger criteria from the LW W3-W4 Extraction Plan presented in the WMP (Tahmoor Coal, 2021) and the appropriate action plan to be enacted should a trigger exceedance occur during mining of LW W1-W2 and LW W3-W4. Figure 13 to Figure 17 present groundwater hydrographs at each site with the associated groundwater level triggers.

Prior to the approval of LW W3 in September 2021, groundwater levels and quality observations were assessed against the TARPs developed for and outlined in the Groundwater Technical Report LW W1-W2 (HS/SLR, 2019). From September 2021, as stated above, groundwater levels and quality observation across the Western Domain are now assessed against latest approved impact assessment trigger criteria (Tahmoor Coal, 2021). The following sections present the groundwater exceedances identified and highlight the change in TARPs that occurred from September 2021.

Further details regarding the development of the TARPs are provided in SLR (2021).

Table 5 Groundwater TARP Level Criteria for Open Standpipes, Shallow VWPs and Deep VWPs (Tahmoor Coal, 2021).

Significance Level	Criteria		
	Open standpipes	Shallow VWPs (<200m bgl)	Deep VWPS (>200m bgl)
Level 1	Groundwater level remains consistent within baseline variability and/or pre-mining trends, with reductions in groundwater level less than two metres and does not trigger Level 2 to Level 4 Significance Levels (refer to Appendix C).	No observable mining induced change at VWP intakes located at or above (i.e. shallower than) 200 m depth.	Observed data does not exceed predicted (modelled) impacts (excluding those monitoring the Bulli Coal Seam).
Level 2	Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) (refer to Appendix C for TARP Significance Level 2). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than) 200 m depth following the commencement of extraction at LW W1 (and LW W2, W3 and W4) (refer to Appendix C for TARP Significance Level 2). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.
Level 3	Water level declines below the water level of TARP Significance Level 3 (refer Appendix C, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Water level declines below the water level of TARP Significance Level 3 (refer Appendix C, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 6 months or more.
Level 4	Water level reduction greater than the maximum modelled drawdown (refer to Appendix C for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Water level reduction greater than the maximum modelled drawdown (refer to Appendix C for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 12 months or more.

4.3 Trigger Exceedances

Table 6 presents the occurrence of trigger level exceedances in groundwater levels since the start of mining at Western Domain as per the trigger values (HS/SLR, 2019; SLR, 2021) and the TARP trigger criteria presented in Table 5 and Appendix B1.

Table 6 Groundwater Level Trigger Exceedances over January 2021 – March 2022 for the Shallow Open Standpipes, Shallow and Deep VWPs.

Bore	Groundwater Level prior to LW W1 (m AHD)	Trigger Level Exceedances															Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W3 (10-SEP-21) (m AHD)	Drawdown since Nov 21 as of March 2022 (m)
		Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22			
Shallow OSP		TARP (HS/SLR, 2019)								TARP (Tahmoor Coal, 2021)									
P12A	170.1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	0.5	170.5	-
P12B	170.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	0.8	170.7	-
P12C	176.3	L4	L4	L4	L4	L4	L4	L4	L4	L3	L3	L3	L3	L3	L3	L3	11.0	172.1	2.1
P13A	167.2	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	#	#	#	#	0.7	167.5	#
P13B	166.4	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	#	#	#	#	1.5	166.5	#
P13C	169.8	L4	L4	L4	L4	L4	L4	L2	L1	L2	#	#	#	#	#	#	5.0	168.3	#
P14A	168.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	-	170.3	-
P14B	166.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.4	166.4	-
P14C	166.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.7	166.2	-
P14D	164.8	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.8	164.8	-
P15A	164.7^	L1	L1	L1	L1	L1	*	L1	L1	L1	L1	L1	L1	L1	L1	L1	-	165.7	-
P15B	165.2^	L1	L1	L1	L1	L1	*	L1	L1	L1	L1	L1	L1	L1	L1	L1	-	165.6	-
P15C	164.9^	L1	L1	L1	L1	L1	*	L1	L1	L1	L1	L1	L1	L1	L1	L1	-	165.6	-
P15D	165.4^	#	#	#	#	#	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	164.4	-
P16A	211.3	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.1	210.7	-
P16B	206.4	L4	L4	L4	L4	L4	L4	L4	L4	L2	L2	L2	L2	L2	L2	L2	5.7	203.9	2.4

Bore	Groundwater Level prior to LW W1 (m AHD)	Trigger Level Exceedances															Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W3 (10-SEP-21) (m AHD)	Drawdown since Nov 21 as of March 2022 (m)
		Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22			
P16C	199.6	L4	L4	L4	L4	L4	L4	L4	L4	L3	L3	L3	L3	L3	L3	L3	13.8	191.4	8.3
P17	171.3	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	#	#	#	#	0.2	171.5	#
		Shallow VWPs (<200m)																	
TNC036 - HBSS-65	209.5	L4	L4	L4	L4	L4	L4	L2	L1	L1	L1	L1	L1	L1	L1	L1	6.7	207.3	0.9
TNC036 - HBSS-97	196.3	L4	L4	L4	L4	L4	L4	L4	L4	L4	L4	L4	L4	L4	L4	L3	24.0	179.5	14.2
TNC036 - BGSS-169	197.5	L4	L4	L4	L4	L4	L4	L4	L4	L2	L2	L2	L2	L2	L2	L2	47.6	161.5	34
TNC040 - WNFM-27	208.3	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1	L1	L1	L1	L1	-	210.3	-
TNC040 - HBSS-65	187.1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1	L1	L1	L1	L1	-	187.5	-
TNC043 - HBSS-65	158.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	0.3	158.2	-
TNC043 - HBSS-111.5	155.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.8	153.9	0.9

Bore	Groundwater Level prior to LW W1 (m AHD)	Trigger Level Exceedances															Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W3 (10-SEP-21) (m AHD)	Drawdown since Nov 21 as of March 2022 (m)
		Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22			
		Deep VWPs (>200m)																	
TNC036 - BGSS-214	176.5	L3	L3	L3	L3	L3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	81.4	103.4	85.5
TNC036 - BGSS-412.5	96.8	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	49.7	33.5	73.5

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

LX: maximum trigger level exceedances recorded (including P13 and P17 decommissioned in October 2021) *"-": no observed drawdown* *^ baseline groundwater level at P15 (A,B,C,D) is the groundwater level recorded in June 2021.* *#: not applicable*

"" not assessed due to disruption in groundwater levels during drilling and packer testing at P15D (see (SLR, 2021c) section 2.3)*

Table 7 Groundwater Level Trigger Exceedances over the Reporting Period (January 2021 – January 2022) for Private Bores

Bore	Baseline Maximum Ground water Depth (m bgl)	Baseline Groundwater Yield (L/s)	Trigger Level Exceedances													Groundwater Depths as of January 2022 (m bgl)	Ground water Yield as of January 2022 (L/s)
			Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	June 2021	July 2021	Aug 2021	Sep 2021	Oct 2021	Nov 2021	Dec 2021	Jan 2022		
Private Bores																	
GW104090	39.0	#	L1	L1	L1	L1	#	#	#	L1	L1	L1	L1	L1	#	# (49.2^)	#
GW105467	32.0	0.5	L1	L1	L1	L1	L1	L1	L2	#	#	*	*	*	*	#	#
GW105228	23.0	1.8	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	22.4	2.0-2.1
GW072402	11.76	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	11.5	#
GW115860	5.0	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	12.6	2.0
GW105546	31.9	1.6	L1	L1	L1	L1	#	#	*	#	#	*	*	*	*	#	#

LX: maximum trigger level exceedances recorded *#: not applicable* ** no site access* *"-"standing water level not available (access is not available inside the bore)*

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

4.4 Discussion of Groundwater Level Exceedances

This section discusses any exceedances observed over the reporting period from November 2021 to March 2022. TARP level exceedances were observed in bores as follows:

- TARP Level 4 at the shallow VWP sensors at TNC036 (HBSS-97m) from October 2021 to February 2022, with a reduction in TARP to Level 3 in March 2022;
- TARP Level 3 at the shallow open standpipes P12C and P16C during the reporting period;
- TARP Level 2 at the shallow open standpipe P16B during the reporting period;
- TARP Level 2 at the shallow VWP sensors at TNC036 (BGSS-169m) during the reporting period; and
- TARP Level 2 at the two deep VWP sensors at TNC036 (BGSS-214m and BGSS-412.5m) during the reporting period.

All other groundwater monitoring sites remained within TARP Level 1 across the six-monthly reporting period.

In terms of yield and groundwater level at the private bores, the following observations are noted over the reporting period (to January 2022):

- GW105228: There was no significant change in groundwater yield at GW105228 that could impede groundwater use in January 2022. In January 2022, groundwater yield was recorded between 2.0-2.1 L/sec compared to 1.82 L/sec during the baseline period (GeoTerra, 2019). As of January 2022, groundwater levels are observed within baseline level. TARP Level 1 applies.
- GW115860: There was no significant change in groundwater yield at GW115860 that could impede groundwater use in January 2022. In January 2022, groundwater yield at this location is recorded between 2.0-2.05 L/sec compared to 2.3 L/sec during the baseline period. As of January 2022, groundwater levels are observed within baseline level. TARP Level 1 applies.
- GW105467: In January 2021 the bore yield at GW105467 has declined from 0.67 L/s to 0.38 L/s in July 2021. A TARP Level 2 was applied at GW105467 as the lowest groundwater yield during the baseline period was 0.47 L/s in March 2019 and during the severe NSW drought. This bore is not actively used for groundwater extraction and no site access was possible in October 2021 and January 2022. Further monitoring is planned at this location.
- There was no site access at GW105546 throughout the reporting period, hence the assessment of trigger assessment exceedances at this location was not possible.

4.4.1 Shallow Open Standpipes

4.4.1.1 P12C

During the reporting period, groundwater levels at P12C have increased to a maximum of 174.2 mAHD in March 2022 and are 2.1 m below baseline levels (Table 6). Groundwater levels at P12C have increased by 2.8 m in March 2022 and are approximately 3.1 m above groundwater level observed in the upper piezometer P12A and P12B (Figure A-1). A TARP Level 3 still applies at P12C as the recovered groundwater levels as of March 2022 are below the trigger level 3.

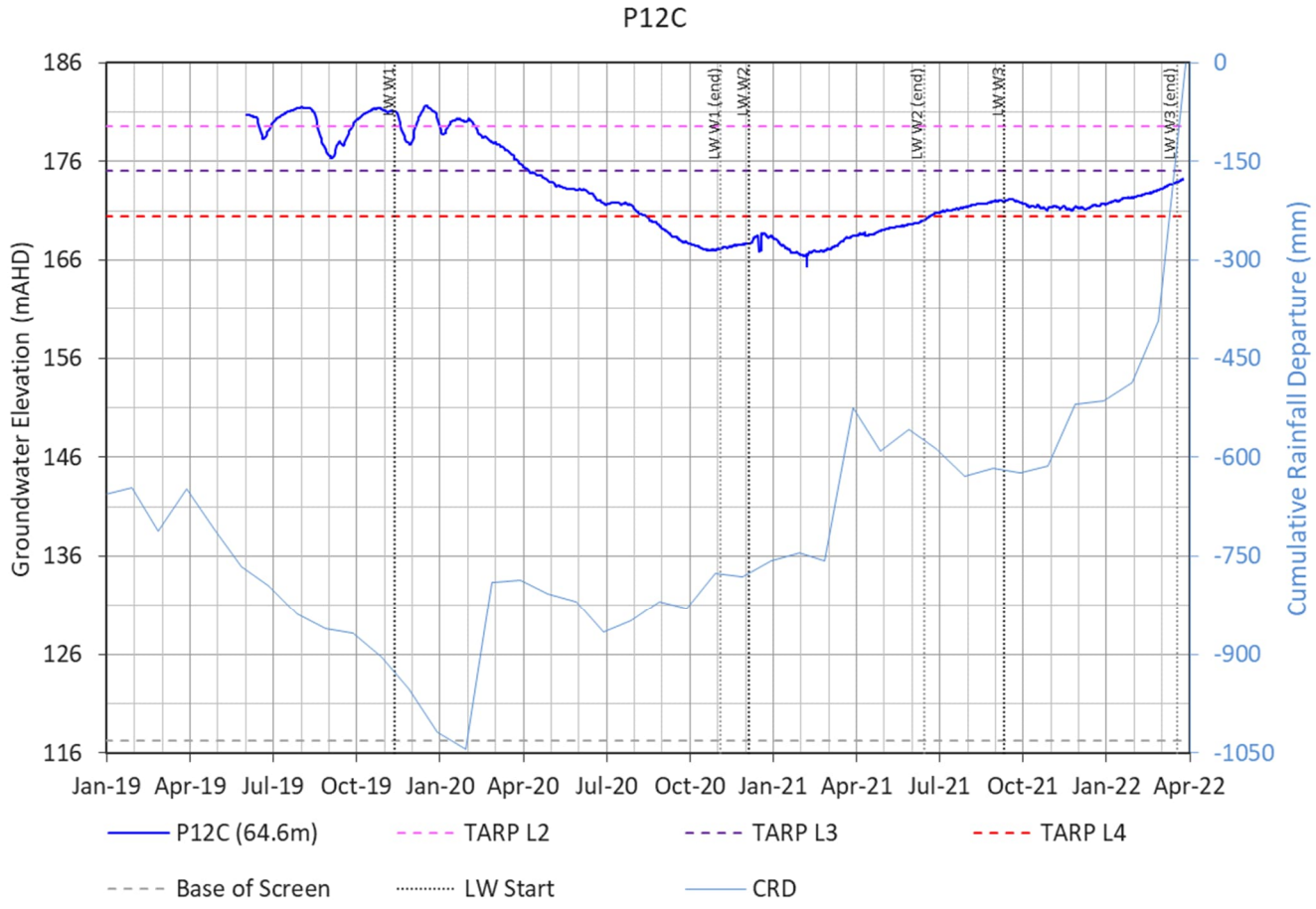


Figure 13 Groundwater Level Exceedance at P12C

4.4.1.2 P16B and P16C

Both P16B and P16C have shown a TARP Level 4 exceedance from December 2020 to August 2021 and reduced respectively to Level 2 and Level 3 from September 2021. During the reporting period a TARP Level 2 and Level 3 still apply at P16B and P16C respectively.

At P16B, groundwater levels were observed at 202.8 mAHD in mid-January 2022, below the trigger TARP Level 2 (205.9 mAHD) following a decline of approximately 1.8m (Figure 14). SLR investigated the nature of the sharp decline (SLR, 2022a). The recent decline in groundwater levels could be due to a delayed mining effect from LW W2 and active mining at LW W3. The sudden decline in groundwater levels at P16B could potentially be due to the sudden movement of strata from mining. Similar sudden declines were observed at P15 located adjacent to the northern end of LW W3 after the commencement of that panel (Appendix A, Figure A-3).

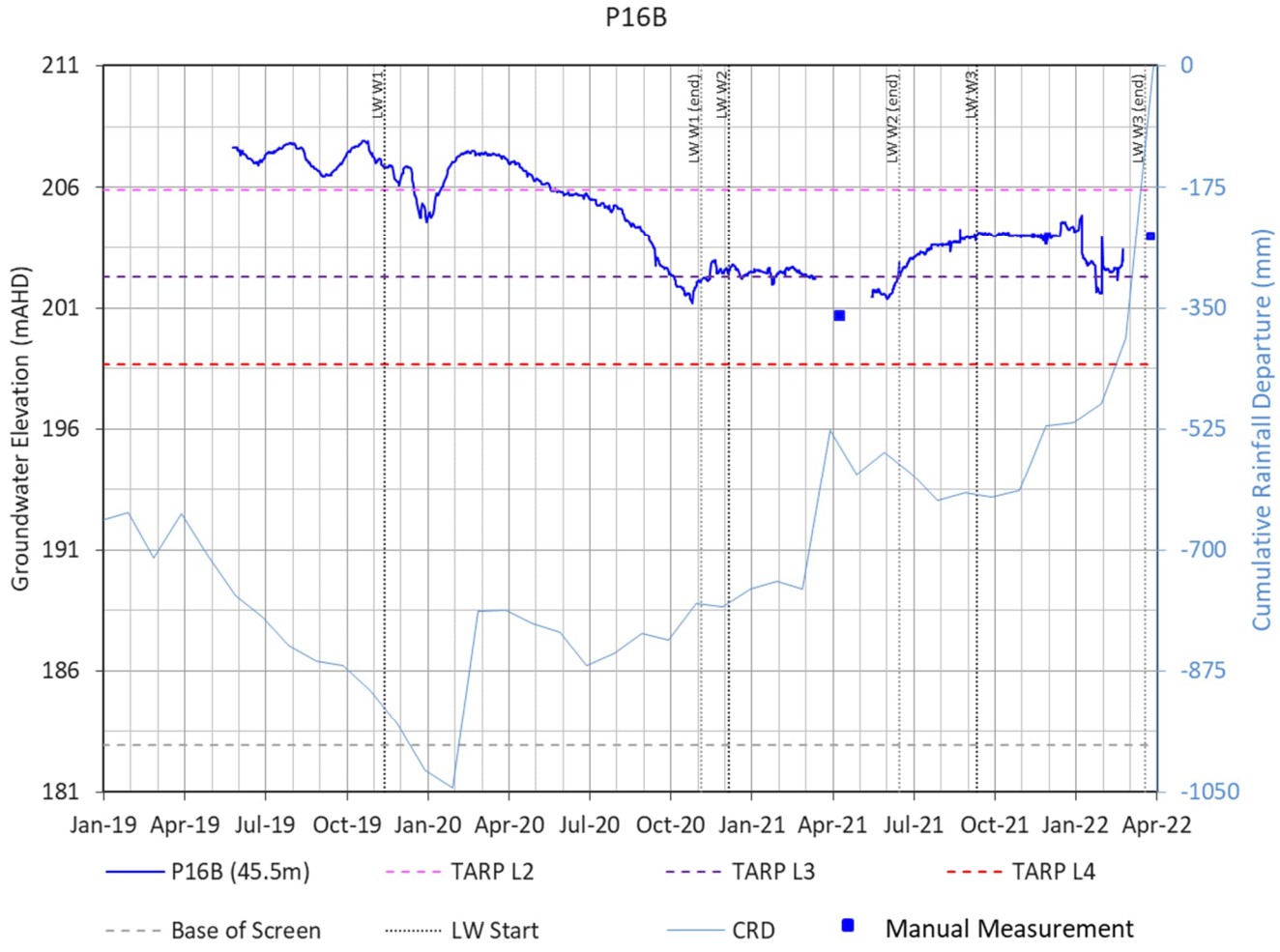


Figure 14 Groundwater Level Exceedance at P16B

During the second half of January 2022, water levels at P16B declined by 1.4 m, dropping below the TARP Level 3 for a short-period of time between 25th- 31st January 2022 before rising back to approximately 203.4 mAHD from March 2022. As of March 2022, groundwater levels at P16B are within a TARP Level 2 (Figure 14).

During the reporting period, recovery in groundwater at P16C has reduced with water levels at 191.7 mAHD and 7.6 m below baseline levels (Table 6 and Figure 15).

Groundwater levels at P16C gradually declined by approximately 0.4 m throughout the reporting period to 190.2 mAHD and are observed at 191.3 mAHD in March 2022. As of March 2022, groundwater levels remain below the trigger TARP Level 3 (193.9 mAHD), hence a TARP Level 3 still applies (Figure 15).

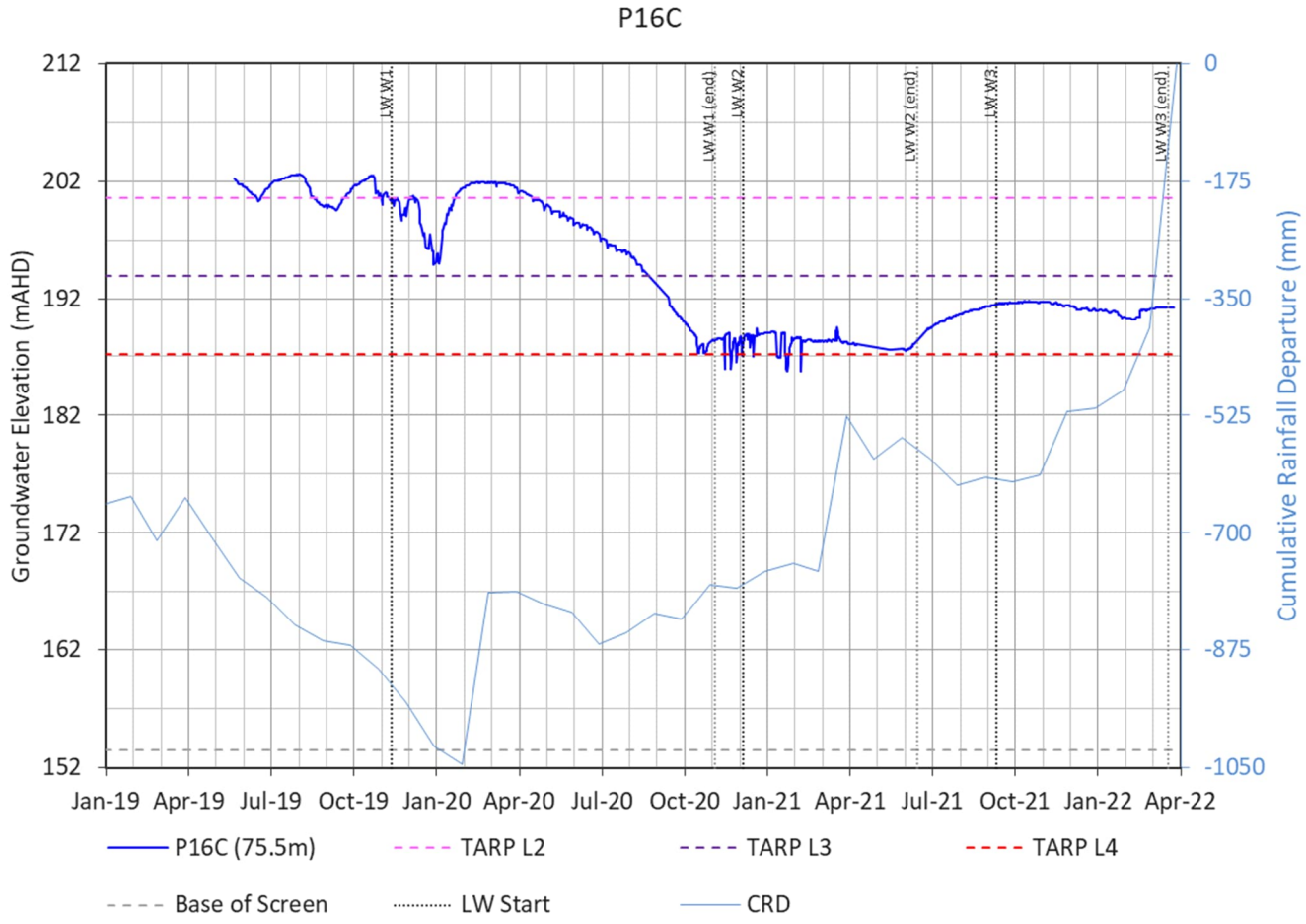


Figure 15 Groundwater Level Exceedance at P16C

4.4.2 Shallow VWPs – TNC036

Groundwater trends at monitoring sites equipped with shallow VWPs (less than 200m depth) were within the TARP Level 1 except at TNC036 (HBSS-65m, HBSS-97m and BGSS-169m) triggering the TARP Level 3 throughout 2020 and TARP Level 4 from December 2020 to April 2021 (Table 6).

The triggering of TARP Level 3 at TNC036 was attributed to mining induced depressurisation of deeper aquifer throughout the passage of LW W1 and exacerbated by a reduction in rainfall recharge events in late 2020.

Following the completion of LW W1 in November 2020, groundwater levels started to stabilise in all shallow TNC036 sensors and in WD01-HBSS-190m. In November 2020, a TARP Level 4 was attributed to TNC036 (HBSS-65m, HBSS-97m and BGSS-169m) due to a greater than 5 m depressurisation over a period of six months. Above LW W1 and following the completion of that longwall, groundwater levels in WD01-190m started to recover.

At TNC036, the progression of mining at LW W2 induced a minor drawdown in HBSS-65m and HBSS-169m while water levels at HBSS-97m are stable. Between December 2020 and June 2021, water levels in HBSS-65m recorded a reduction greater than 5m due to the passage of both LW W1 and LW W2, being within the Level 4 TARP criteria. Groundwater levels started to recover in June 2021 and by the end of July 2021, water levels in HBSS-65m increased above the TARP level 2 (i.e. 4.2 m below baseline level) and since August 2021 a TARP Level 1 applies (Table 6).

At HBSS-97m groundwater levels are observed between 180.7 and 179.6 mAHD between November 2021 and February 2022. Over this period groundwater levels seem to have stabilised with fluctuations up to 1 m. This follows a period of recovery since June 2021 (Figure 16). In February 2022, groundwater levels declined marginally below the trigger TARP Level 4 (180 mAHD) for short periods of time (five days in February 2022). As of March 2022, groundwater levels increased above the trigger TARP Level 4, hence a TARP Level 3 applies.

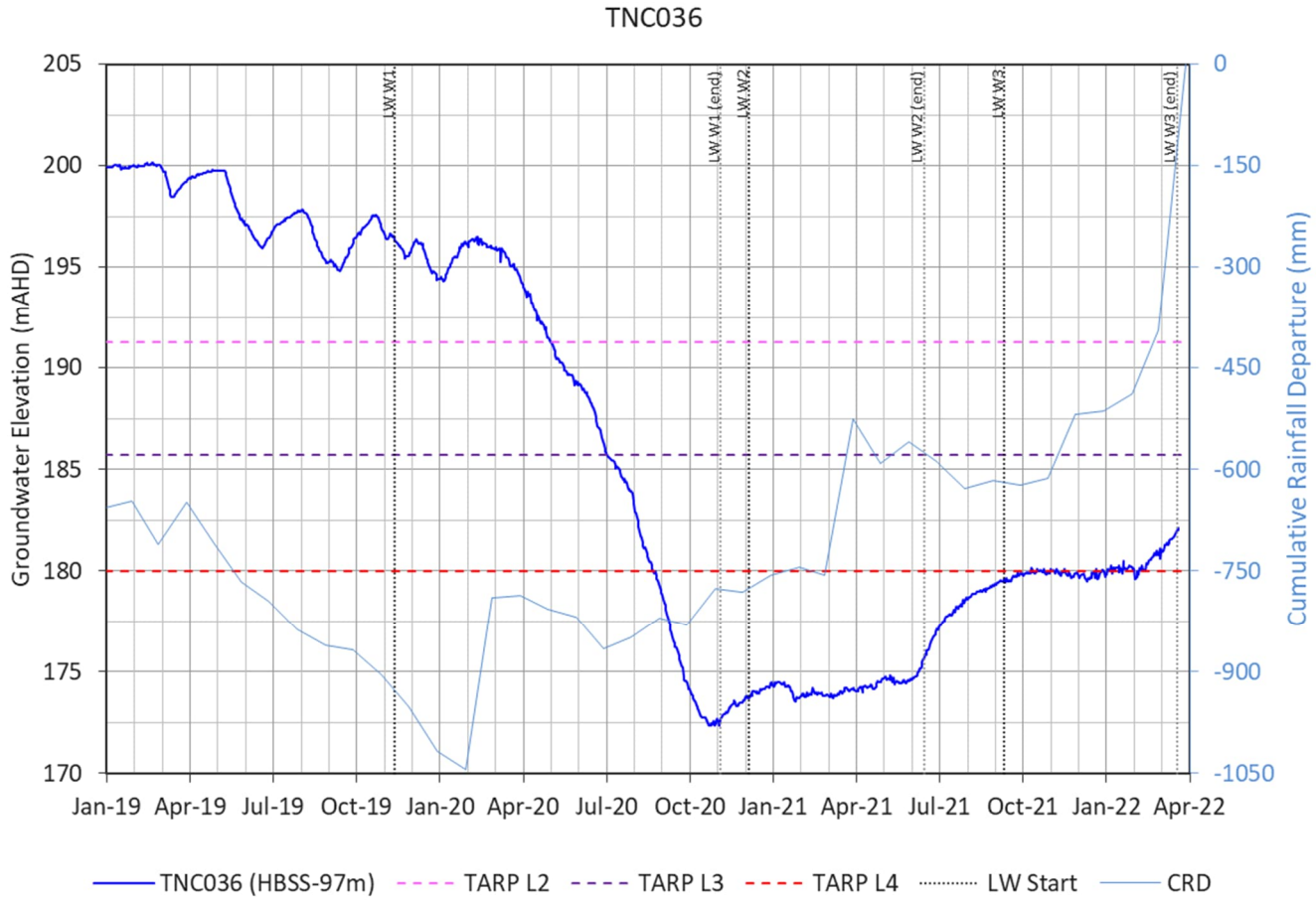


Figure 16 Groundwater Level Exceedance at TNC036-HBSS-97m

In HBSS-169m, the reduction to a TARP Level 2 occurred in September 2021 while groundwater levels continued to recover within the revised TARP Level 2. Groundwater levels are observed between 161.5 and 163.5 mAHD and increase by approximately 2 m during the reporting period (Figure 17). The groundwater trend at TNC36-169m in March 2022 remains consistent with the observations made in the six-monthly review (SLR, 2021a) and previous monthly reporting (SLR, 2022b). As of March 2022, groundwater levels remain below the trigger for TARP Level 2 (192.5 mAHD), hence a TARP Level 2 still applies.

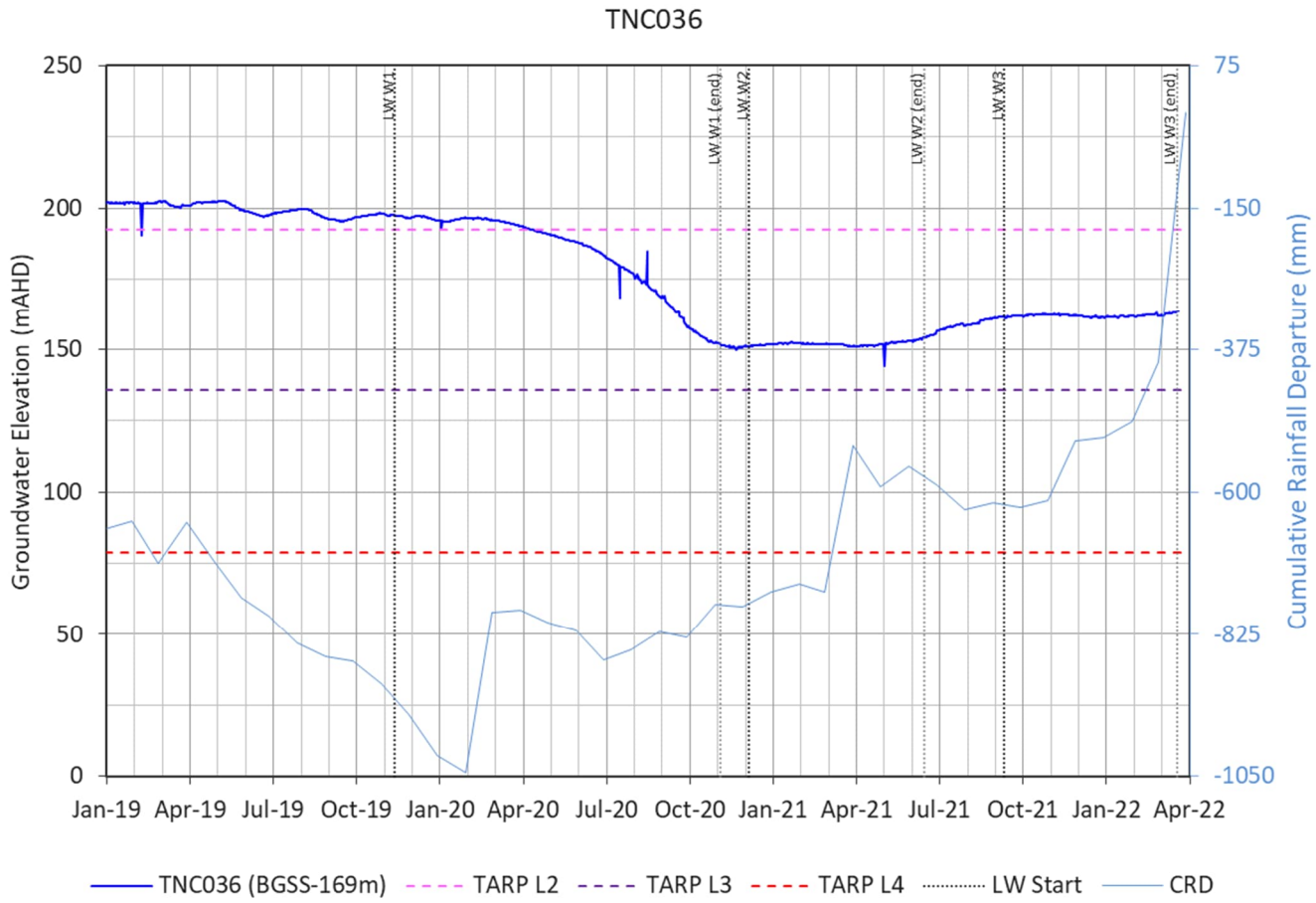


Figure 17 Groundwater Level Exceedance at TNC036-BGSS-169m

4.4.3 Deep VWPs – TNC036

Figure 18 and Figure 19 present the modelled (blueline) and observed (orange marker) drawdown at TNC036 sensors (BGSS-214m, BGSS-412.5m) since the start of LW LW1 extraction. The blue dashed line represents a threshold established as per the TARP for deep VWP sensors which is the modelled drawdown plus 30 m (Table 5).

Figure 18 shows that the observed drawdown at TNC036-BGSS-214m exceeds the modelled drawdown from March 2020 and the 30 m predicted drawdown between September 2020 and April 2021. Since May 2021, a TARP Level 2 applies with observed water levels within the predicted drawdown (+30m) (Table 5).

Figure 19 shows that the observed drawdown at TNC036-BGSS-412.5m exceeds the modelled drawdown from August 2020 but remains within the predicted drawdown (+30m) as of March 2022. A Level 2 TARP criteria applies at TNC036-BGSS-412.5m over the reporting period (Table 5).

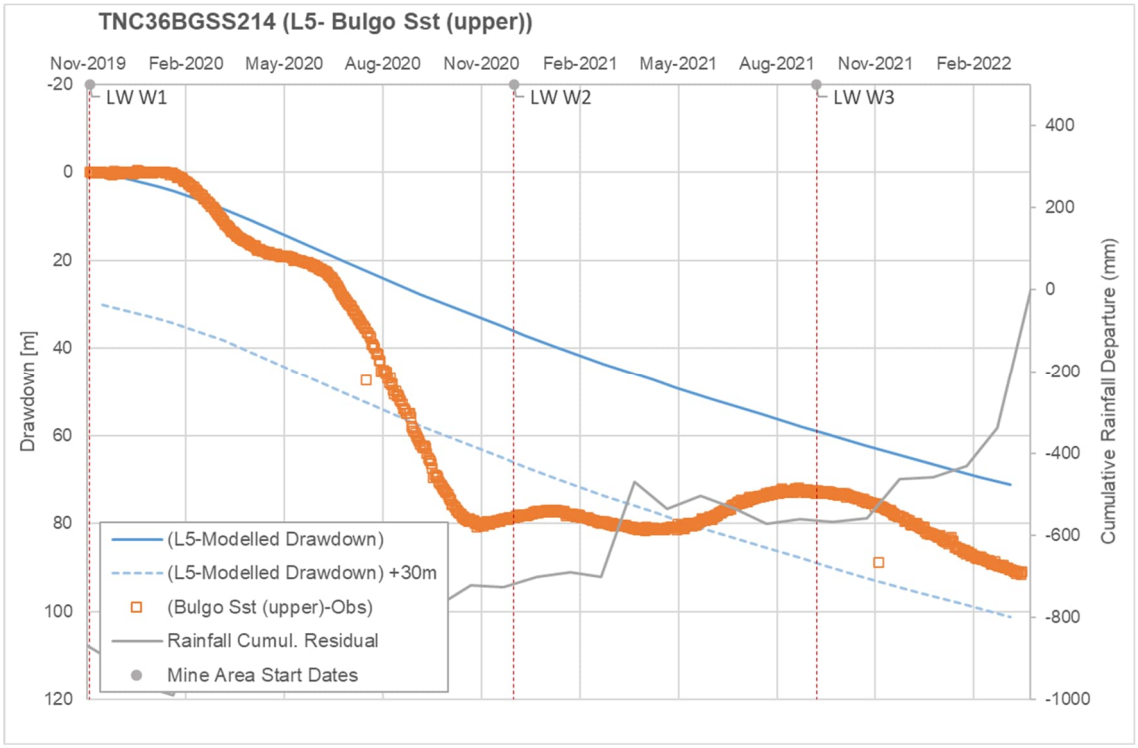


Figure 18 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-214m) with the +30m Threshold Modelled Drawdown

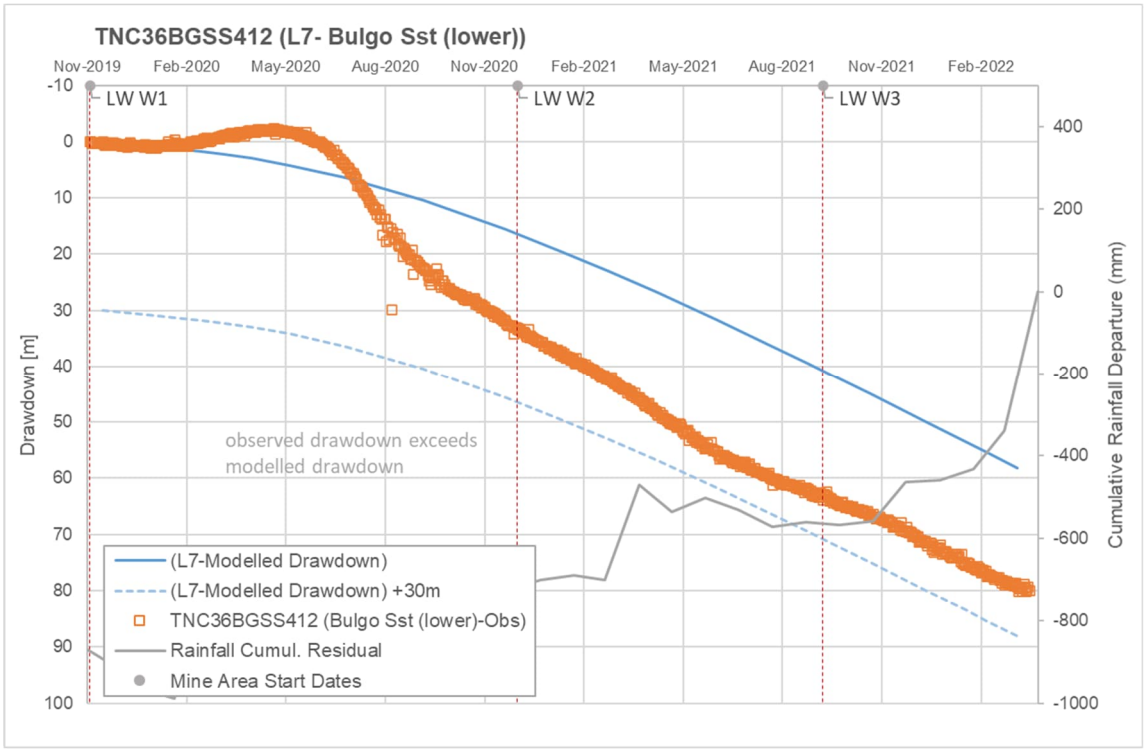


Figure 19 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-412.5m) with the +30m Threshold Modelled Drawdown

5 Groundwater Quality Trigger Review

5.1 Trigger Criteria

The approved trigger criteria for groundwater quality are summarised in Table 8. Appendix B2 details the water quality impact assessment trigger criteria from the LW W3-W4 Extraction Plan (Tahmoor Coal, 2021) and the appropriate action plan to be enacted should a trigger exceedance in groundwater quality occur during mining of LW W1-W2.

The groundwater triggers for water quality parameters are detailed in the Groundwater Technical Report (SLR, 2021) and reproduced in Table 9 below. These values were set for each bore. The water quality triggers were assigned as follows:

- pH - each bore was assigned a lower and upper pH trigger level based on the minimum and maximum pH value recorded in the available dataset minus/plus a pH unit;
- electrical conductivity (EC) - this trigger was established for each bore as the maximum observed EC during the pre-mining baseline and early mining period, plus ten percent of this maximum value; and
- for metals, either:
    - when the maximum metal concentration was recorded during the mining period, the trigger was set at the 95th percentile of the full historical data record (pre-mining and mining period); or
    - when the maximum metal concentration was recorded during the baseline period, the trigger level was defined as the maximum concentration plus ten percent of that value.

Further details on the methodology to develop the proposed groundwater quality trigger levels are provided in the Section 6.2.2 of the Groundwater Technical Report LWW3-W4 (SLR, 2021).

Table 8 Groundwater Quality TARP Criteria for Open Standpipes and Private Bores (Tahmoor Coal, 2021)

Significance Level	Criteria
	Open Standpipes
Level 1	No observable change in salinity, pH or metals outside of the baseline variability*.
Level 2	Short term increase (< 3 months) in salinity and/or metals, or change in pH outside of baseline variability*. The effect does not persist after a significant rainfall recharge event. AND/OR A similar trend or response has been noted at other monitored bores or private groundwater bores.
Level 3	Short term increase (< 3 months) in salinity and/or metals or change in pH outside of baseline variability*. The effect persists after a significant rainfall recharge event. AND/OR the change in water quality is determined not to be controlled by climatic or anthropogenic factors.
Level 4	Medium to long term increase in salinity and / or metals or a change in pH outside of baseline variability* with the effect persisting for greater than 3 months or after a significant rainfall recharge event. AND The reduction in water quality is determined not to be controlled by climatic or anthropogenic factors.

*the baseline variability was estimated using available data and refers to the proposed trigger levels (refer the section 6.2.2 and Table 6.2 of Groundwater Technical Report (SLR,2021)

Table 9 Triggers for Groundwater Quality TARPs

Bore	Trigger Level			Trigger Level Concentrations (mg/L) for Metals											
	EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
P12A	942	5.4	8.1	26.4	1.7	0.0110	0.0044	75.90	0.011	0.06	0.011	0.06	0.3	0.1	0.011
P12B	729	5.0	8.2	15.2	1.3	0.0044	0.0076	50.6	0.011	0.04	0.011	0.04	0.4	0.2	0.011
P12C	528	5.9	9.2	23.1	0.8	0.0034	0.0011	0.90	0.011	0.04	0.011	0.1	0.2	0.1	0.011
P13A	1232	5.2	9.4	69.3	1.5	0.0036	0.0014	0.91	0.011	0.04	0.011	0.03	0.4	0.3	0.011
P13B	1269	5.4	9.6	16.6	1.2	0.0020	0.0011	0.22	0.011	0.06	0.011	0.04	0.2	0.3	0.011
P13C	376	6.3	10.2	46.2	1.4	0.0011	0.0011	0.1	0.011	0.1	0.011	0.02	0.1	0.3	0.011
P14A	396	4.1	9.1	15.4	2.0	0.0022	0.0011	0.21	0.011	0.05	0.011	0.01	0.1	0.1	0.011
P14B	915	4.6	8.8	46.2	0.9	0.0022	0.0011	0.22	0.011	0.04	0.011	0.07	0.1	0.2	0.011
P14C	1881	5.3	9.4	19.8	1.5	0.0011	0.0011	0.04	0.011	0.1	0.011	0.11	0.2	0.4	0.011
P14D	1198	5.5	9.6	11.0	1.9	0.0011	0.0011	0.04	0.011	0.04	0.011	0.35	0.1	0.2	0.011
P15A	4620	4.63	8.22	5.7	1.0	0.0011	0.0011	0.28	0.0011	0.055	0.011	0.13	2.9	2.3	0.011
P15B	3575	4.11	12.1	4.8	0.9	0.0011	0.0011	0.09	0.0011	0.055	0.011	0.14	1.3	1.2	0.011
P15C	2090	5.04	8.66	6.2	0.5	0.0011	0.0011	0.19	0.0011	0.033	0.011	0.20	0.5	0.5	0.011
P15D	1430	5.48	7.72	3.5	0.9	0.0011	0.0011	0.13	0.0011	0.055	0.011	0.19	0.2	0.4	0.011
P16A	1539	4.9	7.8	116.0	3.9	0.0011	0.0011	0.1	0.011	0.04	0.011	0.06	0.3	0.5	0.011
P16B	1180	5.9	9.6	41.8	1.8	0.0011	0.0011	0.03	0.011	0.05	0.011	0.04	0.2	0.1	0.011
P16C	1212	6.2	9.5	46.6	1.6	0.0011	0.0011	0.02	0.011	0.05	0.011	0.1	0.1	0.1	0.011
P17	2019	4.8	8.3	10.6	0.6	0.0011	0.0011	0.2	0.011	0.04	0.011	0.11	0.2	0.7	0.011
GW105546	448	3.5	7.2	37.4	1.6	0.0011	0.0011	0.1	0.011	0.03	0.011	0.011	0.05	0.04	0.011
GW105467	1041	3.7	6.8	77.0	3.9	0.094	0.0019	0.2	0.039	0.04	0.011	0.072	0.1	0.04	0.011

Bore	Trigger Level			Trigger Level Concentrations (mg/L) for Metals											
	EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
GW105228	1793	4.6	7.1	31.4	2.7	0.0011	0.0011	0.2	0.0181	0.04	0.011	0.026	0.23	0.15	0.011
GW072402	8151	4.7	7.5	63.8	0.9	0.0019	0.0011	0.2	0.011	0.03	0.011	0.157	0.3	0.5	0.011
GW115860*	948.2	4.9	7.25	16.5	0.9	0.0011	0.0011	0.02	0.011	0.022	0.011	0.253	0.51	0.3	0.011
GW104090	3861	5.3	7.5	50.6	1.4	0.0011	0.0011	0.05	0.022	0.033	0.011	1.650	0.1	1.2	0.011

'*" Revised trigger level for Ba at bore GW115860 following the groundwater trigger investigation presented in SLR (2022a)

5.2 Discussion of Groundwater Quality Exceedances

The following section details the groundwater quality compliance at Tahmoor Coal in relation to the groundwater quality triggers. Table 10 presents the occurrence of trigger level exceedances in groundwater quality (EC, pH and metals) over the reporting period as per the proposed trigger values (Table 9) and the TARP trigger criteria found respectively in Appendix B.

A brief analysis of the EC, pH and metal concentrations in relation to climate and mining activity during the reporting period is presented in Sections 5.2.1 to 5.2.3 alongside trigger exceedances. Time series plots with the approved trigger values (EC, pH, metals) with exceedances only are shown in Appendix D, Figures D1-D25.

Table 10 Trigger Exceedances for pH, EC and Metal Concentrations over the Reporting Period (November 2021 – March 2022)

Bore	Month	Trigger Level Exceedance														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
Shallow OSP																
P12A	Nov															
	Dec															
	Jan															
	Feb						L2	L2								
	Mar															
P12B	Nov															
	Dec			L2							L2					
	Jan			L2												
	Feb			L2												
	Mar			*L4									L2			
P12C	Nov										L2					
	Dec															
	Jan															
	Feb															
	Mar															
P14A	Nov						L2						L2		L2	
	Dec															
	Jan															
	Feb												L2			
	Mar															
P14B	Nov															
	Dec										L2					

Bore	Month	Trigger Level Exceedance														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Jan										L2					
	Feb															
	Mar															
P14C	Nov										L2					
	Dec															
	Jan															
	Feb										L2					
	Mar															
P14D	Nov															
	Dec															
	Jan															
	Feb															
	Mar															
P15A	Nov														L2	
	Dec														L2	
	Jan														*L4	
	Feb	L2													*L4	
	Mar	L2													*L4	
P15B	Nov														L2	
	Dec	L2														
	Jan															
	Feb														L2	
	Mar	L2														
P15C	Nov					L2									L2	
	Dec															
	Jan															
	Feb										L2				L2	
	Mar					L2									L2	
P15D	Nov															
	Dec															
	Jan															
	Feb				L2									L2		
	Mar															
P16A	Nov													L2		

Bore	Month	Trigger Level Exceedance														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Dec															
	Jan															
	Feb															
	Mar															
P16B	Nov														L2	
	Dec				L2										L2	
	Jan															
	Feb														L2	
	Mar				L2											
P16C	Nov															
	Dec			L2												
	Jan															
	Feb															
	Mar															
Private Bores																
GW104090	Jan													L2	L2	
GW105467	Jan															
GW105228	Jan													L2		
GW072402	Jan													L2		
GW115860	Jan	*L4												*L4 ^		
GW105546	Jan															

TARP Level 1 TARP Level 2 TARP Level 3 Potential TARP Level 4 no site access

site decommissioned (P13 and P17)

LX: maximum trigger level exceedances recorded

"*" remains a potential Level 4 TARP trigger

"^" A potential TARP Level 4 was identified at GW115860 for Ba. Following the groundwater trigger investigation (SLR,2022a), a revision of the trigger levels was recommended with a reduction to a TARP Level 1 (see Section 5.2.3.8)

5.2.1 Electrical Conductivity (EC)

Prior to this reporting period, there had been no trigger exceedances for EC at any of the standpipes (P12-P14, P16, and P17). Private bores GW104090 and GW115860 showed a TARP Level 2 EC trigger exceedance in the July monitoring round, with GW115860 also showing an exceedance in October 2021.

During this reporting period, three monitoring sites have triggered EC trigger levels within this six-monthly monitoring period:

- P15A;

- P15B; and
- GW115860.

All others EC measurements from the Tahmoor standpipes and private bores are within the Level 1 TARP.

5.2.1.1 P15A

EC in P15A shows fluctuating behaviour since monitoring started in April 2021. The salinity at P15A has been increasing from 4,010 in December 2021 to 4,860 µS/cm in February 2022 before reducing to 4,760 µS/cm in March 2022. Since February 2022, EC has been marginally above the TARP Level 2 of 4,620 µS/cm (Figure 20).

5.2.1.2 P15B

EC in P15B also shows fluctuating behaviour. At P15B, EC triggered a TARP Level 2 of 3,575 µS/cm in December 2021 before returning within TARP Level 1 in January 2022. In February 2022, EC increased to 4270 µS/cm and reduced slightly to 4,210 µS/cm in March 2022 triggering the TARP Level 2 since February 2022 (Figure 20).

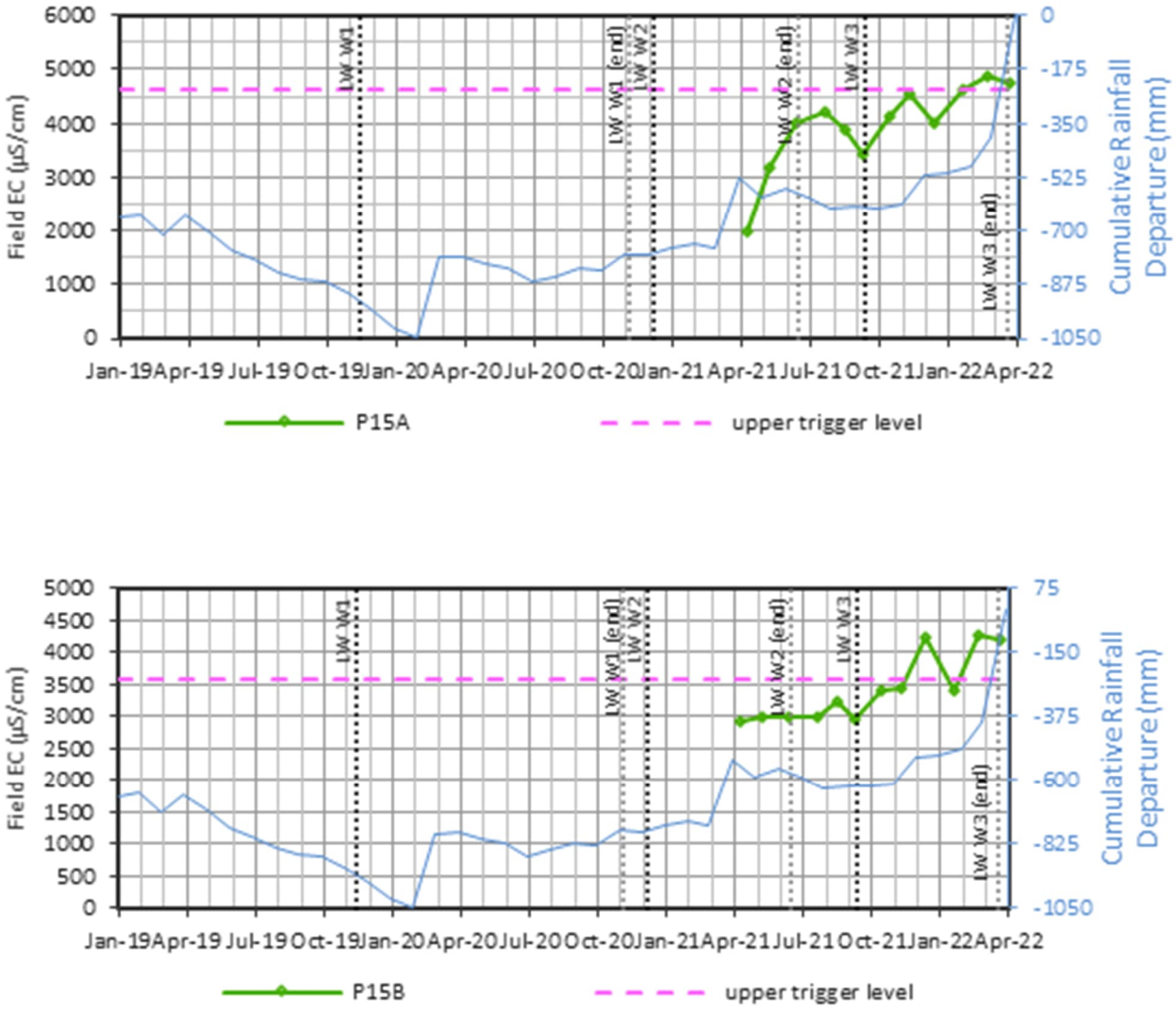


Figure 20 EC Exceedances at P15A and P15B

5.2.1.3 GW115860

The salinity at GW115860 has been steadily increasing from 621 µS/cm in January 2021 to 1,246 µS/cm in March 2022. Final EC in January 2022 at this bore exceeds the trigger level of 948.2 µS/cm for three consecutive recordings (greater than 6 months), resulting in a potential TARP Level 4 (Figure 21). Private bore GW115860 is used for domestic purposes. SLR (2022a) investigated the trigger exceedances at GW115860 for EC. The following summarises the findings presented in SLR (2022a):

- The reason for the increased EC at GW115860 is unclear, although it is consistent with the trend observed at nearby bore GW105228. Therefore, this trigger is only 'potential' Level 4 TARP trigger, and it has not been confirmed that the cause is mining.
- No drawdown was observed during the extraction of LW LW3 at GW115860, and hence drawdown does seem to be the cause of the change in EC;
- The increase in EC at GW115860 (to 1,246 µS/cm) does not change the beneficial use classification of the groundwater extracted at this site, and therefore the currently observed effects are considered to be immaterial. Indeed, salinity (TDS) at GW115860 remains within the desirable palatability of less than 600 mg/L (class A1 category – DPIE, 2012). Groundwater quality at GW115860 remains suitable for all beneficial uses, including the current purpose.
- Given the low salinity of groundwater at GW115860, and the small incremental change in that salinity in relation to the beneficial use classifications it is recommended to continue observing this bore over the next monitoring period (April 2022) to see if EC decreases, otherwise to revise the trigger. The most reliable method to revise the trigger would be to adopt the EC trigger from GW105228 for use at GW115860 as it has been derived from a longer record period.

Further details regarding the investigation of EC exceedances at GW115860 is presented in SLR (2022a).

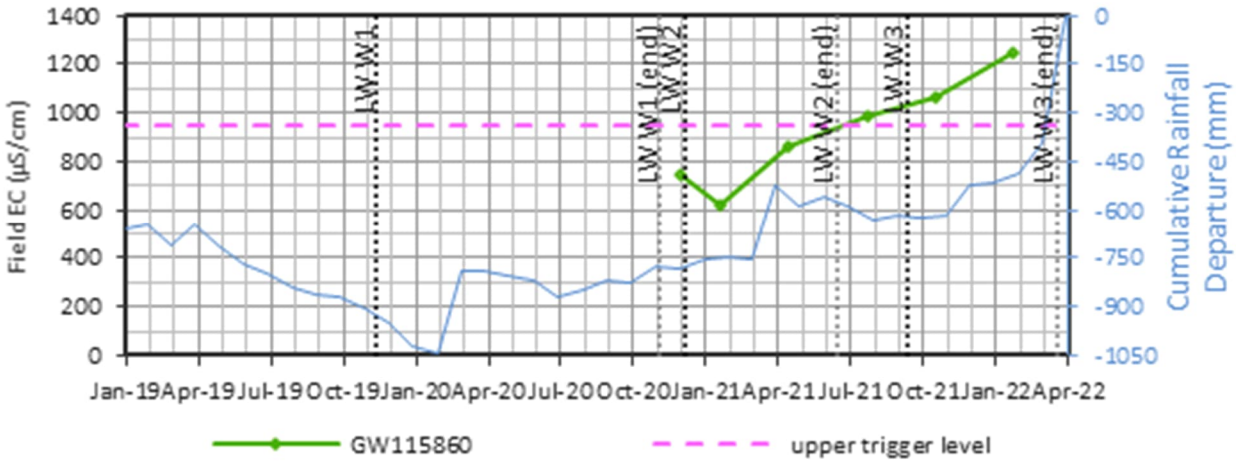


Figure 21 EC Exceedances at GW115860

5.2.2 pH Exceedances

Two monitoring sites have triggered pH trigger levels within this six-monthly monitoring period:

- P12B - triggered the upper pH threshold; and
- P16C - triggered the upper pH threshold.

5.2.2.1 P12B

P12B triggered the upper trigger level for pH between December 2021 and March 2022 with a pH of 10.65 in March 2022 (trigger level = 8.16) (Figure 22). A potential TARP Level 4 was identified in March 2022 as four consecutive recordings (greater than three months) were recorded during a period of above average rainfalls.

SLR (2022a) investigated the recent rise in pH at P12B in January 2022. The following summarises the findings:

- A rising trend in pH was previously observed at P12A, P12B and P12C around December 2020 to April 2021. It has been previously reported by SLR (2021a), that this could be due to compromised integrity of the monitoring bores combined with high rainfall causing cement to become mobilised into the groundwater.
- No anomalous variations in groundwater level were identified in P12A, P12B and P12C, that could be indication of a compromised bore integrity (SLR, 2022a and Figure A-1).
- The reason for the increase in pH at P12B causing the trigger exceedance is unclear and could potentially be related to compromised bore integrity, however an increasing trend was also observed at GW072402.
- GW072402 has experienced a pH increase from 5.9 to 6.8 between January 2021 and January 2022, however the bore had a pH of 6.5 in December 2019 just after mining began. The pH at GW072402 remains at near-neutral values (close to 7), while the pH at P12B is higher, above 10, where a value of 9.5 is often considered the maximum for some beneficial uses (Department of Environment and Heritage Protection, May 2014).

At this time, a mining-related effect is plausible, however the consequences of this effect (if it is mining-related) are considered minor.

In addition, in March 2022, pH at nearby bores P12A and P12C is within a TARP Level 1 at 6.9 and 8.61 respectively, both relatively neutral, and well below the pH seen at P12B (Figure 22). It is recommended that pH at P12B remains a potential TARP Level 4.

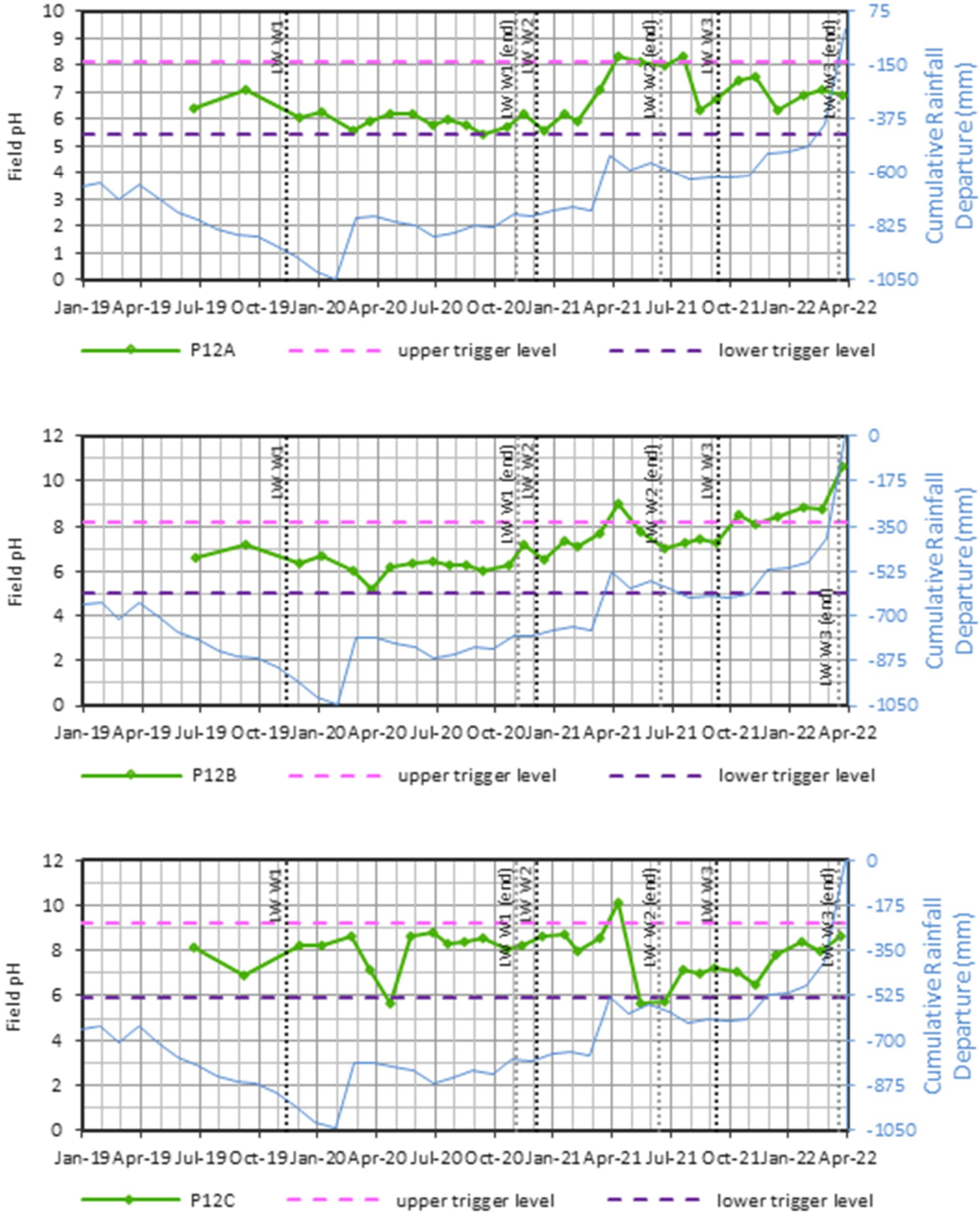


Figure 22 pH at P12A and P12C and pH Exceedances at P12B

5.2.2.2 P16C

pH at P16C exceeded the TARP Level 2 trigger of 9.49 in December 2021. pH increased from 9.36 to 9.5 in December 2021. Between January 2022 and March 2022, pH at P16C shows a fluctuating behaviour ranging from 7.15 to 9.22. As of March 2022, pH at P16C is within a TARP Level 1.

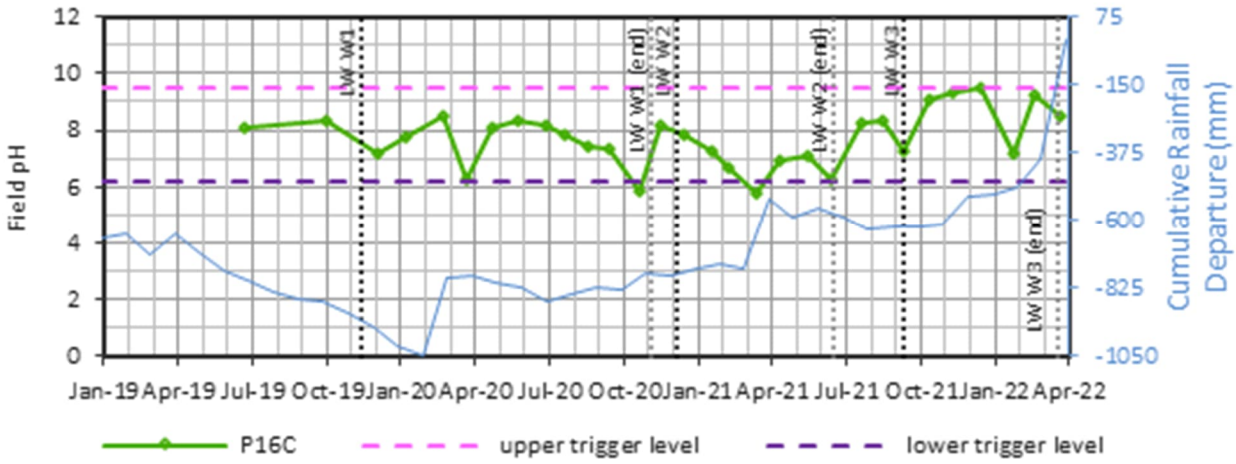


Figure 23 pH Exceedances at P16C

5.2.3 Metals

The following metal triggers were exceeded over the five-monthly monitoring period from November 2021 to March 2022 in the respective bores (Appendix D, Figure D-1 to Figure D-25):

- Iron (Fe) - P15D (February), and P16B (December and March)
- Manganese (Mn) – P15C (March)
- Copper (Cu) – P12A (February), P14A (November)
- Lead (Pb) – P12A (February)
- Aluminium (Al) – P12B (December), P12C (November), P14B (December and January), P14C (November and February), P15C (February)
- Lithium (Li) – P12B (March), P14A (November and February)
- Barium (Ba) – P15D (February), P16A (November), GW104090, GW105228, GW072402, GW115860 (all in January);
- Strontium – P14A (November), P15A (all months), P15B (November and March), P15C (November, February and March), P16B (November, December and February), GW104090 (January).

Over the reporting period, there were no exceedances in the lower pH and in dissolved zinc (Zn), nickel (Ni), arsenic (As) and selenium (Se).

5.2.3.1 P12A, B and C

- A TARP Level 2 for dissolved copper (Cu) and lead (Pb) was triggered at P12A in February Cu concentrations increased from 0.001 mg/Lto 0.011 mg/L in February (i.e. at the trigger level) reducing to 0.005 mg/L in March (Appendix D, Figure D-1). Pb concentrations increased from 0.002 mg/l to 0.005 mg/L in February above the trigger level of 0.0044 mg/L and reducing to 0.003 mg/L in March (Appendix D, Figure D-2).
- A TARP Level 2 for dissolved aluminium (Al) and lithium (Li) was triggered in December and March respectively at P12B. Dissolved (Al) increased from 0.01 mg/L to 0.04 mg/L in December. This aluminium concentration remained close to the trigger level (0.038 mg/L) (Appendix D, Figure D-3). It is noted that aluminium concentrations in all standpipes across the site show fluctuations in the range of 0.01 to 0.06 mg/L, and these are considered representative of the natural groundwater system. Thus, the trigger level for P12B may be too conservative considering the background levels, and therefore occasional exceedances of the trigger limit are expected to occur. Dissolved (Li) increased from 0.027 mg/L to 0.065 mg/L in March marginally above the trigger level of 0.042mg/L (Appendix D, Figure D-4).
- A TARP Level 2 for dissolved aluminium (Al) was triggered in November at P12C. Dissolved (Al) increased from 0.01 mg/L to 0.05 mg/L in November (Appendix D, Figure D-5). Like P12B, this aluminium concentration remained close to the trigger level (0.04 mg/L) and is considered representative of the natural groundwater system.

5.2.3.2 P14A

A TARP Level 2 for dissolved copper (Cu) and strontium (Sr) was triggered in November at P14A. Cu concentration increased to 0.003 mg/L in November, above the trigger level of 0.022 mg/L (Appendix D, Figure D-6). Sr concentration increased to 0.069 mg/L in November, above the trigger level of 0.06 mg/L (Appendix D, Figure D-7).

A TARP Level 2 for dissolved lithium (Li) was triggered in November and February at P14A. Concentrations increased to 0.011 mg/L and 0.09 mg/L marginally above the trigger level of 0.066 mg/L (Appendix D, Figure D-8). As of March, lithium concentration reduced to 0.05 mg/L. As of March 2022, Li concentrations are within TARP Level 1.

5.2.3.3 P14B, C

Short-term increases in dissolved Al triggered the TARP Level 2 throughout the reporting period. A TARP Level 2 was triggered in December and January at P14B for dissolved Al with concentrations rising to 0.05 mg/L (trigger level of 0.044 mg/l) (Appendix D, Figure D-9). A TARP Level 2 was recorded at P14C in November and February with concentration observed rising to the trigger level of 0.05 mg/L (Appendix D, Figure D-10). As mentioned above, aluminium concentrations show natural fluctuations in the range of 0.01 to 0.06 mg/L and these exceedances are not considered a cause for concern.

5.2.3.4 P15A

Strontium levels at P15A have continually exceeded the trigger of 2.31 mg/L from September 2021 to March 2022 monitoring rounds resulting in a potential TARP Level 4 exceedance in January 2022 (Appendix D, Figure D-11). Strontium concentrations have decreased from 3.7 mg/L in January 2022 to 3.1 mg/L in March 2022. SLR (2022a) investigated the recent Sr exceedances at P15A in January 2022 with no clear mining-impact identified.

In March 2022, Sr concentrations at nearby bores P15B and P15C resulted in a minor decrease (-0.2 mg/L at P15B) and was stable at P15C at 0.47 mg/L and observed within a TARP Level 1 at bores P15D, P14A-D. As presented in SLR (2022a), the stable and minor increase in Sr concentrations observed at nearby bores suggest that the exceedance in Sr concentrations in March 2022 at P15A remains a potential TARP Level 4.

Further details regarding the strontium investigation are presented in SLR (2022a). The following presents a summary of the findings:

- Since the start of monitoring at site P15A-D, the Sr concentrations are above the ranges reported at the unaffected sites in Morrison *et al*. (2019) and above the pre-mining Sr concentrations at P14A-P14D except for P15D within pre-mining Sr concentrations at P14.
- No exceedances in Sr concentrations were identified at surface water monitoring sites along Stonequarry Creek, with all surface water monitoring sites across the Western Domain within TARP Level 1 for water quality in January 2022 (HEC, 2022b) and during the reporting period (HEC, 2022a).
- From the U.S Environmental Protection Agency, Sr concentrations in drinking water are assessed relative to the health-based screening level benchmark of 4 mg/L (Musgrove, 2021). Values greater than 4 mg/L are considered high, between 2 mg/L and less than 4 mg/L are considerate moderate and less than 2.0 mg/L are considered low. At P15A, Sr concentrations are considered moderate (less than 4.0 mg/L).
- Since monitoring started at P15A, the higher Sr concentrations observed at P15A compared to other sites (i.e. P14, GW105228 and GW115860) and compared to the deeper piezometers (i.e. P15B-D) suggest a localised Sr source in groundwater at piezometer P15A.
- The range of strontium in natural soils is highly variable, from 50 mg/kg to 1000 mg/kg (USEPA, 1983). P15A is located within the mapped alluvium (Figure 1) and may be screened within alluvial soil with a higher Sr concentration compared to the deeper lithology of weathered and fresh Hawkesbury Sandstone. No bore logs are available to review and verify the lithology at this location.

- The Sr concentrations at nearby registered bores GW105228 and GW115860 are considered low (less than 2 mg/L) (Musgrove, 2021) suggesting no risk of human-health concerns and that the increase in Sr concentrations at P15A is possibly localised.

It is recommended to continue monitoring Sr concentration at site P15A-D, P14A-D and at the two nearby registered bores (GW105228 and GW115860).

5.2.3.5 P15B, C and D

At P15B, strontium levels exceeded the trigger of 1.21 mg/L in November (1.3 mg/L) and February (1.4mg/L) triggering the TARP Level 2. As of March 2022, strontium levels reduced to 1.2 mg/L (Appendix D, Figure D-12).

At P15C, strontium levels exceeded the trigger of 0.45 mg/L in November (concentration rising at the trigger level), in February and March (0.47 mg/L) triggering the TARP Level 2 (Appendix D, Figure D-13). Short-term increases in dissolved Al and Mn were also recorded at P15C triggering a TARP Level 2. Al levels increased from 0.01 mg/l in January to 0.04 mg/L in February, being stable in March above the trigger level of 0.03 mg/L (Appendix D, Figure D-14). As mentioned above, aluminium concentrations show natural fluctuations in the range of 0.01 to 0.06 mg/L and these exceedances are not considered a cause for concern. Mn levels were recorded marginally above the trigger level of 0.54 mg/L in November (0.55 mg/L) and in March (0.58 mg/L) (Appendix D, Figure D-15). As of March 2022, Mn levels at P15C appear lower than in the upper Hawkesbury Sandstone recorded at 0.82 mg/L (P15A) and 0.59 mg/L (P15B) and within a TARP Level 1.

A TARP Level 2 for dissolved iron (Fe) and barium (Ba) was triggered in February at P15D. Fe levels increased from 2.3 mg/L in January to 4.8 mg/L in February and as of March reduced to 2.2 mg/L (TARP Level 1) (Appendix D, Figure D-16). Ba levels increased from 0.15mg/L in December to 0.21 mg/L in February and as of March reduced below the trigger level of 0.21 mg/L to 0.17mg/L (Appendix D, Figure D-17).

5.2.3.6 P16A

A TARP Level 2 for barium (Ba) was triggered in November at P16A. Ba levels increased to 8.5 mg/L in November and reduced to 0.1 mg/L for the rest of the reporting period (Appendix D, Figure D-18). This single trigger is likely an outlier and could be attributed to a lab error measurement. Ba levels at P16A have been observed at 0.1 mg/L since monitoring started.

5.2.3.7 P16B

A TARP Level 2 for Sr was triggered in November and December at P16B and returned to TARP Level 1 in January. In February, Sr levels increased to 0.15 mg/L above the trigger level of 0.13 mg/L triggering the TARP Level 2 (Appendix D, Figure D-9). As of March, Sr reduced to 0.08 mg/L within a TARP Level 1. A TARP Level 2 for Fe was triggered in December at P16B which follows a period of decline in levels observed since July 2021. In January and February, Fe levels reduced within TARP Level 1 (i.e. 9.1mg/L) but as of March Fe levels increased to 86 mg/L (Appendix D, Figure D-20). Iron staining was previously reported at this location likely attributed to the installed steel casing.

5.2.3.8 Private Bores

At GW104090 a short-term increase for Sr and Ba triggered a TARP Level 2 in January. Sr levels have continually been increasing since April 2021 from 0.27 mg/L to 1.7 mg/L in January 2022 (trigger level is at 1.2 mg/L) (Appendix D, Figure D-21). Ba levels increased from 0.08 mg/L in October 2021 to 0.44 mg/L (Appendix D, Figure D-22).

At GW105228, Ba concentrations exceeded the trigger of 0.228 mg/L in January resulting in a TARP Level 2. Concentrations increased marginally from 0.23 mg/L in October 2021 to 0.24 mg/L in January 2022 (Appendix D, Figure D-23).

At GW072402 Ba concentrations in January 2022 were reported at 0.28 mg/L, which is marginally above the trigger value of 0.2785 mg/L, resulting in a TARP Level 2 (Appendix D, Figure D-24).

GW115860 is located 400 m north of LW W3. Barium concentrations at GW115860 exceeded the trigger of 0.33 mg/L for the third consecutive time in the January 2022 (i.e. a period of more than six months), resulting in a potential TARP Level 4 exceedance (Appendix D, Figure D-25). Concentrations increased from 0.36 mg/L in October 2021 to 0.39 mg/L in January 2022. The first reported concentration of Ba in January 2021 at GW115860 was 0.3 mg/L with the lowest concentration reported in April 2021 (0.032 mg/L).

SLR (2022a) investigated the potential TARP Level 4 for Ba at GW115860. The following summarises the findings:

- Ba concentration at GW105228 (110 m from GW115860) are stable within 0.20-0.25 mg/L since monitoring started.
- The short record of Ba concentrations at site P15A-D shows fluctuation within the range of 0.08 to 0.21 mg/L, generally lower than at GW105228.
- No exceedances or increasing trends in Ba concentrations were identified at sites P14A-D and P15A-C (only 180 m and 65 m from LW W3) between October 2021 and January 2022 (SLR, 2021a, 2022a) except at P15D (TARP Level 2) in February 2022 slightly increasing at the trigger level.

A mining-related effect on Ba at GW115860 was assessed to be unlikely but could not be excluded at the time of the investigation. A revision to the Ba trigger level was undertaken (SLR, 2022a) as it appeared that the trigger level was conservative and could not be based on pre-mining data.

The revised trigger level for Ba at bore GW115860 is 0.51 mg/L (SLR, 2022a) (Appendix D, Figure D-27).

The revised trigger level was calculated using the maximum Ba concentration recorded at GW115860 (i.e. 0.39 mg/L in January 2022) plus 30% (i.e. 30% being the percentage increase from 0.3 mg/L in January 2021 to 0.39 mg/L January 2022).

Published guideline values for Barium are:

- 1 mg/L for recreational purposes (ANZECC, 2000 / ANZG, 2018).
- There is no guideline value for Ba for freshwater ecosystems (ANZECC, 2000 / ANZG, 2018).
- 2 mg/L for health (i.e. drinking water) (NHMRC, 2011);

The revised trigger level for Ba at GW115860 remains conservative (i.e. lower than) with respect to the guideline values stated above. Further monitoring at GW115860 will be undertaken in April 2022 to confirm trends.

4.2 Trigger Criteria

TARPs have been developed based on the groundwater management program outlined in the Groundwater Technical Report LW W3-W4 (SLR, 2021) and the WMP (Tahmoor Coal, 2021), and describe necessary responses for exceedances in groundwater quality and groundwater level triggers at open standpipe 'P' bores, as well as exceedance of groundwater pressure triggers developed for VWPs. The approved trigger criteria for shallow and deep groundwater levels are summarised and presented in **Table 7. Appendix B1** details the latest approved impact assessment trigger criteria from the LW W3-W4 Extraction Plan presented in the WMP (Tahmoor Coal, 2021) and the appropriate action plan to be enacted should a trigger exceedance occur during mining of LW W1-W2 and LW W3-W4. **Appendix B (Figure B-1 to B-27)** present groundwater hydrographs at each site with the associated groundwater level triggers.

Prior to the approval of LW W3 in September 2021, groundwater levels and quality observations were assessed against the TARPs developed for and outlined in the Groundwater Technical Report LW W1-W2 (HS/SLR, 2019). From September 2021, as stated above, groundwater levels and quality observation across the Western Domain are now assessed against latest approved impact assessment trigger criteria (Tahmoor Coal, 2021). The following sections present the groundwater exceedances identified during the reporting period.

Further details regarding the development of the TARPs are provided in SLR (2021).

Table 7 Groundwater TARP Level Criteria for Open Standpipes, Shallow VWPs and Deep VWPs (Tahmoor Coal, 2021).

Significance Level	Criteria		
	Open standpipes	Shallow VWPs (<200m bgl)	Deep VWPS (>200m bgl)
Level 1	Groundwater level remains consistent within baseline variability and/or pre-mining trends, with reductions in groundwater level less than two metres and does not trigger Level 2 to Level 4 Significance Levels (refer to Appendix C).	No observable mining induced change at VWP intakes located at or above (i.e. shallower than) 200 m depth.	Observed data does not exceed predicted (modelled) impacts (excluding those monitoring the Bulli Coal Seam).
Level 2	Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) (refer to Appendix C for TARP Significance Level 2). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than) 200 m depth following the commencement of extraction at LW W1 (and LW W2, W3 and W4) (refer to Appendix C for TARP Significance Level 2). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.
Level 3	Water level declines below the water level of TARP Significance Level 3 (refer Appendix C, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Water level declines below the water level of TARP Significance Level 3 (refer Appendix C, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 6 months or more.
Level 4	Water level reduction greater than the maximum modelled drawdown (refer to Appendix C for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	Water level reduction greater than the maximum modelled drawdown (refer to Appendix C for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND The reduction in water level is determined not to be controlled by climatic or anthropogenic factors.	Calculated or observed drawdown (based on 2009-2015 baseline data and excluding VWPs within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 12 months or more.

4.3 Trigger Exceedances

Table 8 presents the occurrence of trigger level exceedances in groundwater levels since the start of mining at Western Domain as per the trigger values (HS/SLR, 2019; SLR, 2021) and the TARP trigger criteria presented in **Table 7** and **Appendix Table B1**.

Table 8 Groundwater Level Trigger Exceedances over September 2021 – September 2022 for the Shallow Open Standpipes, Shallow and Deep VWPs.

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances													Future Review Period						Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	**Apr 22**	**May 22**	**Jun 22**	**Jul 22**	**Aug 22**	**Sep 22**	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
Shallow OSP		TARP (Tahmoor Coal, 2021)																					
P12A	170.1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							0.5	170.7	-
P12B	170.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							0.8	171.3	-
P12C	176.3	L3	L3	L3	L3	L3	L3	L3	L3	L2	L2	L2	L2	L2							11.0	175.6	4.3
P14A	168.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							0.2	171.5	-
P14B	166.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1	L1	L1							1.4	168.4	-
P14C	166.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							1.7	168.5	-
P14D	164.8	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	L1	L1							1.8	167.4	
P15A	164.7^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							-	169.2	-
P15B	165.2^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							-	168.8	-
P15C	164.9^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1							-	168.8	-
P15D	165.4^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	L1							#	169.1	-
P16A	211.3	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1							1.1	210.7	0.9
P16B	206.4	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	#	#	#							5.7	205	1.3 [Jun 22]
P16C	199.6	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3							13.8	191.7	3.3

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances													Future Review Period						Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	**Apr 22**	**May 22**	**Jun 22**	**Jul 22**	**Aug 22**	**Sep 22**	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
Shallow VWPs (<200m)		TARP (Tahmoor Coal, 2021)																					
P41A	194	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1							-	190	0.1
P41B	172.9	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1							-	173	-
P41C	161.0	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1							-	161.7	-
P41D	160.0	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1							-	164.4	-
TNC036 - HBSS-65	209.5	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#							6.7	209.8	-
TNC036 - HBSS-97	196.3	L4	L4	L4	L4	L4	L4	L3	L3	L3	L3	L2	L2	#							24.0	185.5	8.7 [Aug 22]
TNC036 - BGSS-169	197.5	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	#							47.6	164.5	35.2 [Aug 22]
TNC040-WNFM-27	208.3	L1	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#							-	209.6	- [Aug 22]
TNC040 - HBSS-65	187.1	L1	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#							-	189	- [Aug 22]

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances													Future Review Period						Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	**Apr 22**	**May 22**	**Jun 22**	**Jul 22**	**Aug 22**	**Sep 22**	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
TNC043 - HBSS-65	158.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	NA	NA	NA									- [Jun 22]
TNC043 - HBSS-111.5	155.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	NA	NA	NA									0.9 [Jun 22]
Deep VWPs (>200m)		TARP (Tahmoor Coal, 2021)																					
TNC036 - BGSS-214	176.5	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	#							81.4	82.9	96.5 [Aug 22]
TNC036 - BGSS-412.5	96.8	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	#							49.7	13.9	13.9 [Aug 22]

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

LX: maximum trigger level exceedances recorded "-": no observed drawdown "#": groundwater levels not available

^ baseline groundwater level at P15 (A,B,C,D) is the groundwater level recorded in June 2021.

"" not assessed due to disruption in groundwater levels during drilling and packer testing at P15D.*

Table 9 Groundwater Level Trigger Exceedances over the Reporting Period (January 2021 – Sep 2022) for Private Bores

Bore	Baseline Maximum Ground water Depth (m bgl)	Baseline Groundwater Yield (L/s)	Trigger Level Exceedances									Groundwater Depths as of July 2022 (m bgl)	Ground water Yield as of July 2022 (L/s)
			Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22		
Private Bores													
GW104090	39.0	#	^	^	^	^	^	^	~	^		42.6	#
GW105467	32.0	0.5	*	*	*	*	*	*	*	*	*	#	#
GW105228	23.0	1.8	L1	L1	L1	L1	L1	L1	L1	x	x	10.6	1.1 to 2.5
GW072402	11.76	#	L1	L1	L1	L1	L1	L1	~	blocked	blocked	#	#
GW115860	#	#	L1	L1	L1	L1	L1	L1	L1	x	x	10.6	2.5
GW105546	31.9	1.6	*	*	*	*	*	*	*	*	*	#	#

LX: maximum trigger level exceedances recorded *#: not applicable* ** no site access* *"-"standing water level not available (access is not available inside the bore)*
m bgl – metres below ground level *^Bore blocked at 48.3 m bgl* *~sampling did not occur in July 2022, reported in Sept 22.* *"x": to be assessed in next review period (Oct 22)*

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

4.4 Discussion of Groundwater Level Exceedances

This section discusses any exceedances observed over the reporting period from April 2022 to September 2022. Hydrographs for monitoring locations with approved groundwater level triggers are presented in **Appendix C (Figures C1-C27)**.

TARP level exceedances were observed in bores as follows:

- TARP Level 3 at the shallow open standpipes P16C during the reporting period;
- TARP Level 3 at the shallow VWP sensors at TNC036 (HBSS-97m) from March 2022 to June 2022, with a reduction in TARP to Level 2 in July 2022;
- TARP Level 3 at the shallow open standpipes P12C in April 2022, with a reduction in TARP to Level 2 in May 2022;
- TARP Level 2 at the shallow open standpipe P16B during the reporting period;
- TARP Level 2 at the shallow VWP sensors at TNC036 (BGSS-169m) during the reporting period; and
- TARP Level 2 at the two deep VWP sensors at TNC036 (BGSS-214m and BGSS-412.5m) during the reporting period.

All other groundwater monitoring sites remained within TARP Level 1 across the six-monthly reporting period.

In terms of yield and groundwater level at the private bores, the following observations are noted over the reporting period (to July/September 2022):

- GW105228: There was no significant change in groundwater yield at GW105228 that could impede groundwater use during the reporting period. In July 2022, groundwater yield was recorded between 1.1-2.5 L/sec compared to 1.82 L/sec during the baseline period (GeoTerra, 2019). As of July 2022, groundwater levels were observed within baseline level**. TARP Level 1 applies**.
- GW115860: There was no significant change in groundwater yield at GW115860 that could impede groundwater use. In July, groundwater yield at this location is recorded at 2.5 L/sec compared to 2.3 L/sec during the baseline period. As of July 2022, groundwater levels were observed within baseline level**. TARP Level 1 applies**.
- GW105467: This bore is not actively used for groundwater extraction and no site access was possible during the reporting period. Further monitoring is planned at this location, if site access allows it.
- GW105546: There was no site access at GW105546 throughout the reporting period, hence the assessment of trigger assessment exceedances at this location was not possible.
- GW072402: No mining effect on groundwater levels is identified at this location at least until May 2022 (i.e. latest available records). The bore is suspected to be blocked at a depth of approximately 3 m. Further investigation is required to be completed to identify the cause of blockage and unblock the bore.

4.4.1 Shallow Open Standpipes

4.4.1.1 P12C

Groundwater levels are stable at 176.7 mAHD in September 2022 following a period of recovery. Groundwater levels have increased above the trigger TARP Level 3 (175 mAHD) in May 2022 which reduced the TARP to Level 2 (179.5 mAHD). Groundwater levels are 2.8m below the TARP Level 2 hence a TARP Level 2 applies (**Appendix C, Figure C-3**).

4.4.1.2 P16B and P16C

Since July 2022 no groundwater levels are recorded for P16B due to blockage of the bore. Groundwater levels were at approximately 205 mAHD in July 2022 and a TARP Level 2 was applied at P16B (**Appendix C, Figure C-13**). The groundwater monitoring bore P16B has been unblocked in October 2022 with groundwater data expected in the next review period.

In September 2022, groundwater levels at P16C were observed below the trigger TARP Level 3 (193.9 mAHD) (**Appendix C, Figure C-14**). There seem to be discrepancies between groundwater levels (mAHD) from the data logger and the manual measurements since June 2022, showing differences in the range of 3 m **(Appendix C, Figure C-14)**. While the groundwater levels from the data logger are used in the groundwater level TARP assessment, it is recommended to record several (i.e. 2-3) records of the depth to water at P16C using a water level meter to make sure the correct standing water level is recorded. Additionally, it is recommended to record the data logger installation depth and use this record in the calculations to convert pressure into a groundwater head (mAHD).

A drain to divert surface run-off has been developed in early November 2022 at P16B and P16C along with re-sealing the monitoring bores. These should ensure that no surface water run-off flows into the bore.

4.4.2 Shallow VWPs – TNC036

4.4.2.1 TNC036 - HBSS-97m

Groundwater levels gradually recovered above the TARP Level 3 threshold in July 2022 and therefore moved to TARP Level 2. A TARP Level 2 applies in August 2022 as groundwater levels were observed at 187.2 mAHD still below the threshold for TARP Level 2 (191.3 mAHD). (**Appendix C, Figure C-16)**

4.4.2.2 TNC036-169m

Groundwater levels were observed at 174.2 mAHD in late August 2022 (**Appendix C, Figure C-17**). The latest measurement taken on the 31st August 2022 indicated a decline of 12m in groundwater levels to 162.2mAHD. Further monitoring is required to confirm this sudden change against the general trend. As of August 2022, groundwater levels remain below the trigger TARP Level 2 (192.5 mAHD), hence a TARP Level 2 still applies.

4.4.3 Deep VWPs – TNC036

Figure 10 and **Figure 11** present the modelled (blueline) and observed (orange marker) drawdown at TNC036 sensors (BGSS-214m, BGSS-412.5m) since the start of LW LW1 extraction. The blue dashed line represents a threshold established as per the TARP for deep VWP sensors which is the modelled drawdown plus 30 m (**Table 7**).

The groundwater level observed at TNC036-BGSS-214m and TNC036-BGSS-412.5m exceeds the modelled drawdown from mid-2020 but remains within the 30 m predicted drawdown as of August 2022 (**Figure 10** and **Figure 11**). A Level 2 TARP criteria (exceeds modelled drawdown but less than 30 m exceedance) still applies at TNC036-BGSS-214m and TNC036-BGSS-412.5m over the reporting period (**Table 8**).

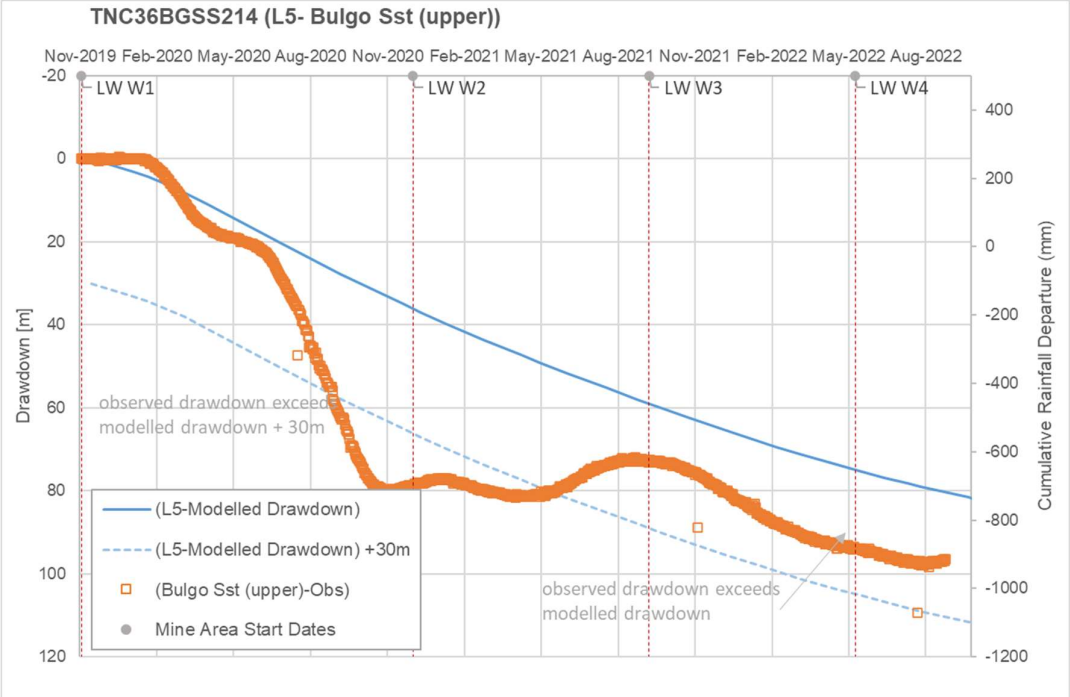


Figure 10 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-214m) with the +30m Threshold Modelled Drawdown

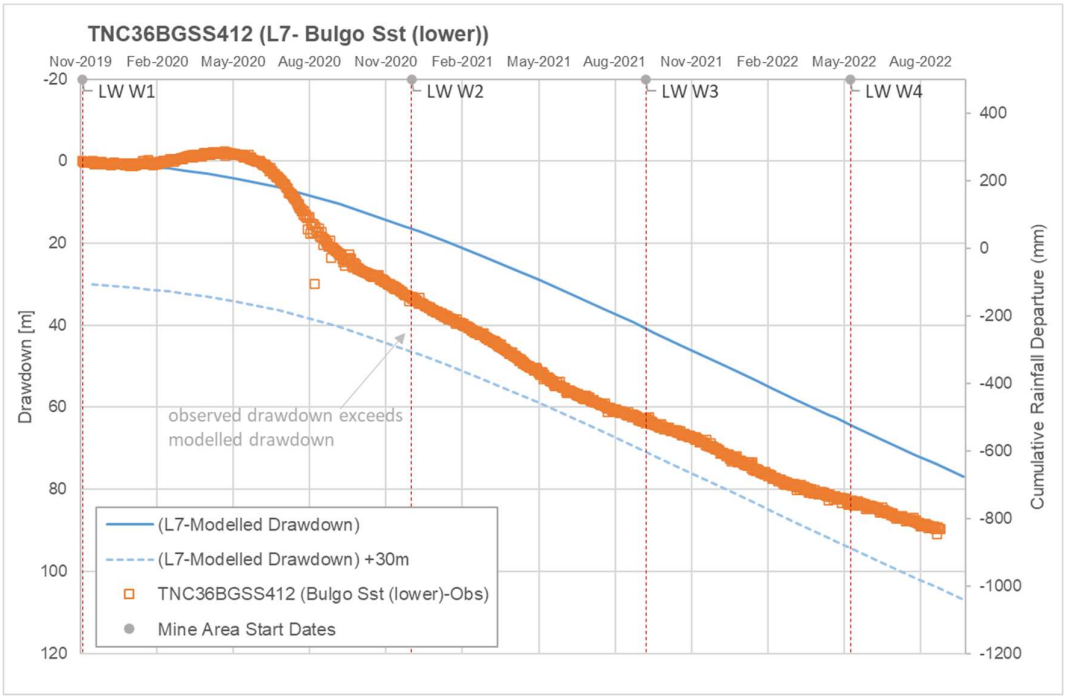


Figure 11 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-412.5m) with the +30m Threshold Modelled Drawdown

5 Groundwater Quality Trigger Review

5.1 Trigger Criteria

The approved trigger criteria for groundwater quality are summarised in **Table 10. Appendix B2** details the water quality impact assessment trigger criteria from the LW W3-W4 Extraction Plan (Tahmoor Coal, 2021) and the appropriate action plan to be enacted should a trigger exceedance in groundwater quality occur during mining of LW W3-W4.

The groundwater triggers for water quality parameters are detailed in the Groundwater Technical Report (SLR, 2021) and reproduced in **Table 11** below. These values were set for each bore. The water quality triggers were assigned as follows:

- pH - each bore was assigned a lower and upper pH trigger level based on the minimum and maximum pH value recorded in the available dataset minus/plus a pH unit;
- electrical conductivity (EC) - this trigger was established for each bore as the maximum observed EC during the pre-mining baseline and early mining period, plus ten percent of this maximum value; and
- for metals, either:
    - when the maximum metal concentration was recorded during the mining period, the trigger was set at the 95th percentile of the full historical data record (pre-mining and mining period); or
    - when the maximum metal concentration was recorded during the baseline period, the trigger level was defined as the maximum concentration plus ten percent of that value.

Further details on the methodology to develop the proposed groundwater quality trigger levels are provided in the Section 6.2.2 of the Groundwater Technical Report LWW3-W4 (SLR, 2021).

Table 10 Groundwater Quality TARP Criteria for Open Standpipes and Private Bores (Tahmoor Coal, 2021)

Significance Level	Criteria
	Open Standpipes
Level 1	No observable change in salinity, pH or metals outside of the baseline variability*.
Level 2	Short term increase (< 3 months) in salinity and/or metals, or change in pH outside of baseline variability*. The effect does not persist after a significant rainfall recharge event. AND/OR A similar trend or response has been noted at other monitored bores or private groundwater bores.
Level 3	Short term increase (< 3 months) in salinity and/or metals or change in pH outside of baseline variability*. The effect persists after a significant rainfall recharge event. AND/OR the change in water quality is determined not to be controlled by climatic or anthropogenic factors.
Level 4	Medium to long term increase in salinity and / or metals or a change in pH outside of baseline variability* with the effect persisting for greater than 3 months or after a significant rainfall recharge event. AND The reduction in water quality is determined not to be controlled by climatic or anthropogenic factors.

*the baseline variability was estimated using available data and refers to the proposed trigger levels (refer the section 6.2.2 and Table 6.2 of Groundwater Technical Report (SLR,2021)

Table 11 Triggers for Groundwater Quality TARPs

Bore	Trigger Level			Trigger Level Concentrations (mg/L) for Metals											
	EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
P12A	942	5.4	8.1	26.4	1.7	0.0110	0.0044	75.90	0.011	0.06	0.011	0.06	0.3	0.1	0.011
P12B	729	5.0	8.2	15.2	1.3	0.0044	0.0076	50.6	0.011	0.04	0.011	0.04	0.4	0.2	0.011
P12C	528	5.9	9.2	23.1	0.8	0.0034	0.0011	0.90	0.011	0.04	0.011	0.1	0.2	0.1	0.011
P13A	1232	5.2	9.4	69.3	1.5	0.0036	0.0014	0.91	0.011	0.04	0.011	0.03	0.4	0.3	0.011
P13B	1269	5.4	9.6	16.6	1.2	0.0020	0.0011	0.22	0.011	0.06	0.011	0.04	0.2	0.3	0.011
P13C	376	6.3	10.2	46.2	1.4	0.0011	0.0011	0.1	0.011	0.1	0.011	0.02	0.1	0.3	0.011
P14A	396	4.1	9.1	15.4	2.0	0.0022	0.0011	0.21	0.011	0.05	0.011	0.01	0.1	0.1	0.011
P14B	915	4.6	8.8	46.2	0.9	0.0022	0.0011	0.22	0.011	0.04	0.011	0.07	0.1	0.2	0.011
P14C	1881	5.3	9.4	19.8	1.5	0.0011	0.0011	0.04	0.011	0.1	0.011	0.11	0.2	0.4	0.011
P14D	1198	5.5	9.6	11.0	1.9	0.0011	0.0011	0.04	0.011	0.04	0.011	0.35	0.1	0.2	0.011
P15A*	4620	4.63	8.22	5.7	1.0	0.0011	0.0011	0.28	0.0011	0.055	0.011	0.13	2.9	**4.0**	0.011
P15B	3575	4.11	12.1	4.8	0.9	0.0011	0.0011	0.09	0.0011	0.055	0.011	0.14	1.3	1.2	0.011
P15C	2090	5.04	8.66	6.2	0.5	0.0011	0.0011	0.19	0.0011	0.033	0.011	0.20	0.5	0.5	0.011
P15D	1430	5.48	7.72	3.5	0.9	0.0011	0.0011	0.13	0.0011	0.055	0.011	0.19	0.2	0.4	0.011
P16A	1539	4.9	7.8	116.0	3.9	0.0011	0.0011	0.1	0.011	0.04	0.011	0.06	0.3	0.5	0.011
P16B	1180	5.9	9.6	41.8	1.8	0.0011	0.0011	0.03	0.011	0.05	0.011	0.04	0.2	0.1	0.011
P16C	1212	6.2	9.5	46.6	1.6	0.0011	0.0011	0.02	0.011	0.05	0.011	0.1	0.1	0.1	0.011
P17	2019	4.8	8.3	10.6	0.6	0.0011	0.0011	0.2	0.011	0.04	0.011	0.11	0.2	0.7	0.011
GW105546	448	3.5	7.2	37.4	1.6	0.0011	0.0011	0.1	0.011	0.03	0.011	0.011	0.05	0.04	0.011
GW105467	1041	3.7	6.8	77.0	3.9	0.094	0.0019	0.2	0.039	0.04	0.011	0.072	0.1	0.04	0.011

Bore	Trigger Level			Trigger Level Concentrations (mg/L) for Metals											
	EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
GW105228	1793	4.6	7.1	31.4	2.7	0.0011	0.0011	0.2	0.0181	0.04	0.011	0.026	0.23	0.15	0.011
GW072402	8151	4.7	7.5	63.8	0.9	0.0019	0.0011	0.2	0.011	0.03	0.011	0.157	0.3	0.5	0.011
GW115860*	948.2	4.9	7.25	16.5	0.9	0.0011	0.0011	0.02	0.011	0.022	0.011	0.253	0.51	0.3	0.011
GW104090	3861	5.3	7.5	50.6	1.4	0.0011	0.0011	0.05	0.022	0.033	0.011	1.650	0.1	1.2	0.011

'*" Revised trigger level for Ba at bore GW115860 following the groundwater trigger investigation presented in SLR (2022a) and revised trigger level for SR at bore P15A following the groundwater investigation in SLR (2022b)

5.2 Summary of Groundwater Quality Exceedances

The following section details the groundwater quality compliance at Tahmoor Coal in relation to the groundwater quality triggers. **Table 12** presents the occurrence of trigger level exceedances in groundwater quality (EC, pH and metals) over the reporting period as per the proposed trigger values (**Table 11**) and the TARP trigger criteria found respectively in **Appendix B.**

A brief analysis of the EC, pH and metal concentrations in relation to climate and mining activity during the reporting period is presented in **Sections 5.2.1** to **5.2.3** alongside trigger exceedances. Time series plots with the approved trigger values (EC, pH, metals) with exceedances only are shown in **Appendix D, Figures D1-D44.**

Table 12 Trigger Exceedances for pH, EC and Metal Concentrations over the Reporting Period (April 2022 – September 2022)

Bore	Month	Trigger Level Exceedance														
		EC	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
Shallow OSP																
P12A	Apr															
	May															
	Jun															
	Jul							L2			L2					
	Aug							L2			L2					
	Sep							L2			L2					
P12B	Apr			*L4							L2					
	May			*L4												
	Jun															
	Jul				L2											
	Aug				L2											
	Sep				L2											
P12C	Apr															
	May															
	Jun				L2	L2										
	Jul				L2	L2										
	Aug				L2	L2										
	Sep				L2	L2										
P14A	Apr															
	May								L2							
	Jun										L2					
	Jul															

Bore	Month	Trigger Level Exceedance														
		EC	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Aug						L2									
	Sep						L2									
P14B	Apr															
	May															
	Jun															
	Jul															
	Aug															
	Sep												L2	L2	L2	
P14C	Apr															
	May								L2							
	Jun															
	Jul															
	Aug						L2									
	Sep															
P14D	Apr															
	May								L2							
	Jun															
	Jul															
	Aug				L2		L2									
	Sep						L2									
P15A	Apr	L2													*L4	
	May	L2													*L4	
	Jun					L2							L2		L2	
	Jul					L2							L2		L2	
	Aug												L2		L2	
	Sep	L2											L2		L2	
P15B	Apr	L2							L2						L2	
	May	L2							L2							
	Jun	L2													L2	
	Jul														L2	
	Aug														L2	
	Sep	L2					L2									
P15C	Apr															
	May				L2											

Bore	Month	Trigger Level Exceedance														
		EC	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Jun	L2			L2										L2	
	Jul														L2	
	Aug											L2			L2	
	Sep	L2									L2				L2	
P15D	Apr				L2											
	May				L2											
	Jun	L2			L2	L2										
	Jul				L2											
	Aug				L2											
	Sep				L2											
P16A	Apr															
	May								L2							
	Jun			L2												
	Jul															
	Aug						L2									
	Sep															
P16B	Apr															
	May								L2				L2			
	Jun															
	Jul															
	Aug															
	Sep															
P16C	Apr															
	May								L2							
	Jun								L2		L2					
	Jul						L2		L2							
	Aug						L2		L2							
	Sep						L2		L2		L2					
Private Bores																
GW104090	Apr															
	Jul															
GW105467	Apr															
	Jul															
GW105228	Apr															

Bore	Month	Trigger Level Exceedance														
		EC	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Jul												L2			
GW072402	Apr															
	Jul															
GW115860	Apr	L2														
	Jul	L2													L2	
GW105546	Apr															
	Jul															

TARP Level 1 TARP Level 2 TARP Level 3 Potential TARP Level 4 no site access

LX: maximum trigger level exceedances recorded

"*" remains a potential Level 4 TARP trigger

5.2.1 Electrical Conductivity (EC) and pH

During this reporting period, EC and pH recorded at the following groundwater monitoring bores were observed above the TARP Level 2 trigger level:

- EC at P15A, B, C and D – TARP Level 2 (**Appendix D, Figure D1-D4**);
- EC at GW115860 – TARP Level 2 (**Appendix D, Figure D5**);
- pH at P12B – potential TARP Level 4 reducing to TARP Level 1 June 2022 (**Appendix D, Figure D6**); and
- pH at P16A (**Appendix D, Figure D7**) – TARP Level 2.

The increase in EC and pH at the groundwater monitoring bores presented above is not a result of a mining effect in the Western Domain (SLR, 2022d). As of September 2022, there were no groundwater quality trigger exceedances for EC and pH.

All others EC and pH measurements from the Tahmoor Coal standpipes and private bores were observed within the Level 1 TARP.

5.2.2 Metals

During this reporting period, metal concentrations for all groundwater monitoring bores, and three private bores were observed above the trigger level as presented in **Table 12** and **Appendix D, Figure D8-D43**. The increases in metal concentrations observed across the Western Domain bores are short-term increases (less than three months) and likely due to natural fluctuations in groundwater quality rather than a mining related effect (SLR, 2022). Further discussion on increases in metal concentrations at specific locations is presented in **Section 5.2.3.**

5.2.3 Discussion of Groundwater Quality Exceedances

Table 13 presents a discussion of trigger exceedances at each groundwater monitoring and private bores observed during the reporting period. Metal concentrations measurements above the trigger level for a single month are listed as TARP Level 2 in **Table 12** and briefly mentioned in **Table 13** although not discussed in details below as natural fluctuations in groundwater quality is likely the reason for the short-term (1 month) increase.

Table 13 Groundwater Quality Trigger Exceedances - Discussion

Site	Discussion
P12A	TARP Level 2 metals for lead (**Figure D22**) and aluminium (**Figure D30**) from July to September 2022. The increase in metal concentrations (Pb and Al) in July 2022 is likely due to wet conditions (i.e. flooding) rather than mining. A decreasing trend was observed since August 2022 for both metals justifying the TARP Level 2. Additional monitoring required to confirm trends.
P12B	Potential TARP Level 4 pH upper exceedance observed in May 2022 but is reduced to a TARP Level 1 in June 2022. The higher pH at bore P12B is likely due to an issue with the integrity of the bore, with the recent flooding flushing cement/grout in the bore (**Figure D6**). The potential TARP Level 4 put in place since April 2022 at P12B reduces to a TARP Level 1 in June 2022 as the source of the pH increase is not related to mining but to grout contamination. The consequences of this effect (unlikely to be mining-related) were assessed as minor in the latest six-monthly review (SLR, 2022). Since July 2022 pH at P12B reduced within baseline level and was observed within a TARP Level 1. The pH at nearby monitoring bores P12A and P12C remain within a TARP Level 1 during the reporting period. A greater volume of water was purged from bore P12B in the May round of monitoring to remove groundwater potentially contaminated with grout before sampling. Additional purging will be conducted in the next review period prior sampling. TARP Level 2 metals (iron) observed between July and September 2022 (**Figure D8**). This exceedance for dissolved metal concentration is a short-term increase (three months) and likely due to above average rainfalls and bore construction material. In fact, the increase in iron is likely due to iron staining on the steel casing rather than mining related effect. Further monitoring is required to confirm Fe trends.
P12C	TARP Level 2 metals (iron and manganese) exceedance observed since June 2022 (**Figure D9-D13**). A decreasing trend in manganese was observed from August 2022 hence a TARP Level 2. The increase in dissolved iron is likely caused by the dissolution of iron present on the steel casing rather than mining related effect. Additional monitoring required to confirm trends.
P14A	Single measurement in zinc concentration observed above the trigger level in May 2022 **(Figure D23**). Single measurement in aluminium concentration observed above the trigger level in June 2022. **(Figure D32**) Two consecutive measurements in copper concentration observed above the trigger levels in August and September 2022 (**Figure D16**). These higher dissolved metals concentrations are short-term increases (less than three months) and no mining effect is identified.
P14B	Single measurement in lithium, barium, strontium concentrations observed above the trigger levels in September 2022 (**Figure D37, D40**). These higher dissolved metal concentrations are short-term increases (less than three months) and no mining effect is identified.

Site	Discussion
P14C	Single measurement in zinc and copper concentrations observed above the trigger levels in May 2022 and August 2022 respectively (**Figure D24, D17**). These exceedances for dissolved metals concentrations are short-term increases (less than three months) and no mining effect is identified.
P14D	Single measurement in zinc and iron concentrations observed above the trigger levels in May 2022 and August 2022 respectively (**Figure D25, D10**). Two consecutive measurements in copper concentrations observed above the trigger level in August and September 2022 (**Figure D18**). These higher dissolved metals concentrations are short-term increases (less than three months) and no mining effect is identified.
P15A	Potential TARP Level 4 metals (strontium) exceedance observed in April and May 2022, but it is reduced to a TARP Level 2 in June 2022. Concentration of strontium increased by approximately 9 mg/L over the reporting period to 11.7 mg/L in June 2022 but has decreased and is stable at 8.1 mg/L since July 2022. At P15D, strontium concentration has fluctuated between 0.1 and 0.3 mg/L, which suggests that the deeper strata have not been impacted by the strontium observed in the shallow groundwater (P15A). The high strontium concentration at P15A remain localised and unlikely to be a mining related impact though mining was not excluded as a potential cause as discussed in SLR (2022c). Six months following the potential TARP Level 4 for strontium at P15A, no significant increases were observed at adjacent site P14 and deeper bores at site P15 (concentration of strontium increased by approximately 0.2 mg/L at P15B and P15C in the previous reporting period). Hence the trigger level at P15A for Sr was revised to 4 mg/L in June 2022 (Figure D-20), as the trigger was assessed to be too conservative for this site (SLR 2022c). The concentration of strontium was reported as a TARP Level 2 from June 2022. Strontium concentrations at site P15B and P15C have started to increase above the trigger level in July 2022 however the overall increase to September 2022 is within the range of 0.2 mg/L, considerably less than previously observed at P15A. Strontium concentration at P14 sites and nearby private bores should be closely monitored in the next review period. TARP Level 2 metals (lithium) exceedances observed since June 2022 (more than 3 months) however a decline in lithium concentration was observed in September 2022 hence a TARP Level 2 applies (**Figure D38**). Two consecutive measurements in manganese concentration observed above the trigger levels in June and July 2022 (**Figure D4**). Reduction to a TARP Level 1 for EC due to a decrease in EC in July 2022 following rainfall events (**Figure D1**). As of September 2022, TARP Level 2 applies following an increase in EC to 5,250 µS/cm.
P15B	TARP Level 2 EC reduces to a TARP Level 1 in July 2022 following a steady decline which could be associated to rainfall recharge (**Figure D2**). As of September 2022, EC increased above the trigger level hence a TARP Level 2 applies. Mining effect is unlikely. Two consecutive measurements in zinc concentration observed above the trigger levels in April and May 2022 (**Figure D26**). These higher dissolved metal concentrations are short-term increase (less than three months) and no mining effect is identified. TARP Level 2 metals (strontium) exceedance observed in April and between June and August 2022 (**Figure D42**). As of September 2022, strontium concentrations decreased below 0.1 mg/L within a TARP Level 1. It is recommended to continue closely monitoring strontium concentrations, with respect to TARP Level 2 in place for strontium for site P15A.

Site	Discussion
P15C	TARP Level 2 EC exceedance observed in June 2022 (**Figure D3**). EC at P15C decreased in May 2022 before sharply increasing to a maximum of 3,595 µS/cm in June 2022. A decline in EC was observed between July and August 2022 (TARP L1) before increasing to 2,400 µS/cm in September 2022 (TARP L2). Two consecutive measurements in iron concentration observed above the trigger levels in May and June 2022 (**Figure D11**). These are a short-term increase (less than three months) and no mining effect is identified. Single measurement in aluminium and arsenic concentrations observed above the trigger levels in September 2022 and August 2022 respectively. TARP Level 2 metals (strontium) exceedance observed between June and September although a declining trend was observed from August 2022 (**Figure D43**). Over the reporting period the overall increase in strontium concentration at P15C is approximately 0.35 mg/L compared to 9 mg/L at P15A in June 2022. It is recommended to continue closely monitoring strontium concentrations, with respect to a TARP Level 2 in place for strontium for site P15A.
P15D	Single measurement in EC observed above the trigger levels in June 2022 resulting in a TARP Level 2 (**Figure D4**). Large fluctuations in iron concentrations were observed and above the trigger level for most of the reporting period (**Figure D12**). Maximum iron concentration peaked at 27mg/L in June 2022, declined in August and increased slightly in September 2022 to 17 mg/L. Recent increase in iron may be due to iron precipitation within the bore. Insufficient baseline data is available to assess potential mining influences. Continued monitoring is recommended to assess if concentration stabilise post-mining. Single measurement in manganese concentrations observed above the trigger levels in June 2022 (**Figure D15**). This is a short-term increase (less than three months) and no mining effect is identified.
P16A	Single measurement in pH observed above the trigger levels in June 2022 (Figure D7). Single measurement in copper and zinc concentrations observed above the trigger levels in August and May 2022 (**Figure D20**). These exceedances for pH and dissolved metal concentration are short-term increases (less than three months) and no mining effect is identified.
P16B	Single measurement in zinc and lithium concentrations observed above the trigger levels in May 2022. These exceedances for dissolved metals concentrations are short-term increases (less than three months) and no mining effect is identified.
P16C	TARP Level 2 metals (zinc) exceedance observed from May to September 2022 (**Figure D29**). The source of the recent increase in zinc concentration is unknown but likely due to surface runoff flowing into the bore however a mining effect is not excluded. Purging of the bore to remove the potential surface water run-off has been recommended. Additional monitoring will be conducted to confirm trends. Zinc concentrations at the nearby shallow piezometers P16A is within a TARP Level 1. Three consecutive measurements in copper concentrations observed from June 2022 (**Figure D21**). Recent decline in copper concentration observed in September 2022 hence TARP Level 2 applies. Single measurements in aluminium concentrations observed above the trigger levels in June and September 2022 (**Figure D34**). Except for the exceedances in zinc which required further monitoring, exceedances at P16C for other dissolved metals concentrations are a short-term increase (less than three months) and no mining effect is identified.

Site	Discussion
GW105228	Recent increases in lithium concentrations above the trigger level was observed since April 2022. Further monitoring is required to confirmed trends however the lack of baseline data is likely to make the trigger level too conservative (**Figure D36**).
GW115860	EC observed above the trigger level since July 2021. Given the low salinity of groundwater at GW115860, and the small incremental change in that salinity in relation to the beneficial use classifications (SLR, 2022) a TARP Level 2 remains. In addition, EC has declined since April 2022 to 1,029 µS/cm (trigger level set at 948.2 µS/cm) (**Figure D5**). No mining effect identified. Single measurement in strontium concentration observed marginally above the trigger levels in September 2022 (**Figure D39**). Further monitoring to be conducted in the area in relation to the higher strontium concentration observed in P15A.

6 Predicted and Observed Groundwater Depressurisation

The following section provides a summary of comparison between the modelled and observed groundwater levels using the groundwater model SLR (2021) results (i.e. referred in this report as the "groundwater model") presented in the Groundwater Technical Report: Extraction Plan for LW W3-W4 (SLR, 2021) and latest available observed groundwater data (up to March 2022).

6.1 Summary

The drawdowns observed during LW W1, LW W2 and LW W3 show a clear relationship with depth below surface (or height above the mined seam), with drawdowns greatest at depth, and being 8-15 m in the lower or mid-Hawkesbury Sandstone, and less in the shallower horizons (typically 0.5-1 m). The same trend was observed for the subsequent recovery post LW W1 and LW2, with greatest recovery in the deep piezometers (6 m) and being 1-3.5 m in the lower or mid-Hawkesbury Sandstone. As of September 2022, groundwater recovery is complete in the shallower horizons except at some site (P16A) where a potential partial recovery was observed (approximately 0.5-0.8 m below baseline).

The hydrographs for P12, P14, P15, P16, and TNC036 monitoring sites were reviewed in light of the TARP exceedances (**Section 4.3**) at these monitoring sites (**Figure 12** to **Figure 16**). The modelled water level for the piezometer A at each site is shown. The key findings over the reporting period are:

- Piezometers at P12 and P16 are spaced, in a vertical sense, at a smaller interval than the model layers, so that it is not possible nor practical for the model to simulate or replicate water levels at all piezometers. Also, temporal discretisation does not allow all short-term variability, especially to rainfall events, to be simulated.
- The groundwater model does not simulate groundwater abstraction at private bores because the extractions are not metered by WaterNSW nor are there estimated extraction rates available.
- The historical period of the model ends in November 2020, which means that all predictions after December 2020 are based on average rainfall. Hence, the model does not capture the response to the rainfall recharge observed in 2021 and more recently in July 2022 (i.e. flood events).
- To the north-west area of the Western Domain, the groundwater levels in upper (P12A) and mid (P12B) Hawkesbury Sandstone aquifers continue to be well replicated by the model (within +/- 1-2m of observed). In the deeper start at P12C, the recovery in groundwater level (model layer 2) continues to be a good approximation of the recovery in P12C (i.e. same was true for the drawdown in 2020). The timing of recovery is well replicated, while its magnitude is slightly underestimated by the model (within 3 m of observed) over the reporting period. No mining effect due to LW W4 is simulated at P12C (model layer 2) which is also reflected in the observed groundwater levels.
- North to the Western Domain, it was previously reported that the modelled drawdown was slightly overestimated at sites P14 and P15 (during LW W2 and early parts of LW W3). From April 2022, in all piezometers at site P14, modelled groundwater levels in model layers 1 and 2 are within 1m of the observed groundwater levels.

- During 2022, the modelled drawdown at P15 is overestimated by approximately 3-4m in model layer 2 however modelled groundwater levels in model layer 1 are within 1m of observed. The modelled groundwater levels in model layers 1 and 2 remain a good approximation of observed groundwater levels for all piezometers at site P15. We note that piezometers P15A, B, C and D all sit within the same model layer 2. The presence of multiple piezometers within a single layer makes it challenging (if not impossible) to replicate or match all observations. Similar observations apply to site P14 in terms of model layering and model performance.
- At P16B and P16C, sitting within the model in Layer 1 and Layer 2 respectively, the model replicates the stabilisation of water level throughout the reporting period. Modelled groundwater levels in model layer 2 replicates well the observed groundwater levels in P16C within +/-2m. Further monitoring data is required at P16B to compare to modelled estimates however it is within 3m of observed groundwater levels at the start of the reporting period which is acceptable as the modelled trends is generally well matched.
- At TNC036 (Figure 16) there is a small underestimation in the model to replicate the observed recovery during 2022 but modelled groundwater levels are within 5-10 m observed as of August 2022 (i.e. similar as modelled prior to LW W1). The HBSS-65m and HBSS-97 m piezometers are assigned the same model layer, which makes difficult to match the difference in groundwater head between the two shallow piezometers, but previously the model gives a reasonable estimate in the rate and magnitude of drawdown at this location.
- The observed stabilisation and recovery in water levels in BGSS-169 m are well replicated by the model, being within 1 m of observed prior the start of LW W4. This suggests that the height and mode of subsidence fracturing in this area is well represented in the model. The modelled underestimates the groundwater recovery in the upper model layers due to the July rainfall recharge not being captured in the model. This explains why the modelled groundwater levels diverge from observed groundwater levels from July 2021 in TNC36-169m. The model performance at this site remains acceptable.

2.3 Groundwater Monitoring Network Status Update

All groundwater level monitoring bores and vibrating wire piezometers (VWPs) in the vicinity of the Western Domain, and their available completion details, are listed in Table 3 below.

Updates on the status of the groundwater monitoring network and operations from 1 October 2022 to 31 December 2022 are as follows:

- No groundwater levels were available at P16B in October 2022 and at GW72402 during the reporting period due to blockage of the bores.
- No groundwater levels nor groundwater quality sampling was undertaken in October 2022 at GW105546 and GW105467.
- Manual measurements of groundwater levels were taken at private bores GW115860 and GW105228 in October 2022.

Table 3 Groundwater Monitoring Network

Monitoring bore or VWP ID	Owner	Easting[1] (GDA94)	Northing[1] (GDA94)	Bore screen or VWP sensor depth (mBGL)	Status
Shallow Groundwater Levels (monitoring bores/standpipe piezometers)					
P12A	Tahmoor Coal	277771	6216561	14.6 - 19.6	EX
P12B	Tahmoor Coal	277776	6216560	31.6 - 34.6	EX
P12C	Tahmoor Coal	277781	6216559	61.6 - 64.6	EX
P13A	Tahmoor Coal	278180	6216550	19.5 - 22.5	D
P13B	Tahmoor Coal	278175	6216554	33.5 - 37.5	D
P13C	Tahmoor Coal	278170	6216558	64.5 - 67.5	D
P14A	Tahmoor Coal	278398	6216536	4.5 - 6.0	EX
P14B	Tahmoor Coal	278393	6216534	13.6 - 16.6	EX
P14C	Tahmoor Coal	278397	6216542	28.6 - 31.6	EX
P14D	Tahmoor Coal	278391	6216540	58.6 - 61.6	EX
P15A	Tahmoor Coal	278550	6216426	16.1-17.6	EX
P15B	Tahmoor Coal	278545	6216423	18.6-20.1	EX
P15C	Tahmoor Coal	278556	6216427	30.5-32.0	EX
P15D	Tahmoor Coal	278561	6216431	66 (bore depth)	EX
P16A	Tahmoor Coal	277351	6215147	24.5 - 27.5	EX
P16B	Tahmoor Coal	277350	6215140	42.5 - 45.5	EX
P16C	Tahmoor Coal	277347	6215135	72.5 - 75.5	EX
P17	Tahmoor Coal	277941	6217153	19.6 - 22.6	D
GW072402	Private	277708	6216852	8.2 - 72.0	EX
GW105228	Private	278490	6216858	23.0 - 63.0	EX
GW105467	Private	277253	6215247	73.0 - 79.0	EX
GW105546	Private	277018	6215732	48.0 - 56.0	EX

Monitoring bore or VWP ID	Owner	Easting[1] (GDA94)	Northing[1] (GDA94)	Bore screen or VWP sensor depth (mBGL)	Status
GW115860	Private	278543	6216760	20, 48 and 55	EX
Shallow Groundwater Pressures (VWPs < 200 mBGL)					
P40(A-D)	Tahmoor Coal	277620.6	6216160.1	HBSS-39	EX
				HBSS-44	EX
				HBSS-49	EX
				HBSS-85	EX
P41(A-F)	Tahmoor Coal	279167	6216068	WMFM-53 (vertical)	EX
				HBSS-71 (vertical)	EX
				HBSS-88 (vertical)	EX
				HBSS-106 (vertical)	EX
				HBSS-123 (vertical)	EX
				140 (vertical)	EX
TNC036	Tahmoor Coal	277269	6215382	HBSS-65	EX
				HBSS-97	EX
				BGSS-169	EX
TNC040	Tahmoor Coal	279004	6214521	WMFM-27	EX
				HBSS-65	EX
				HBSS-111	F
TNC043	Tahmoor Coal	280077	6212671	HBSS-65	L
				HBSS-111.5	L
WD01	Tahmoor Coal	278099	6214828	HBSS-70	EX
				HBSS-90	EX
				HBSS-190	F
WD02	Tahmoor Coal	278246	6215178	Drilling in Feb 23	TBC
Deep Groundwater Pressures (VWPs > 200 mBGL)					
TNC036	Tahmoor Coal	277269	6215382	BGSS-214	EX
				BGSS-298.5	F
				BGSS-412.5	EX
				BUSM-463.5	F
TNC040	Tahmoor Coal	279004	6214521	HBSS-225	F
				BHCS-252	F
				BGSS-352	F
				SCSS-482	F
				BUCO-501.9	F
TNC043	Tahmoor Coal	280077	6212671	HBSS-213	D

Monitoring bore or VWP ID	Owner	Easting[1] (GDA94)	Northing[1] (GDA94)	Bore screen or VWP sensor depth (mBGL)	Status
				BGSS-240	D
				BGSS-332.6	D
				BGSS-405.2	D
				BUCO-476.3	D
WD01	Tahmoor Coal	278099	6214828	210-HBSS	EX
				230-Newport Fm	F
				300-BGSS	F
				330-BGSS	F
				350-BGSS	F
WD02	Tahmoor Coal	278246	6215178	Drilling in Feb 23	TBC

1 Coordinates in metres (GDA 1994 MGA Zone 56).

WMFM – Wianamatta Group
BGSS – Bulgo Sandstone
HBSS – Hawkesbury Sandstone
SCSS – Scarborough Sandstone
BHCS – Bald Hill Claystone
BUCO – Bulli Coal Seam

VWP – vibrating wire piezometer
EX – Existing
P – Proposed monitoring bore
L – Loss of logger (stolen), manual readings still taken.
"-" - Not drilled yet

mBGL – metres below ground level
F - Failed
D – Decommissioned

3 Groundwater Level Trends

During the reporting period, groundwater level trends were observed across the shallow open standpipes (P12, P14-P16), shallow vibrating wire piezometers (P40, P41 and TNC036/40) and the deep vibrating wire piezometers (TNC036). The cause and effect of key groundwater trends observed at these sites, over the reporting period, are briefly discussed in this section.

Groundwater level trends which represented TARP Level exceedances are discussed in Section 4.

Hydrographs for groundwater levels at P12, P14, P15, P16, P40, P41, TNC036, TNC40, P9, P11 and private bores are presented in Appendix A.

Some of the key groundwater trends over the reporting period include:

- Site P12: groundwater levels at P12A and P12B remained relatively stable at 170.4 mAHD and 171 mAHD respectively during the review period (Appendix A, Figure A-1). At P12C, the observed trend of previous months continued with groundwater levels increasing by approximately 1.5 m over the reporting period to 178.4 mAHD in December 2022. As of December 2022, groundwater levels at sites P12 are within baseline level (P12A), 0.5m above baseline level (P12B) and have mostly recovered in P12C as groundwater levels are observed within baseline level. The recovery period at P12C follows a maximum groundwater depressurisation of 11m in February 2021 caused by mining of LW W1-W2.

- Site P14: groundwater levels at P14A decreased by approximately 1.1 m over the reporting period, to 169.9 mAHD in December 2022, which is likely attributable to lower rainfall recharge in November and December 2022 (Figure A-2). As of December 2022, groundwater levels at P14A are observed 1.2m above baseline levels. Overall, groundwater levels fluctuated within 0.5 m, and were observed above the creek bed elevation at P14B, P14C and P14D which suggest strengthening of baseflow conditions along Stonequarry Creek over the reporting period (Figure A-2).
- Site P15: overall, groundwater levels fluctuated within 0.5-1 m over the reporting period, and decreased in late November 2022, at P15A, P15B, P15C and P15D, which aligned with observed CRD trends (Figure A-3). Similar to the observations for the P14 sites, groundwater levels at P15 sites (P15A, B, C and D) remained above the creek bed elevation favouring baseflow conditions along Stonequarry Creek.
- Site P16: groundwater levels at P16A were consistently observed at approximately 210.5 mAHD over the reporting period (Figure A-4). As observed in previous years, there are no responses observed in groundwater levels to rainfall at P16A during the reporting period with groundwater levels being approximately 1m below baseline level. A localised long-term impact on groundwater levels is to be considered at P16A. At P16B, the available groundwater levels in November and December 2022 indicated that groundwater conditions have remained stable with groundwater levels observed at a similar elevation as in May 2022 prior the commencement of LW W4 (Figure A-4). At P16C, groundwater levels stabilised at approximately 197.4 mAHD following successive periods of recovery in 2021-2022. Groundwater levels in the mid and lower Hawkesbury Sandstone aquifers (P16B and P16C respectively) are observed approximately 1.5m and 3m below baseline levels. Additional groundwater monitoring data will inform whether post mining conditions (i.e., following valley closure) will allow groundwater to completely recover at sites P16.
- Site P40: groundwater levels at P40A and P40B fluctuated by 0.5m during the review period (Figure A-5). To note at P40B a groundwater decline of approximately 1.2m in late November 2022 likely due to lower rainfalls. A similar groundwater decline was observed in June 2022 likely associated with drier condition this month. At P40C observed groundwater levels were remain stable at 178.7 mAHD. In the lower Hawkesbury Sandstone aquifer at P40D, groundwater levels continued to increase and for the first time in November 2022 increased above the Cedar Creek bed elevation. The increase in groundwater levels at P40D between October and December 2022 was observed at a lower rate than previously measured in early and mid-2022. During the review period, groundwater levels at P40A, B, C and D remained above the surveyed creek bed elevation at Cedar Creek which favour baseflow condition (i.e. gaining condition) in the vicinity of surface monitoring site CB.
- Site P41: Groundwater levels at P41A were observed at almost the same elevation as the VWP (189.2 mAHD) which suggests near unsaturated condition at this elevation. In P41B, water levels are stable at 173.2 mAHD throughout the reporting period at the same VWP elevation which also suggest unsaturated condition. At P41C, a gradual increase in groundwater levels was observed since October 2022 and from early November 2022 started to stabilise at 163.3mAHD. The P41C piezometer is located at a similar elevation to the surveyed elevation of Stonequarry Creek (SC surface water monitoring site) with groundwater levels at approximately 1m above the Stonequarry Creek bed elevation (labelled “SC base elevation” on Figure A-6). As presented in SLR (2022), review and analysis of groundwater level exceedances at site P41 is focused on VWPs P41A, P41B, P41C and P41D (i.e. the primary assessment sites). Groundwater levels at P41D, P41E and P41F are likely influenced by faulty sensors but will continue to be reviewed in future reports. P41E and P41F are not considered in the groundwater level trigger assessment and P41D has been removed from the TARP as groundwater trends continue to appear erroneous (SLR, 2022).

- TNC36: Groundwater levels in HBSS-65m and HBSS-97m increased by 1.1m and 2m during the reporting period (Figure A-7). In the Bulgo Sandstone aquifer, groundwater levels in the sensor BGSS-169m recorded an increase in groundwater levels of 8.5m and are observed at 181.8 mAHD in December 2022. Groundwater levels in the lower Bulgo Sandstone aquifer started to recover in late September 2022 and have shown a significant recovery during the review period of approximately 9m to 93.2 mAHD. In the deepest piezometer BGSS-463m, a groundwater levels continued to decrease with an observed groundwater depressurisation of 5.5m during the reporting period.
- TNC40: The two remaining sensors at TNC040 WHFM-27m and HBSS-65m recorded an increase in groundwater level of 0.3m and 0.7m respectively during the review period (Figure A-8). No delayed groundwater depressurisation due to mining of LW W4 is identified at TNC040.
- Private Bores: Groundwater levels in the private bores (i.e. where available) generally responded to rainfall events in the range of 0.5m at GW104090 between October and December 2022 (Figure A-10). To the north of the LW W3-W4 and as of October 2022 groundwater levels in GW115860 and GW105228 were observed at a stable elevation compared to water levels in April and July 2022 (Figure A-11). To note that the manual measurement taken in July 2022 (171.4 mAHD) at GW105228 is likely a measurement error. For the private bores, no effects on groundwater levels due to post-mining operations at LW W4 during the review period is identified. Additional groundwater monitoring data is required at GW72402 to confirm groundwater trends post LW W4.
- P9 and P11 (Tahmoor North Domain): The latest groundwater available for P9A, P9B and P11 are dated 30 November 2022. Groundwater levels at P9A and P9B remained stable over the reporting period fluctuating by 0.5m following rainfall events (Figure A-12). Groundwater levels at P9A-24m were observed above the creek bed elevation during the reporting period which suggests strengthening of gaining conditions along Redbank Creek in the vicinity of P9. At P9B, following a possible groundwater depressurisation in early 2021 during mining of LW W1-W2, groundwater levels have shown an increasing trend since late 2021. However as of November 2022, groundwater levels at P9-40m remain approximately 3m below baseline level. Hence since early 2021, a downward vertical head gradient between P9A and P9B (i.e. groundwater head separation of 3m) is established which suggests a possible medium-long term impact at P9B due to historic mining (i.e. LW 32) and LW W1-W2. Further monitoring data is required at P9A-B to assess post-mining groundwater conditions. Groundwater levels in P11 (i.e. located 700 m south-east of LW W4) have also remained stable with groundwater levels being close to surface (1m below ground level) which explain the subdued response to rainfall 2021-22 compared to March 2020 (Figure A-13). No delayed mining effect on groundwater levels due to mining of LW W4 is observed at P9A-B and P11 during the review period.

4 Groundwater Level Trigger Review

4.1 Summary of Groundwater Level Exceedances

Approved Trigger Action Response Plan (TARP) levels are defined for each site (Tahmoor Coal, 2021) and presented in Appendix B. Groundwater hydrographs for each monitoring site where the groundwater trigger level is plotted is also presented in Appendix B (Figure B1-B28).

An assessment of groundwater levels at each of the monitored bore and VWP locations against the TARP trigger levels has been undertaken. During the reporting period, the following exceedances were observed:

- TARP Level 2
  - Shallow bores: P16B across the whole reporting period. Bore P12C during the review period likely to be reduced to a TARP level 1 in the next review period.
  - A reduction form TARP Level 3 to Level 2 at P16C in October 2022 onwards.

- Shallow VWPs: TNC036 (HBSS-97m) and TNC036 (BGSS-169m) across the whole reporting period.
- Deep VWPs: TNC036 (BGSS-214m) until November 2022, then reduced to a TARP Level 1 in December 2022. TNC036 (BGSS-412.5m) across the whole reporting period.

No TARP Level 3 and 4 for groundwater levels are identified during the review period.

All other groundwater monitoring sites remained within TARP Level 1 across the quarterly reporting period. A summary of the groundwater level trigger exceedances during the reporting period, in comparison to previous months, at the monitored bores are presented in Table 4 and Table 5 (note private bores were only scheduled for sampling in October 2022).

Hydrographs for groundwater levels with approved groundwater trigger levels at P12, P14, P15, P16, P40, P41, GW72402, GW104090, GW115860, GW105228, TNC036, TNC040 are presented in Appendix B.

Table 4 Groundwater Level Trigger Exceedances - Shallow-Open Standpipes (Shallow OSP), Shallow and Deep Vibrating Wire Piezometers (VWPs)

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances																		Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
Shallow OSP		TARP (Tahmoor Coal, 2021)																					
P12A	170.1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				0.5	170.7	-
P12B	170.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				0.8	171.3	-
P12C	176.3	L3	L3	L3	L3	L3	L3	L3	L3	L2	L2	L2	L2	L2	L2	L2	L2				11.0	175.6	-
P14A	168.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				0.2	171.5	-
P14B	166.7	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1	L1	L1	L1	L1	L1				1.4	168.4	-
P14C	166.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				1.7	168.5	-
P14D	164.8	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	L1	L1	L1	L1	L1				1.8	167.4	
P15A	164.7^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				-	169.2	-
P15B	165.2^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				-	168.8	-
P15C	164.9^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	L1	L1	L1	L1				-	168.8	-
P15D	165.4^	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	#	#	L1	L1	L1	L1				#	169.1	-
P16A	211.3	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				1.1	210.7	0.7
P16B	206.4	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	#	#	#	L2	L2				5.7	205	0.7
P16C	199.6	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L3	L2	L2	L2				13.8	191.7	2.2

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances																		Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
Shallow VWPs (<200m)		TARP (Tahmoor Coal, 2021)																					
P41A	194	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1	L1	L1	L1				-	190	-
P41B	172.9	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1	L1	L1	L1				-	173	-
P41C	161.0	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1	L1	L1	L1				-	161.7	-
P41D	160.0	#	#	#	#	#	#	#	#	L1	L1	L1	L1	L1	L1	L1	L1				-	164.4	-
TNC036 - HBSS-65	209.5	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				6.7	209.8	-
TNC036 - HBSS-97	196.3	L4	L4	L4	L4	L4	L4	L3	L3	L3	L3	L2	L2	L2	L2	L2	L2				24.0	185.5	5.0
TNC036 - BGSS-169	197.5	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2				47.6	164.5	15.7
TNC040-WNFM-27	208.3	L1	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				-	209.6	-
TNC040 - HBSS-65	187.1	L1	#	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1				-	189	-
Deep VWPs (>200m)		TARP (Tahmoor Coal, 2021)																					

Bore	Groundwater Level prior to LW W1 (m AHD) (pre-mining)	Trigger Level Exceedances																		Maximum drawdown Nov 2020 - Aug 2021	GWL Prior to LW W4 (15-MAY-22) (m AHD)	Drawdown as of Sep 2022 compared to pre-mining GWL (m)
		Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23			
TNC036 - BGSS-214	176.5	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L1				81.4	82.9	83.4
TNC036 - BGSS-412.5	96.8	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L2				49.7	13.9	94

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

LX: maximum trigger level exceedances recorded "-": no observed drawdown "#": groundwater levels not available

^ baseline groundwater level at P15 (A,B,C,D) is the groundwater level recorded in June 2021.

"" not assessed due to disruption in groundwater levels during drilling and packer testing at P15D.*

Table 5 Groundwater Level Trigger Exceedances - Private Bores

Bore	Baseline Maximum Ground water Depth (m bgl)	Baseline Groundwater Yield (L/s)	Trigger Level Exceedances						Future Reviews			Groundwater Depths as of Dec 2022 (m bgl)	Ground water Yield as of Dec 2022 (L/s)
			Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23		
GW104090	39.0	#	blocked	L1	L1	L1	L1	L1				20.32	#
GW105467	32.0	0.5	*	*	*	*	*	*				#	#
GW105228	23.0	1.8	L1	L1	L1	L1	L1	L1				10.6	#
GW072402	11.76	#	blocked	blocked	blocked	blocked	blocked	blocked				#	#
GW115860	#	#	L1	L1	L1	L1	L1	L1				10.6	#
GW105546	31.9	1.6	*	*	*	*	*	*				#	#

LX: maximum trigger level exceedances recorded *#: not applicable* ** no site access* *"-"standing water level not available (access is not available inside the bore)*
m bgl – metres below ground level

TARP Level 1 TARP Level 2 TARP Level 3 TARP Level 4

4.2 Discussion of Groundwater Level Exceedances

During the reporting period, groundwater level triggers were exceeded at P12, P16 and TNC036. Analysis of the observed exceedances, and a high-level outline of the potential influencing factors for the exceedances, are briefly discussed in Table 6.

Table 6 Groundwater Level Trigger Exceedances – Discussion

Site	Discussion
P12C	TARP Level 2 exceedance was observed from October to December 2022. Groundwater level increased at 178.4 mAHD, just 1m below the TARP Level 2. TARP Level 1 is likely to apply at P12C in the next review period.
P16B	TARP Level 2 exceedance was observed from October to December 2022. Groundwater levels are observed at 205.6 mAHD in December 2022, 0.3m below the TARP Level 2. TARP Level 2 could remain in the short to medium term as a long-term groundwater impact is likely at P16.
P16C	TARP Level reduced from Level 3 to Level 2 exceedance in October 2022. Groundwater levels are observed at 197.4 mAHD in December 2022, 3.2m below the TARP Level 2. TARP Level 2 could remain in the short to medium term as a long-term groundwater impact is likely at P16.
TNC036 (BGSS - 97m)	TARP Level 2 exceedance was observed from October to December 2022. Groundwater level increased to the TARP Level 2 end of December 2022. It is likely that TNC036-HBSS 97m TARP Level will reduce to a TARP Level 1 in the next review period.
TNC036 (BGSS - 169m)	TARP Level 2 exceedance was observed from October to December 2022. Groundwater levels are observed at 181.6 mAHD in December 2022 and increased by approximately 8.5 m during the reporting period. As of December 2022, groundwater levels remain below the trigger TARP Level 2 (192.5 mAHD), hence a TARP Level 2 still applies.
TNC036 (BGSS - 214m)	A reduction from TARP Level 2 exceedance to TARP Level 1 was observed during the review period. The groundwater level observed at TNC036-BGSS-214m exceeds the modelled drawdown from mid-2020 but remains within the 30 m predicted drawdown in October and November 2022 (Figure 4). As of December 2022, the observed drawdown does not exceed the modelled drawdown resulting in a TARP Level 1.
TNC036 (BGSS – 412.5m)	TARP Level 2 exceedance was observed during the review period. The groundwater level observed at TNC036-BGSS-412.5m exceeds the modelled drawdown from mid-2020 but remains within the 30 m predicted drawdown as of December 2022 (Figure 5). A Level 2 TARP criteria (exceeds modelled drawdown but less than 30 m exceedance) still applies at TNC036-BGSS-412.5m over the reporting period.

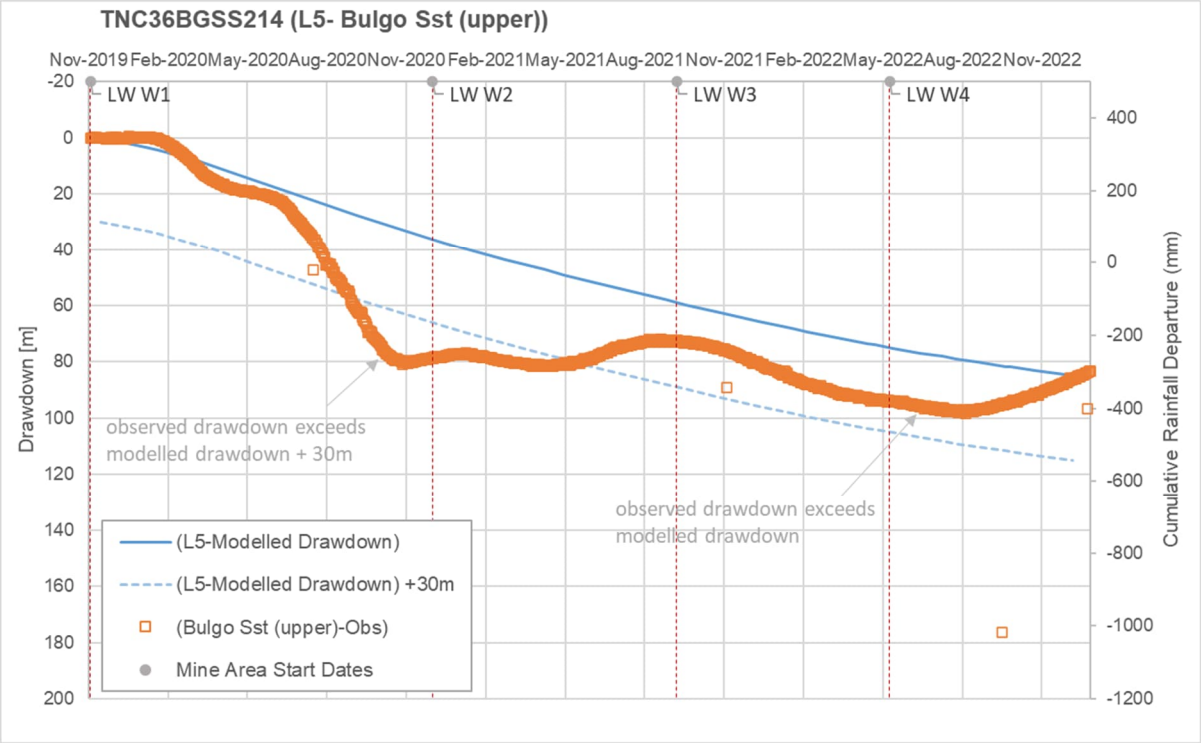


Figure 4 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-214m) with the +30m Threshold Modelled Drawdown

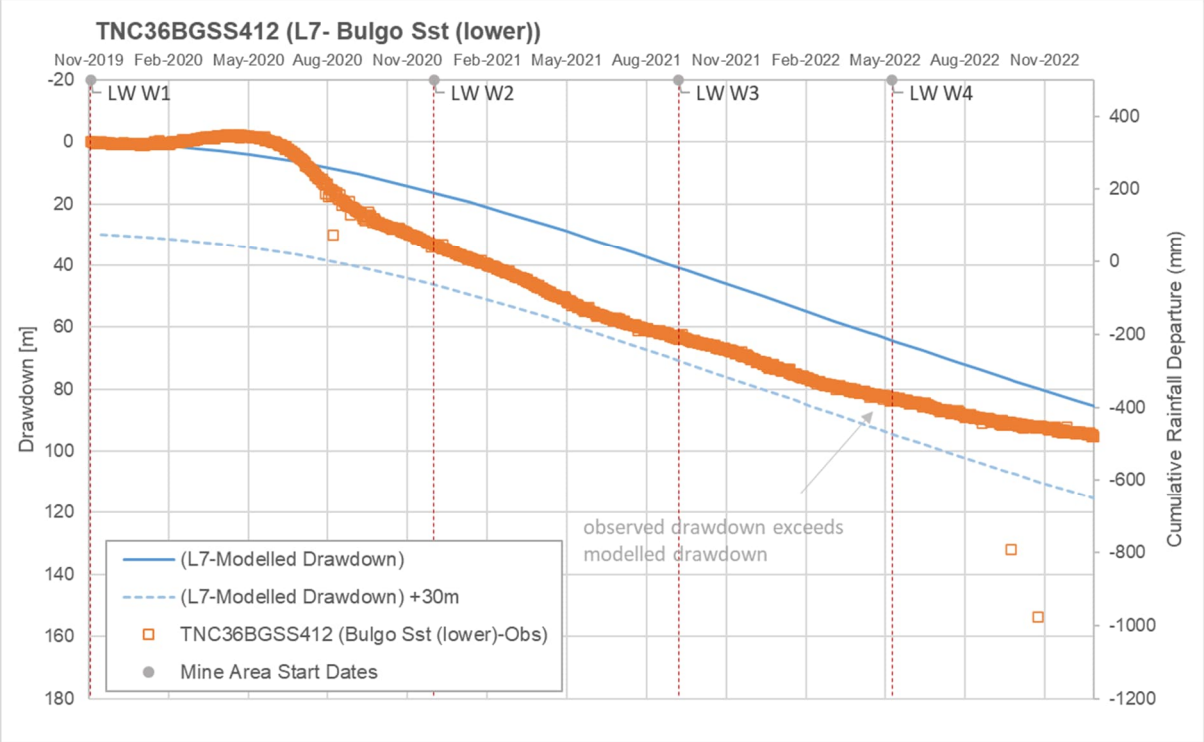


Figure 5 Comparison of Modelled and Observed Drawdown at TNC036 (BGSS-412.5m) with the +30m Threshold Modelled Drawdown

5 Groundwater Quality Trigger Review

5.1 Summary of Groundwater Quality Exceedances

Approved Trigger Action Response Plan (TARP) levels are defined for each site (Tahmoor Coal, 2021) and presented in Appendix B (Table B1-B2). Graphs for pH, electrical conductivity (EC) and metals exceedances are presented in Appendix C and Appendix D.

An assessment of groundwater quality at each of the monitored bore locations against the TARP trigger levels has been undertaken. During the reporting period, the following exceedances and reduction in TARP Level were observed:

- TARP Level 3
    - Metals – zinc (Zn): bore P16C. Dissolved zinc concentrations have fluctuated above the trigger level (0.021 mg/L) since May 2022 but declined following rainfall events (i.e July and October 2022). In October 2022, dissolved zinc concentrations decreased to 0.034 mg/L (marginally above the trigger level). As of December 2022, zinc concentrations increased to 0.12 mg/L, where a TARP Level 3 applies (Appendix D, Figure D12).
- TARP Level 2 (EC, pH and metals)
    - EC: bore P15A and P15B in October and November 2022. P16B in November 2022.
    - pH upper: bore P16A, GW115860, GW105228, GW104090 in October 2022.
    - pH lower: bore P16A in December 2022.
    - Fe (P12C), Mn (P12C, P15D), Cu (P14A, P14C, P14D, P15D, P16A, P16B, P16C), Zn (P16C), Al (P12A, P14D, P16C), As (P15C), Sr (P15A, P15B, P15C, P16B, P16C, GW104090)

All other groundwater monitoring sites remained within TARP Level 1 across the quarterly reporting period.

A summary of the groundwater quality (electrical conductivity, pH, and metals) trigger exceedances during the reporting period at the monitored bores are presented in Table 7.

Groundwater quality parameters are sampled every three months as per the Water Management Plan and TARPs (Tahmoor Coal, 2021), and as such private bores were last sampled in October 2022 and the exceedances from that sampling event are presented in Table 7.

Table 7 Trigger Exceedances for pH, EC, and Metal Concentrations

Bore	Month	Trigger Level Exceedance														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
Shallow OSP																
P12A	Oct										L2					
	Nov															
	Dec															
P12B	Oct															
	Nov															
	Dec															
P12C	Oct					L2										
	Nov				L2	L2										
	Dec				L2	L2										
P14A	Oct						L2									
	Nov						L2									
	Dec															
P14B	Oct															
	Nov															
	Dec															
P14C	Oct						L2									
	Nov															
	Dec						L2									
P14D	Oct															
	Nov						L2				L2					
	Dec															
P15A	Oct	L2											L1^		L2	
	Nov	L2											L1^		L2	
	Dec												L1^		L2	
P15B	Oct	L2													L2	
	Nov	L2													L2	
	Dec	*													L2	
P15C	Oct														L2	
	Nov											L2			L2	
	Dec														L2	
P15D	Oct				L1^											
	Nov				L1^	L2										
	Dec				L1^		L2									
P16A	Oct			L2			L2									

Bore	Month	Trigger Level Exceedance														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
	Nov															
	Dec		L2													
P16B	Oct															
	Nov						L2								L2	
	Dec	*					L2								L2	
P16C	Oct						L2		L2						L2	
	Nov								L2							
	Dec						L2		L3		L2					
GW104090	Oct			L2*											L2	
GW105467	Oct	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
GW105228	Oct			L2*									L1^			
GW072402	Oct															
GW115860	Oct			L2*												
GW105546	Oct	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#

TARP Level 1 TARP Level 2 TARP Level 3 Potential TARP Level 4

LX: maximum trigger level exceedances recorded *possible measurement error in EC and pH calibration #: no data available

^: TARP Level 1 following revision of the trigger level

5.2 Discussion of Groundwater Quality Exceedances

During the reporting period, groundwater quality triggers were exceeded at sites P12, P14, P15, P16, and GW105228 and overall, the:

- EC levels are observed within a TARP Level 2 at site P15A and P15B over the reporting period;
- pH levels are observed within a TARP Level 2 at site P16A, GW115860, GW105228 and GW104090; and
- Metals concentrations are observed within a potential TARP Level 3 at site P16C and within a TARP Level 2 at sites P12, P14, P15, P16 and GW104090. All metals observations within a TARP Level 2 are likely short-term increases (less than three months), otherwise specified in Table 8 and are not identified as a mining related effect.

Assessment of the observed exceedances, short-term increases (less than three months) and a high-level outline of the potential influencing factors for the exceedances, are briefly discussed in Table 8.

Table 8 Groundwater Quality Trigger Exceedances – Discussion

Site	Discussion
P12A	Short-term increase in aluminium observed in October 2022 (TARP Level 2) (Figure D13)
P12C	TARP Level 2 metals (iron and manganese) (Figure D1 and Figure D3). Dissolved iron concentrations have shown significant fluctuations in the past six-months with a peak observed in September 2022 to 76 mg/L followed by a sharp decline to 18 mg/L (below the trigger level) in October 2022 (Figure 6). However dissolved iron concentrations fluctuated between 64 and 38 mg/L and above the trigger level in November and December 2022. Dissolved iron concentrations remained below the trigger level at P12A and P12B being recorded at 5.2 mg/L and 14 mg/L respectively which show that dissolved iron concentrations in the shallow Hawkesbury Sandstone aquifer remain within baseline level (Figure 6). The increase in dissolved iron at P12C is suggested to be localised and likely the result of iron being mobilised during the groundwater recovery observed over the past six months. Iron staining may have formed along the steel casing during the period of groundwater depressurisation and is likely mobilised as groundwater levels increased in the bore. It is recommended to purge the bore for a longer period in the next monitoring round to confirm trends in dissolved iron concentrations. The increase of dissolved manganese concentrations above the trigger level during the reporting period (i.e. peak at 1.3. mg/L in October 2022) could also be linked to the staining of the casing. As shown on Figure 6 and Figure 7, dissolved iron and manganese concentrations appear to be correlated. Also, dissolved manganese concentrations at P12A and P12B were recorded between 1 and 1.5 mg/L and are observed within similar level as P12C during the reporting period. This suggests that natural fluctuation in groundwater quality could be associated with the increasing trend at sites P12. As for dissolved iron concentration trigger level, prior to undertake a revision to the dissolved iron trigger level, it is recommended to purge the bore for a longer period in the next monitoring round to confirm trends in dissolved manganese concentrations.
P14A, P14C, P14D, P16A, P16B, P16C, P15D	Figure D5 to Figure D11 —TARP Level 2 metals (copper) – short-term fluctuations in dissolved copper concentrations above the trigger level likely to be the result of above average rainfall in 2022.
P14D	Short-term increase in aluminium observed in November 2022 (TARP Level 2) (Figure D14)

Site	Discussion
P15A	Groundwater EC was observed marginally above the trigger level in October and November 2022 before declining below the trigger level in December at 4,000 uS/cm. (Figure C1). TARP Level 2 metals (strontium) – dissolved strontium concentrations continue to decrease over the reporting period to 5.7 mg/L following a peak to 11.7 mg/L in June 2022 (Figure D18). TARP Level 2 metals (lithium) (Figure D23) – dissolved lithium concentrations have fluctuated marginally above the trigger level (0.13 mg/L) since June 2022 between 0.17-0.21 mg/L. Since June 2022 minor increases in lithium concentrations in the range of 0.05 mg/L are observed in the mid Hawkesbury Sandstone (P15B and P15C) and at less than 0.05mg/L in the lower Hawkesbury Sandstone (P15D) (Figure 10) and within TARP Level 1. Also, lithium concentrations at the nearby private bores are observed at less than 0.05 mg/L. The nearby groundwater monitoring sites P14A, B, C and D record lithium concentrations of less than 0.025 mg/L and are observed within a TARP Level 1 (Figure 11). This suggests that the slight increase in lithium concentrations above the trigger level at P15A is localised and not driven by upwelling of groundwater with higher lithium concentration (i.e. unlikely to be mining related). Since no significant increases in lithium concentration is observed at nearby bores P14, P15B, C, D and private bores, the trigger level was revised to 0.25 mg/L in line with the private bores GW115860. Further monitoring for lithium concentrations should continue at P15A and nearby groundwater monitoring bores and private bores.
P15B	Groundwater EC was observed marginally above the trigger level (3,575 uS/cm) in October and November 2022 at 3,741 uS/cm (Figure C2). The groundwater EC data point for December 2022 was removed the datasets as the record appears erroneous (i.e. greater than 6,500uS/cm) while TDS is recorded at 233.5 mg/L. The TDS value suggests that the groundwater EC would be close to 348.5 uS/cm (i.e. EC approximately equals to TDS / 0.67). TARP Level 2 metals (strontium) exceedance observed across the reporting period (Figure D19). Strontium concentrations peaked to 1.5 mg/L in October 2022 and have declined to 1.3 mg/L in December 2022, marginally above the trigger level of 1.21 mg/L (Figure D19). It is recommended to continue closely monitoring strontium concentrations at P15B although the fluctuations in lithium concentrations slightly above the trigger level are likely due to floods events in 2022.
P15C	TARP Level 2 metals (strontium) exceedance observed across the reporting period (Figure D20). Strontium concentrations peaked to 0.74 mg/L in July 2022 and have gradually declined to 0.52 mg/L in December 2022, marginally above the trigger level of 0.45 mg/L. Fluctuations in strontium concentrations just above the trigger level is likely the result of flood events in 2022 and the local geology mobilising a slightly higher source of lithium following rainfall events than at P14 or nearby private bores (within TARP Level 1). The strontium concentrations observed at P15B and P15C remain well below the US health-based screening level benchmark of 4 mg/L.

Site	Discussion
P15D	TARP Level 2 metals (iron) (Figure D2). While dissolved iron concentrations increased above the trigger level since April 2022, concentrations have moderately fluctuated (i.e. from less than 30 mg/L in June 2022 to less than 10 mg/L in August 2022) (Figure D2). The range in dissolved iron concentrations observed at P15D is not significantly different and is even lower than iron concentrations observed at other monitoring sites (P14A) or private bores (GW105228) observed within TARP Level 1. In addition, no exceedance in dissolved iron is observed at GW115860 (i.e. closest private bore to P15D) during the reporting period. No significant increases in dissolved iron concentrations are observed in the shallow and mid Hawkesbury aquifer (P15A, B and C) which suggest that the increase at P15D is localised and likely natural. The trigger level for dissolved iron concentrations at P15D is too conservative as the trigger level was calculated using data points taken during July-September 2021, period associated with rainfalls and decline in dissolved iron concentrations at most groundwater monitoring sites (Figure 8). It is recommended to revise the trigger level for dissolved iron at P15D to 25 mg/L, just below the peak value of 28 mg/L in June 2022. Following the revised trigger level dissolved iron concentrations at P15D are observed within a TARP Level 1 during the review period. TARP Level 2 metals (manganese) in November 2022 and marginally above the trigger level and observed within TARP Level 1 in December 2022 (Figure D4).
P16A	pH at P16A has fluctuated significantly as it triggered the upper pH level in October 2022 and lower pH level in December 2022 (Figure C4). pH at P16A has previously shown large fluctuations. Additional monitoring data is required to confirm pH trends. TARP Level 2 applies in October and December 2022.
P16B	Short-term increase in strontium observed in November and December 2022 (TARP Level 2) (Figure D16).
P16C	TARP Level 3 metals (zinc) (Figure D12). Dissolved zinc concentrations have fluctuated above the trigger level (0.021 mg/L) since May 2022 but declined following rainfall events (i.e July and October 2022). In October 2022, dissolved zinc concentrations decreased to 0.034 mg/L (marginally above the trigger level). As of December 2022, zinc concentrations increased to 0.12 mg/L, where a TARP Level 3 applies. For comparisons, P16A and P16B have shown natural fluctuations in zinc concentrations (i.e in the range of 0.1 mg/L) following rainfall events however no increases are observed during the reporting period. This suggest that the increase in zinc in the lower Hawkesbury Sandstone (P16C) is localised (Figure D12). Since early 2022, the sustained increase in groundwater levels seen at P16C could locally mobilised a naturally occurring source of zinc (i.e in the range of 0.10-0.15 mg/L). Also, the mild steel casing at P16C could contribute to a higher zinc concentration. Higher zinc concentrations at P16C could be related to a post mining impact however natural fluctuations in groundwater quality and major flood events in 2022 are likely the reason for higher zinc concentrations. As of December 2022, it is recommended to apply a TARP Level 3 at P16C for dissolved zinc concentrations. A TARP Level 4 should be considered in the next review period if further increase in zinc at P16C is observed and if zinc concentrations increase above the trigger level at P16A and P16B. Short-term increase in aluminium observed in December 2022 (TARP Level 2) (Figure D15) Short-term increase in strontium observed in November and December 2022 (TARP Level 2) – (Figure D17).

Site	Discussion
GW115860, GW105228, GW104090	pH at these private bores increased significantly in October 2022 compared to the last pH reading in July 2022 (i.e. pH increased up to 5 pH units) (Figure C5 to C7). Since monitoring of pH started at these bores, pH did not fluctuate significantly only within 1 pH unit and did not exceed the upper or lower pH trigger level. The recorded pH in October 2022 is likely a measurement error. pH in January 2023 (i.e. reported in the next review period) is observed within baseline level.
GW104090	TARP Level 2 metals (strontium) (Figure D21) – following a peak in strontium concentration to 1.7 mg/L in January 2022 and above the trigger level of 1.2 mg/L, strontium concentrations have continued to decline to 1.1 mg/L in October 2022 hence a TARP Level 2 remains. Further monitoring is required to confirm post-mining trend in strontium concentrations although minimal baseline data exist at this site.
GW105228	TARP Level 2 metals (lithium) (Figure D22) – since April 2022 lithium concentrations have gradually increased above the trigger level (0.026mg/L) from 0.024 mg/L in April 2022 to 0.037 mg/L in October 2022. A couple of data points have been used to develop the lithium trigger level at GW105228, which make the trigger level too conservative. For comparison, the trigger level at GW115860 was set at 0.25 mg/L. Lithium concentrations at GW115860 and GW105228, located a couple of hundreds of meters apart, show similar lithium concentrations (Figure 10). It is considered appropriate to revise the trigger level at GW105228 in line with GW115860 to 0.25 mg/L. Using the revised trigger level of 0.25 mg/L at GW105228, a TARP Level 1 applies.

7 Trigger Level Review

A review of the monitoring data compared to the trigger levels has been conducted to identify if any triggers have occurred that would enact the TARP.

Given the identified sensitivities with the current TARPs, the following sections report both triggers against the original and the modified TARPs. In light of the proposed amendments, there are no TARPs triggered over the reporting period, October through December 2022.

7.1 WMP8 - Shallow OSPs and Private Bores (WMP8)

There are no proposed changes to WMP8, and all bores were within normal conditions for the reporting period (Table 5).

Table 5 TARP Level Review – WMP8

Bore	Groundwater Level prior to LW S1A (m AHD)	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Shallow standpipes						
P51A	298.1				-	-
P51B	299.2				-	-
P52A	249.6				-	-
P53A	257.2				2.8	2.8
P53B	257.2				-	-
P53C	255.9				-	-
P54A	DRY	DRY	DRY	DRY	NA	NA
P54B	DRY	DRY	DRY	DRY	NA	NA
P55A	273				2	2
P55B	268.7				0.7	0.7
P55C	262.7				4.7	4.7
P56A	291				-	-
P56B	280.5				0.8	0.8
P56C	259.6				3.4	3.4
REA4	250.3				0.3	0.3
Private Bores						
GW062068	276.3				-	-
GW104008	235.2				-	-
GW104323	259.1			*	-	-
GW104659	252.4				-	-
GW105395	324				-	-
GW109257	282.7				-	-
GW112473	296				-	-

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

7.2 WMP9 - Shallow VWPs (sensors <200 metres)

The TARP WMP9 required amendment, and consequently, presented in Table 6 are the triggered TARP levels for both the original and updated TARPS, represented on the lower left and upper right quadrants respectively.

It is noted, that groundwater pressures at TBC032 HBSS 131m declined by approximately 6 metres through November and December 2022 which as per the original WMP would trigger Level 2. However, this only occurred temporarily and has since observed some recovery in the pressure. This validates the requirement for a temporal scale on the TARP levels. Under the revised TARPs, this is not yet triggering a response.

Table 6 TARP Level Review – WMP9 (original (lower left) and updated (upper right))

Bore	Groundwater Level prior to LW S1A (m AHD) [TARP Groundwater Reference Level]	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Shallow VWPs (<200 mbgl)						
TBC09HBSS-30m	326.6 [287.6]				0.3	0.3
TBC09HBSS-75m	325.1 [309.4]				-	-
TBC09BHCS-182m	308.3 [293]				0.1	0.1
TBC09 BGSS-192m	292.7 [290.4]				-	-
TBC018 WWFM/HBSS-70m	250.5 [250.5]				0.7	0.7
TBC018 WWFM/HBSS-117m	253.6 [251.9]				0.6	0.6
TBC018 - HBSS (lower) -164m	249.9 [250.7]				0.7	0.7
TBC018 BHCS -179m	248.4 [248.5]				0.6	0.6
TBC018 BGSS -198m	244.4 [244.7]				0.7	0.7
TBC024 HBSS-117m	322.4 [287.6]				-	-
TBC024 HBSS-139m	256.0 [287.0]	#	#	#	-	-
TBC024 BHCSS-168m	300.7 [289.5]				-	-
TBC024 BGSS-185m	308.6 [289.3]				-	-
TBC027 HBSS-95m	321.8 [320.1]				1.3	1.3
TBC027 HBSS-132m	313.6 [312.8]				2.6	2.6
TBC027 HBSS-169m	312.9 [312.2]				2.5	2.5
TBC027 BHCS-181m	309.9 [310.7]				2.1	2.1
TBC027 BGSS-198m	308 [310.3]				0.3	0.3
TBC032 HBSS-95m	262.6 [262.3]				4.3	4.3
TBC032 - HBSS-131m	255.6 [255.0]				6.6	6.6
TBC032 - HBSS-168m	280.7 [266.9]				2.1	2
TBC032 - BHCS-181m	243.8 [242.8]				5.8	5.8
TBC032 - BGSS-200m	245.1 [243.8]				5.5	5.5
TBC034 HBSS-65m	372.4 [371.8]				-	-
TBC034 HBSS-113m	507.2 [368.0]	~	~	~	-	-
TBC034 HBSS-161m	358.0 [358.4]				-	-
TBC034 BHCS-176m	233.3 [354.9]	~	~	~	-	-
TBC034 BGSS-196m	360.9 [358.3]				-	-
TBC039 HBSS-65m	313.6 [313.5]				-	-

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

7.3 WMP10 - Deep VWPs (sensors > 200 metres)

WMP10 resulted in numerous Level 1 TARPs triggered based on the original wording, as noted in the bottom left quadrants of Table 7. However, as presented in Column 6, the maximum drawdowns since commencement of LW S1A are overall very small. Consequently, the updated TARP now allows for these small fluctuations that do not warrant TARP triggers. Based on the updated TARP, there are currently no TARP levels triggered over the reporting period (see top right quadrants of columns C, D and E of Table 7).

Table 7 TARP Level Review – WMP10 (original (lower left) and updated (upper right))

Bore	Groundwater Level prior to LW S1A (m AHD) [TARP Groundwater Reference Level]	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Deep VWPs (greater than 200 mbgl)						
TBC09 BGSS-332m	236				0.3	0.3
TBC09 BGSS-343m	270.1				1	1
TBC09 SBSS-357m	202.6				0.8	0.8
TBC09 BUSM-381m	^	^	^	^	NA	NA
TBC09 WWCO-391m	243.6				1.1	1.1
TBC09 WWCO-397m	221.1				-	-
TBC18 BGSS-282m	238.6				0.76	0.76
TBC18 BGSS-366m	217.1				0.5	0.5
TBC18 WBCS-377m	~				~	~
TBC18 BUSM-404m	218.5				0.4	0.4
TBC18 WO-432m	215.1				0.5	0.5
TBC20 BGSS (mid)-211m	243.3				4.8	4.8
TBC20 BGSS (mid)-293m	239.3				0.4	0.4
TBC20 BGSS (mid)-375m	246.4				0.7	0.3
TBC20 WBCS-397m	^	^	^	^	0.8	0.3
TBC20 BGSS (upper)-411m	216.2				-	-
TBC20 WO-434m	220				-	-
TBC20 WO-439m	~	~	~	~	~	~
TBC26 BGSS (mid)-211m	203.2				-	-
TBC26 BGSS (mid)-278m	198.9				0.1	0.1
TBC26 BGSS (mid)-344m	204.1				0.2	0.2
TBC26 WBCS-409m	220.2				0.2	0.2
TBC26 BUSM-432m	114.5				4.8	4.8
TBC26 ECSL-440m	199				0.1	0.1
TBC26 ECSL-460m	221.1				-	-
TBC32 BGSS-200m	245				5.4	5.4
TBC32 BGSS-237m	234.7				0.4	0.4
TBC32 BGSS-294m	232.8				0.7	0.7
TBC39 BGSS-243m	214.2				-	-
TBC39 BGSS-299m	231.8				1.2	1.2
TBC39 SBSS-354m	250.1				0.2	0.2
TBC39 BUSM-375m	259.6				0.4	0.4
TBC39 WWCO-402m	266.3				0.3	0.3

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

"": no data available*

7.4 WMP11 – Groundwater Quality

Review of the groundwater quality against the revised trigger levels for the TARPS was only undertaken for November and December 2022, noting that at the time of monitoring in October 2022, extraction was yet to commence.

The groundwater quality triggers were developed based on a relatively short baseline period, and consequently, are unlikely to have captured the full range of natural variation. The original wording of the TARP as per the Water Management Plan does not have any temporal allowance, therefore not allowing for a trend to develop to indicate potential impact via mining. This approach does not allow for atypical measurements to be considered with adjacent data prior to triggering a TARP. For example, an erroneous data point or a response to an extreme climatic event may result in one point breaching a trigger level which will resolve the following month.

Table 8 presents the TARP Levels triggers for the OSPs and Private Bores, for the original TARPs in the lower left quadrant, and revised TARPs in the upper right quadrant. Based on the revisions to the TARPs, there are no triggers identified across the reporting period.

Table 8 TARP Level Review – WMP 11 ((original (lower left) and updated (upper right))

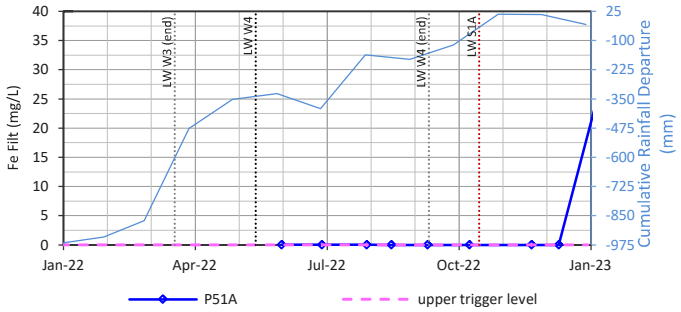
Bore	Month	TARP Level Exceeded														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
Shallow OSP																
P51A	Nov															
	Dec															
P51B	Nov															
	Dec															
P52	Nov															
	Dec															
P53A	Nov															
	Dec															
P53B	Nov															
	Dec															
P53C	Nov															
	Dec															
P54A	Nov		*	*												
	Dec		*	*												
P54B	Nov															
	Dec		*	*												
P55A	Nov															
	Dec		*	*												
P55B	Nov															
	Dec															
P55C	Nov															
	Dec															
P56A	Nov															
	Dec															
P56B	Nov															
	Dec															
P56C	Nov															
	Dec															
GW062068	Nov															
	Dec															
GW104008	Nov															
	Dec															
GW104323	Nov															
	Dec															
GW104659	Nov															
	Dec															
GW105395	Nov															
	Dec															
GW109257	Nov															
	Dec															
GW112473	Nov															
	Dec															

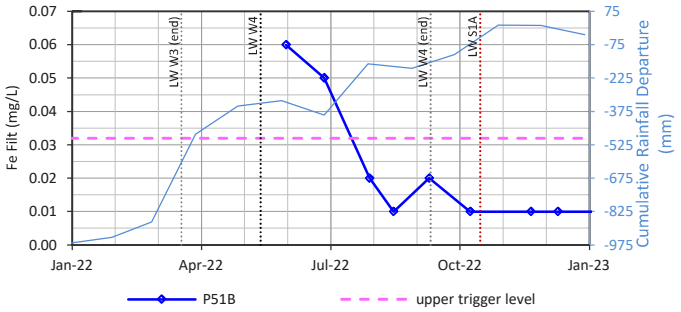
Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

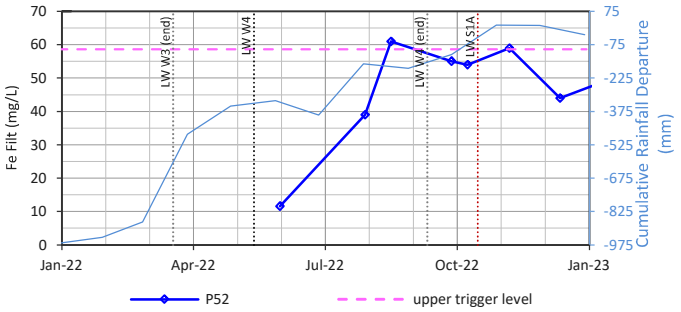
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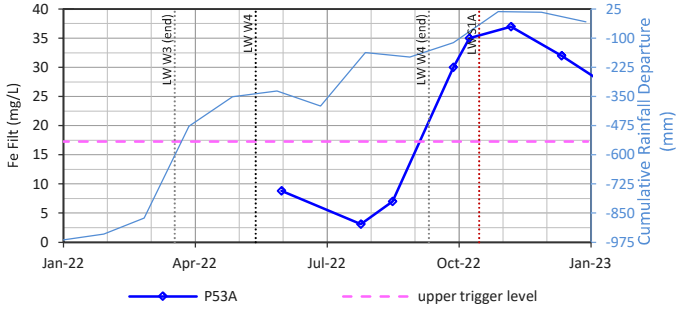
Appendix D:

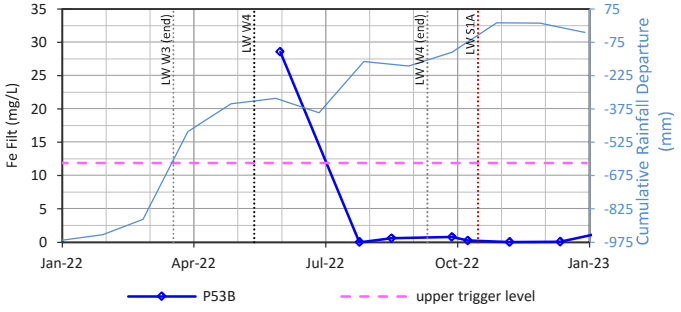
Groundwater Quality Time-series plots for Shallow OSPs and Private Bores

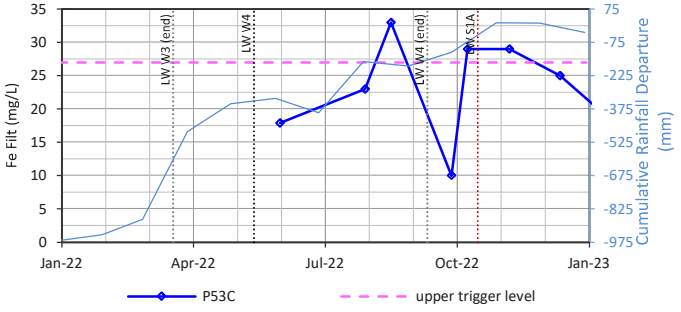

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51A
upper trigger level

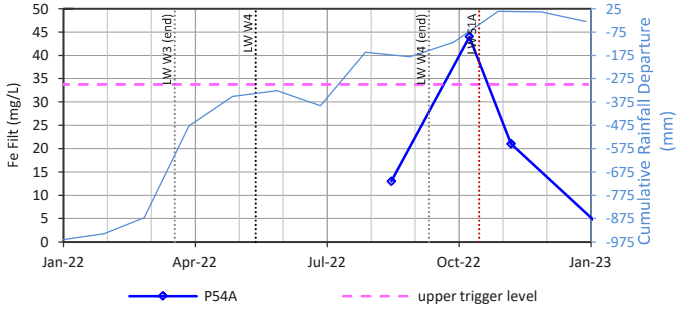

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B
upper trigger level

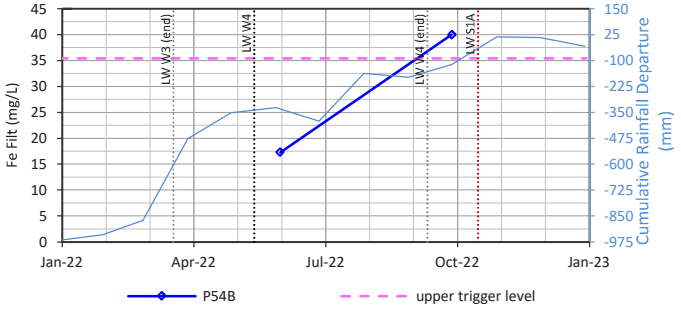

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

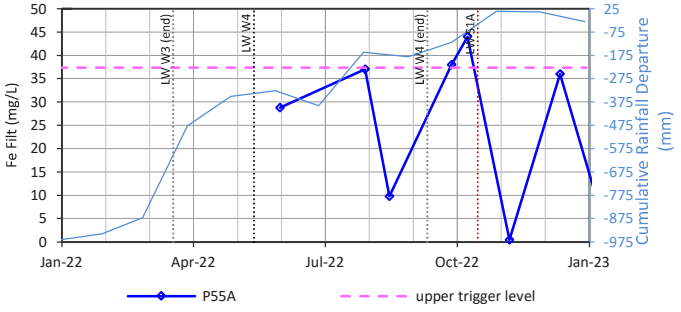

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

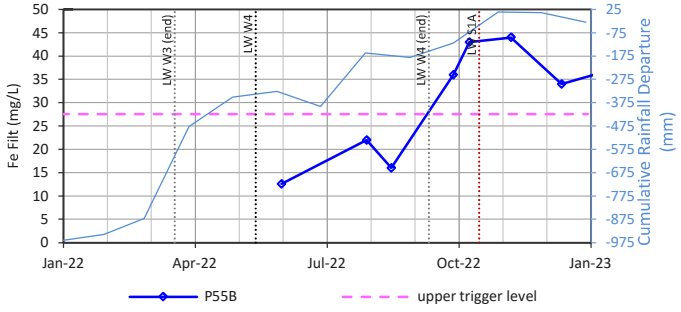

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

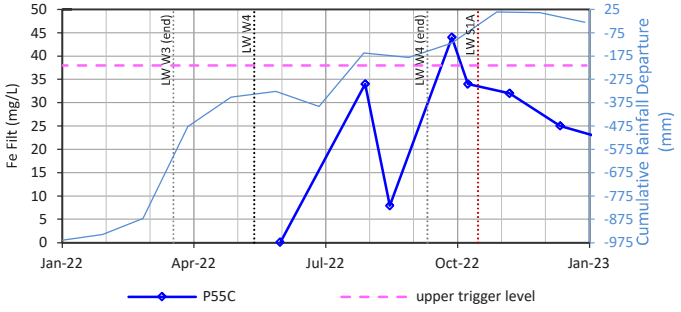

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

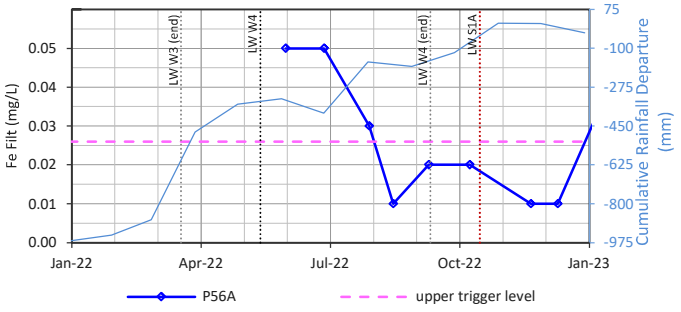

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

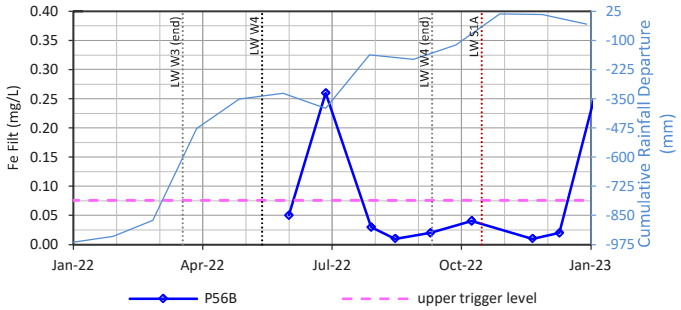

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

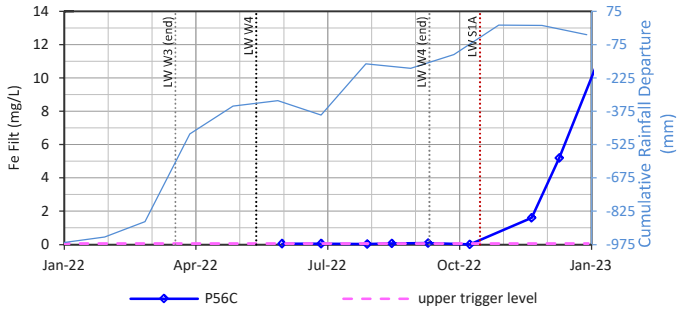

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

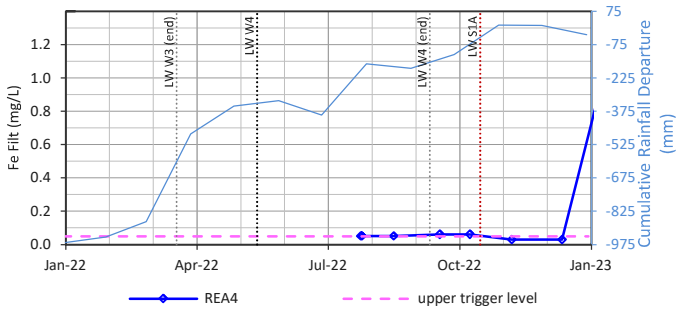

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

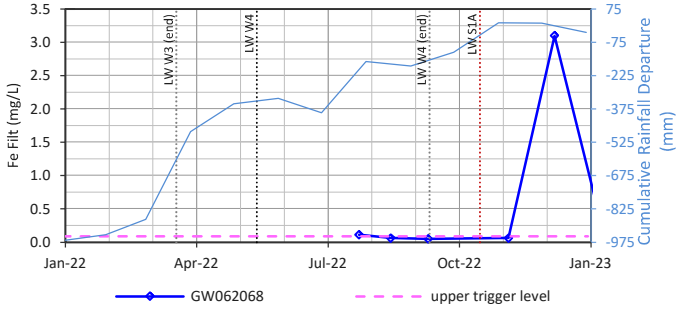

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

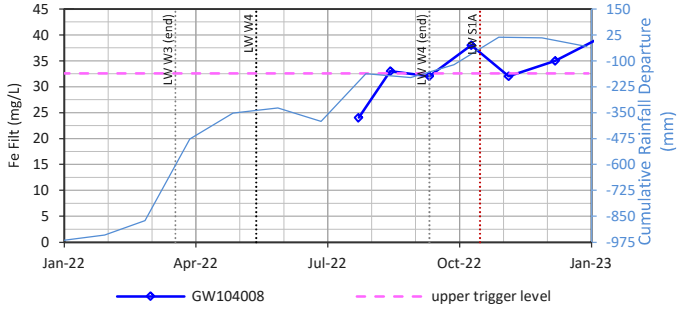

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

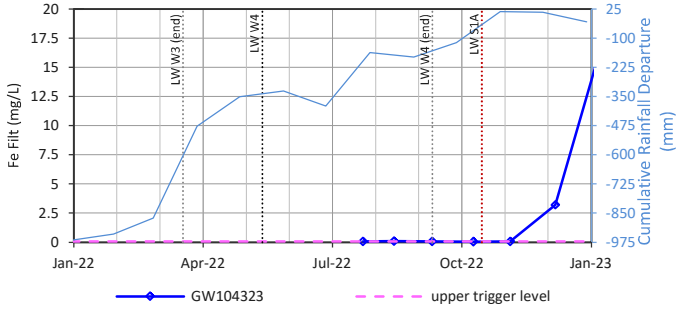


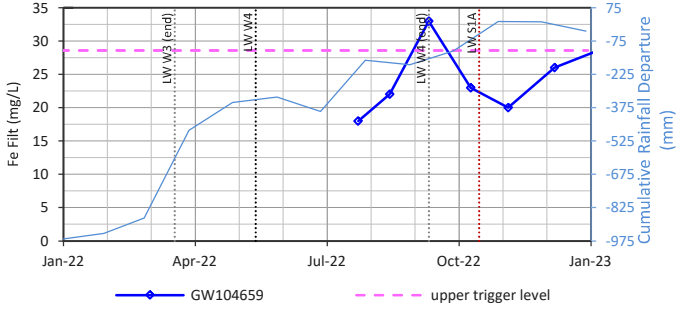


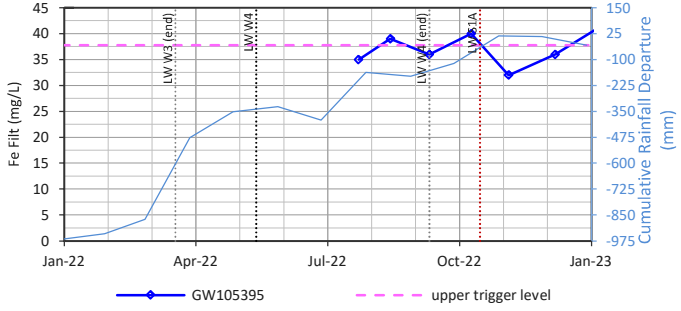


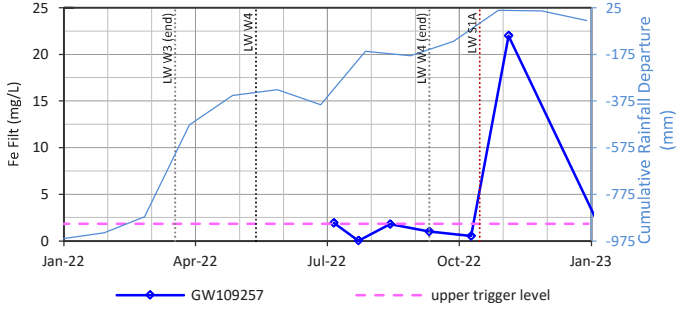


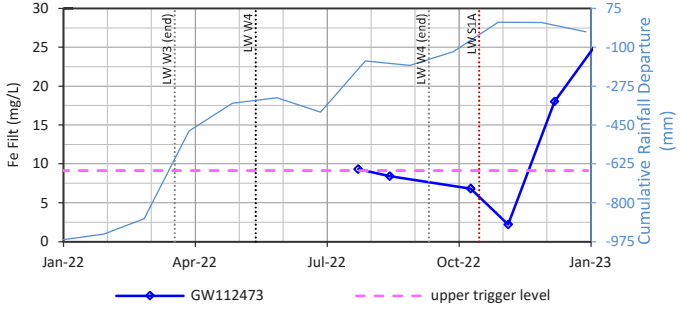




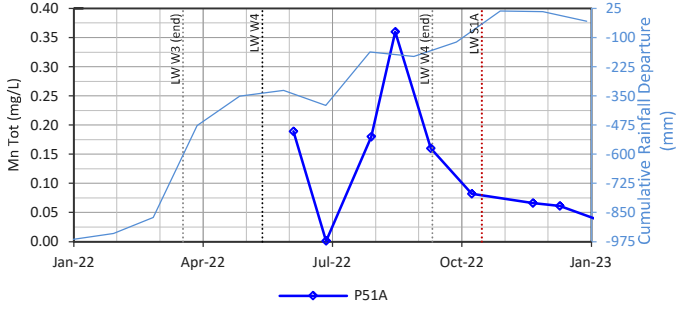


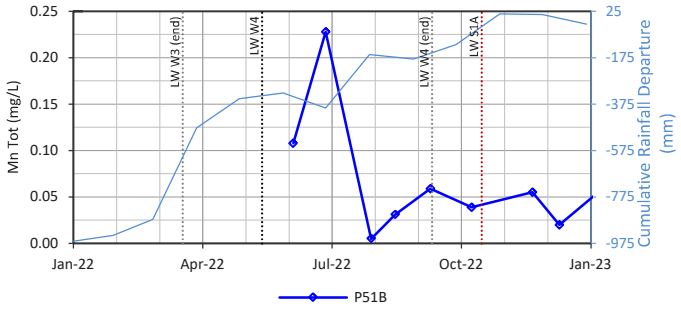


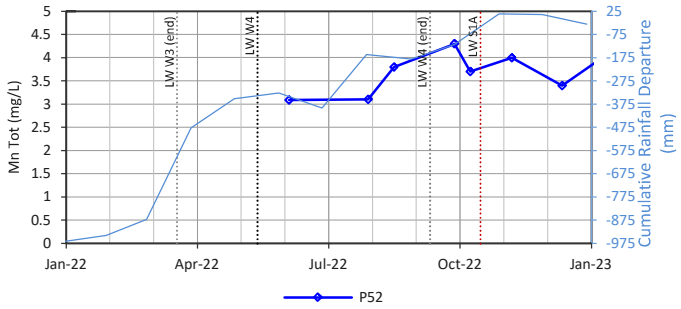


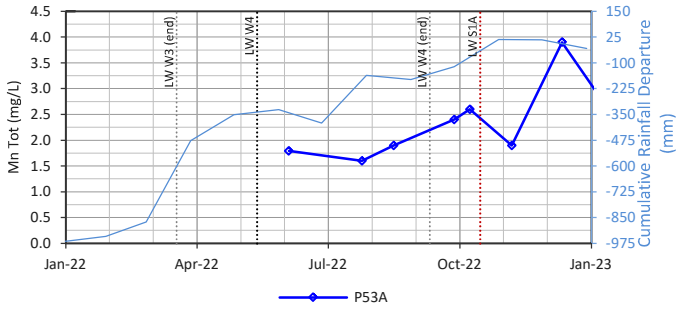


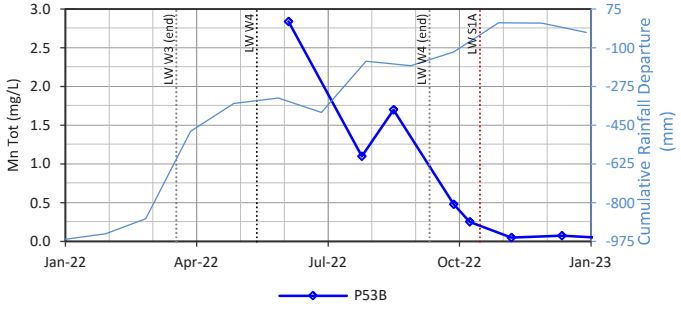
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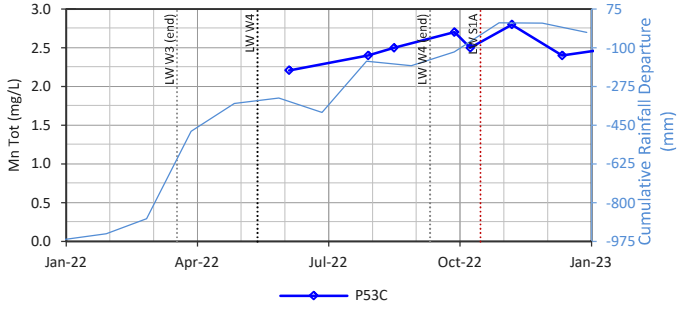


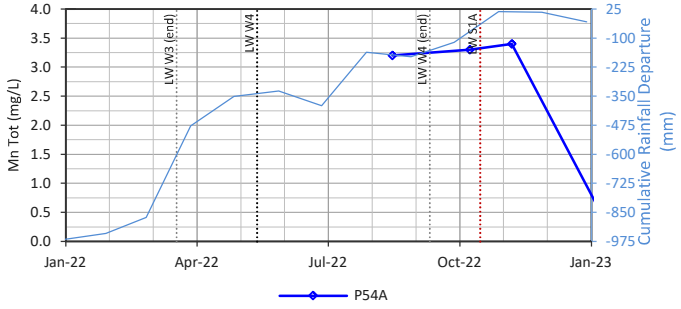

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B

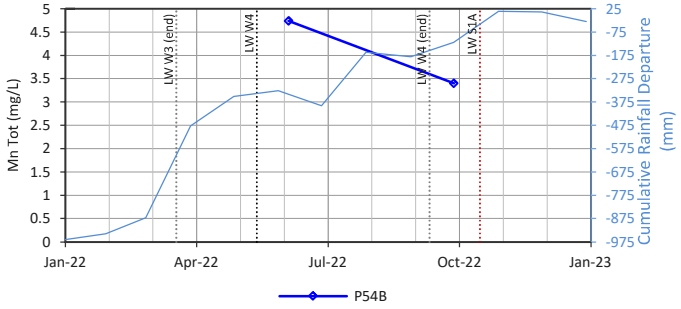

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52

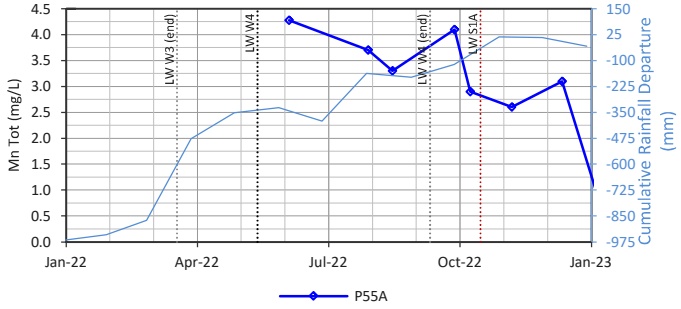

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A

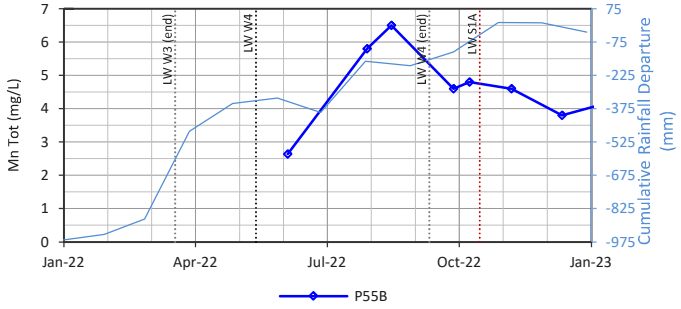

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B

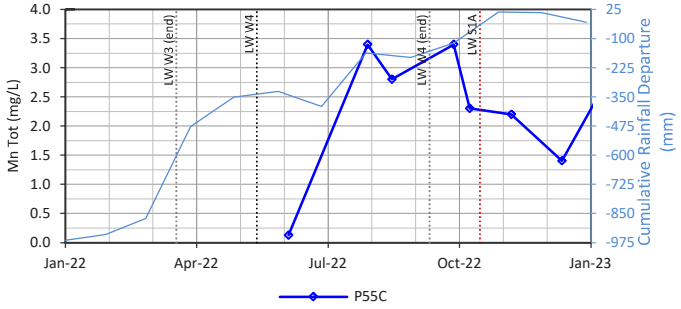

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C

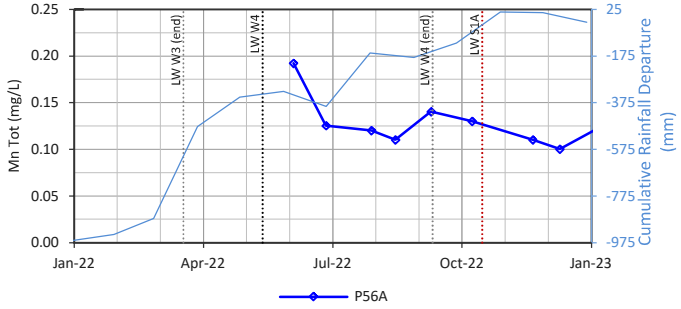

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A

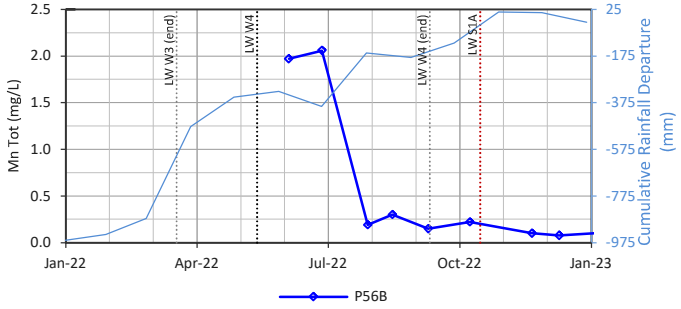

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B

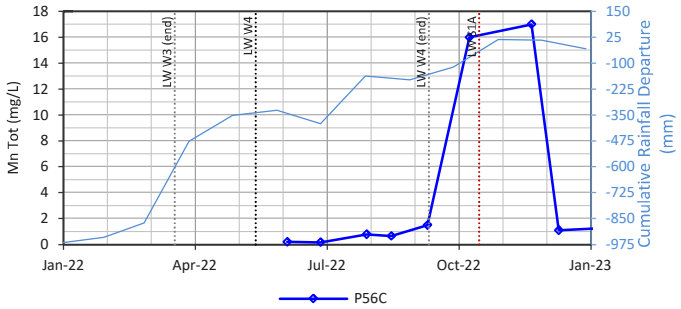

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A

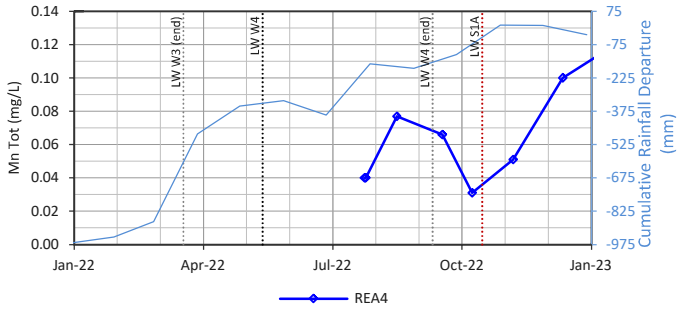

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B

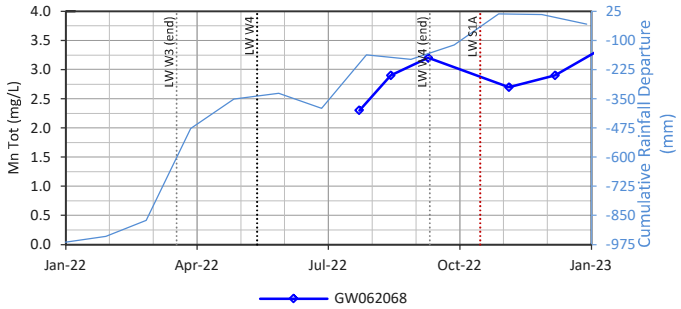

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C

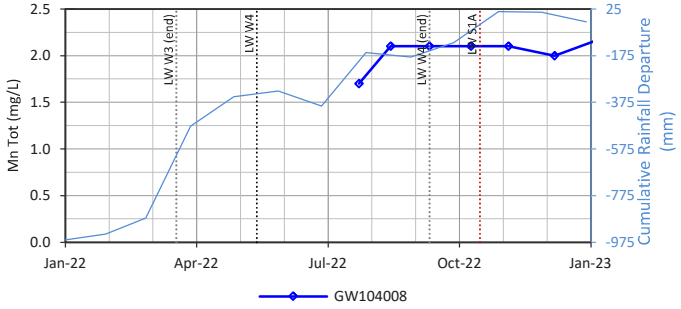

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A

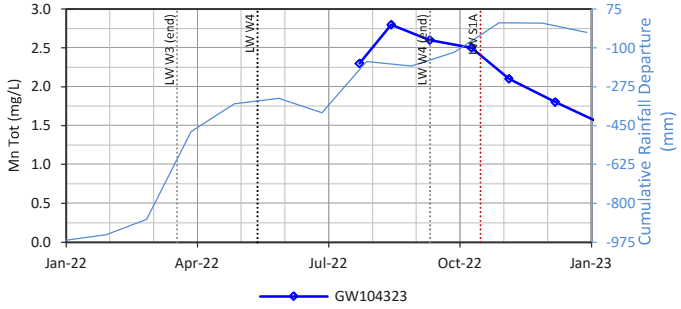

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B

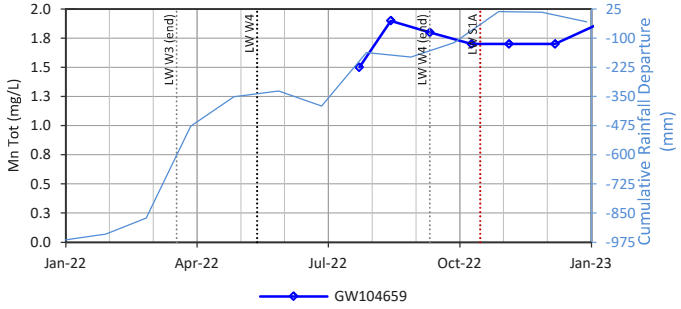


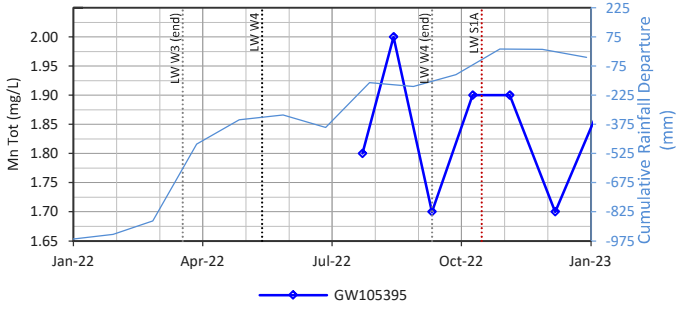


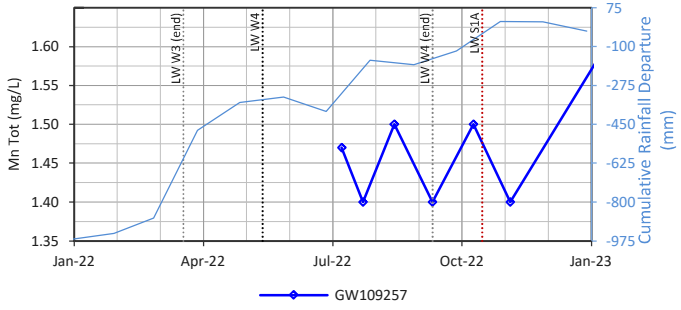


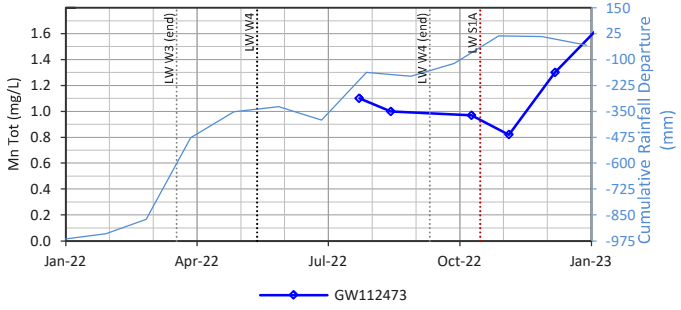




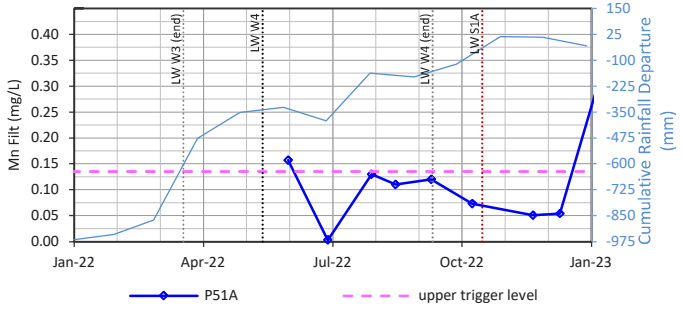


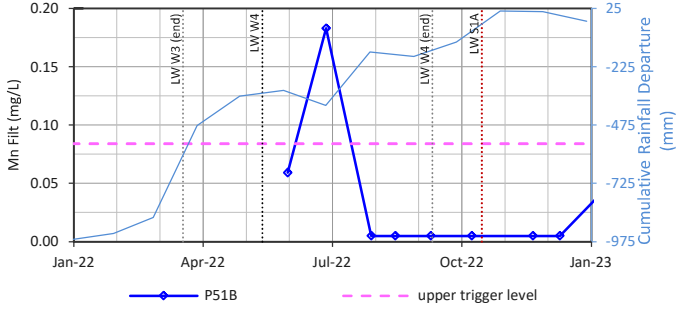


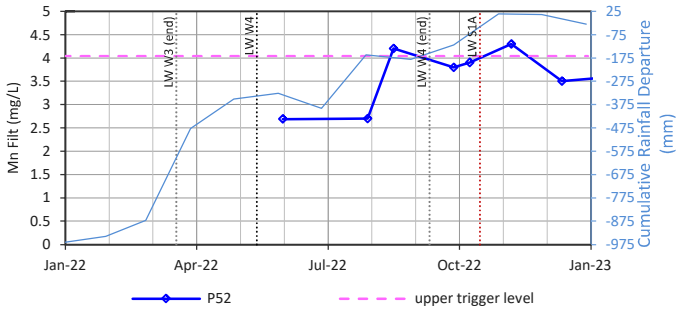


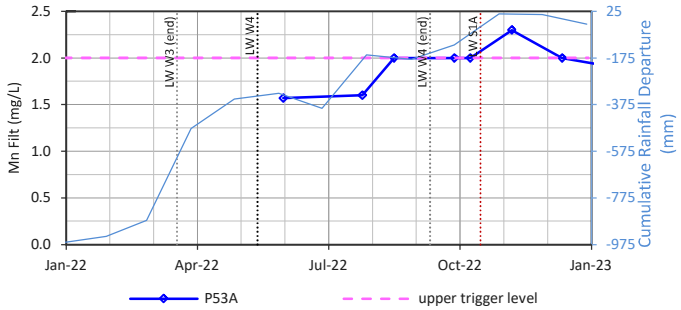


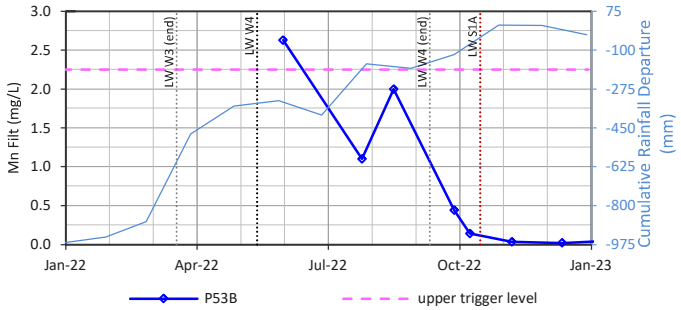
No Data Available for Mn Tot (mg/L)

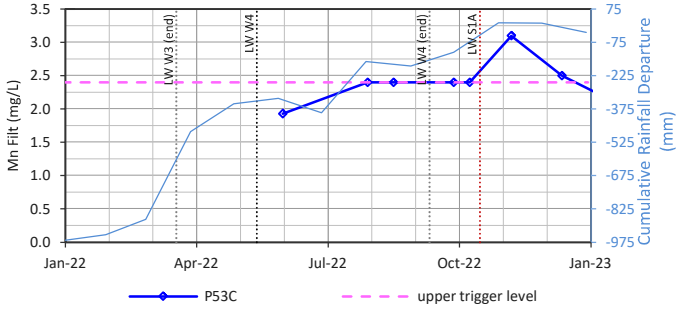


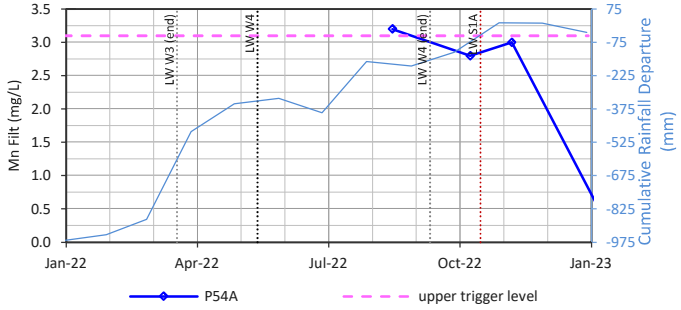


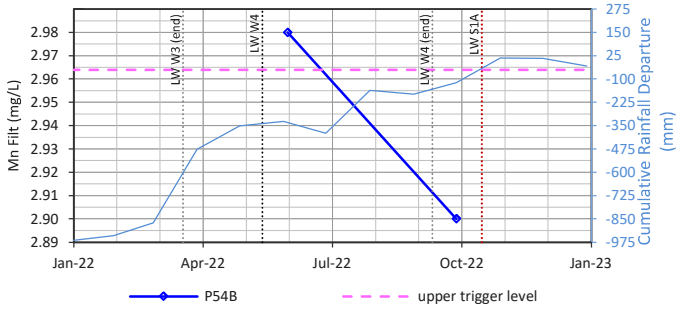

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

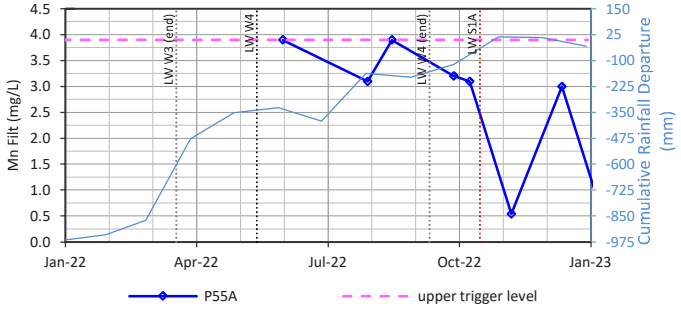

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

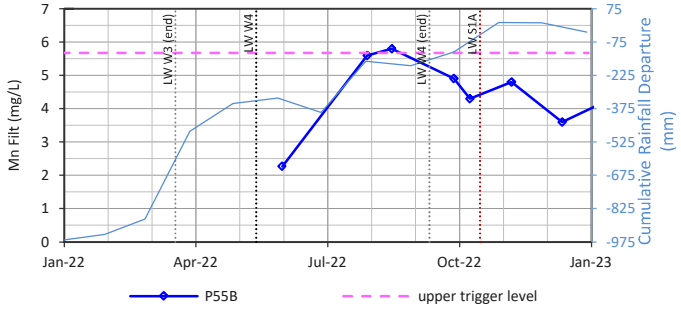

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

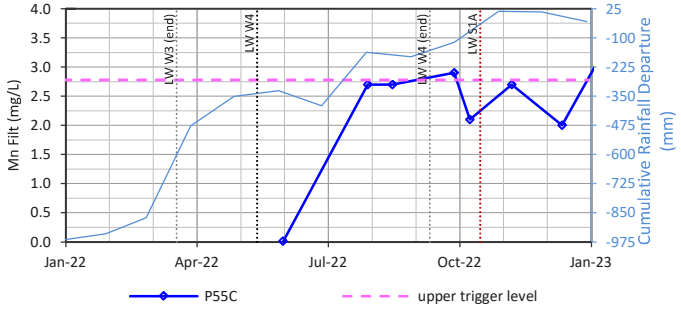

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

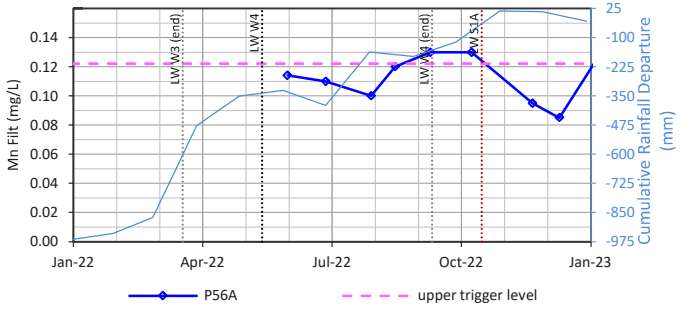

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

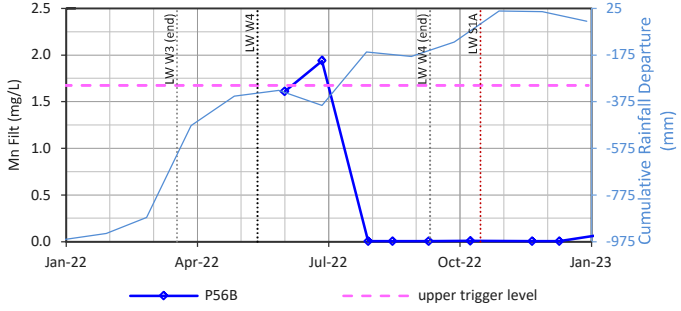

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

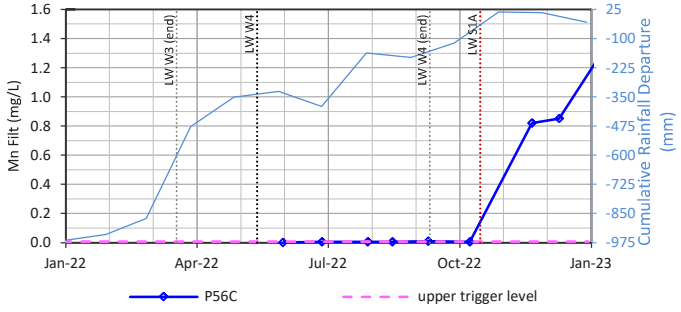

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

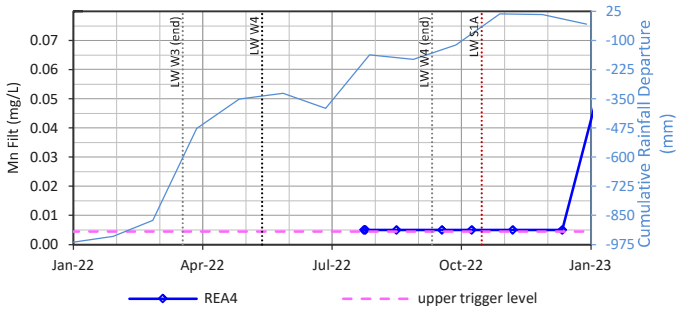

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

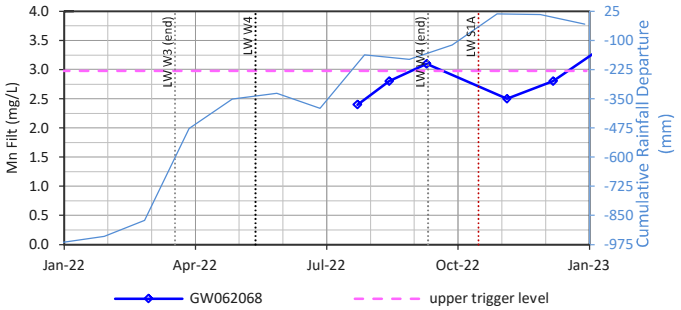

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

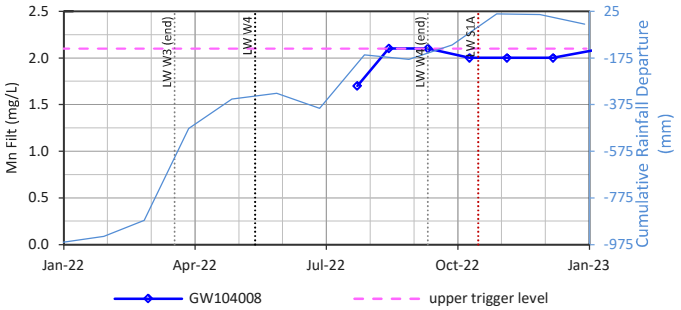

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

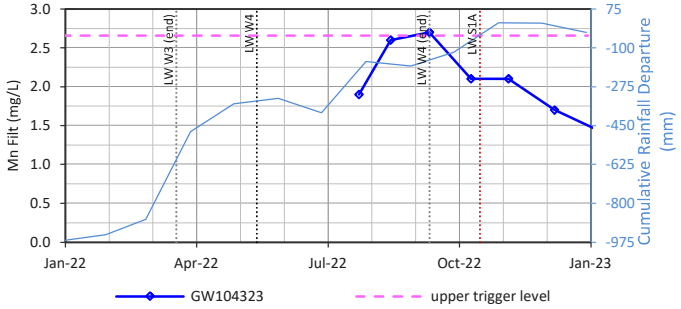

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

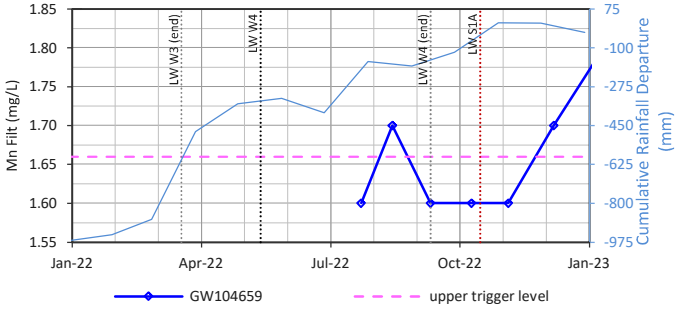

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

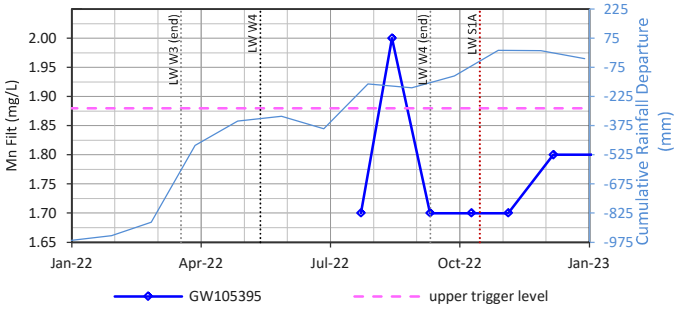


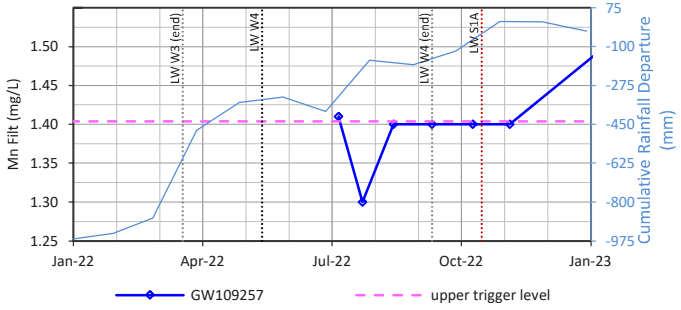


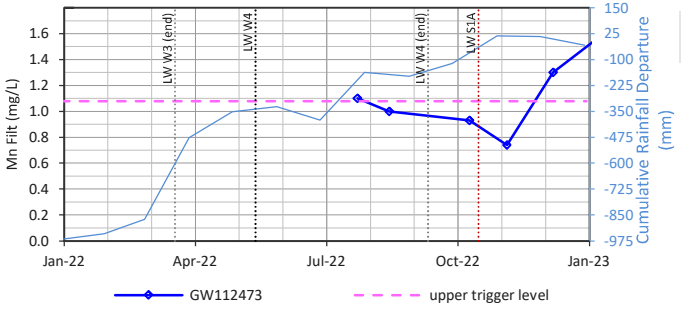




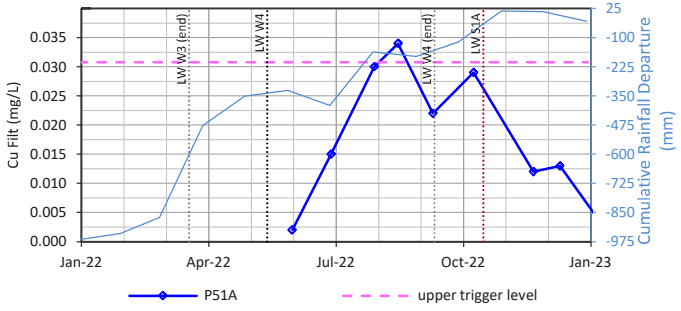


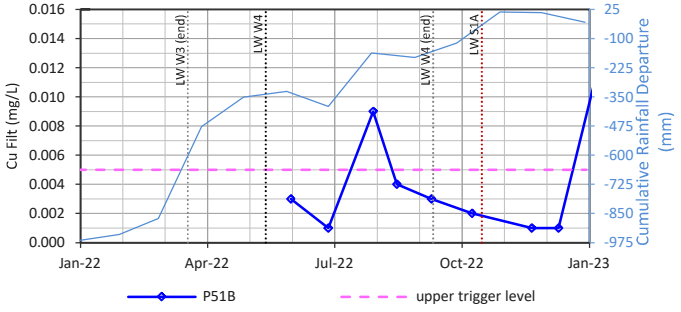


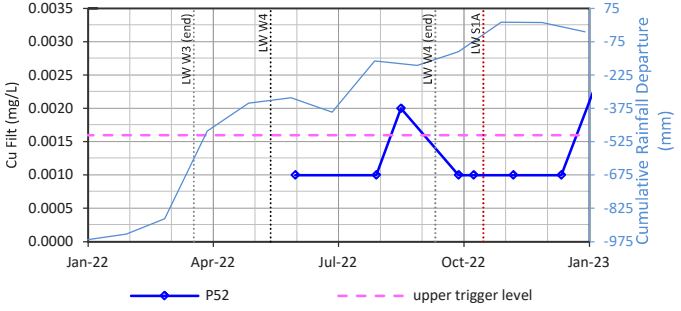


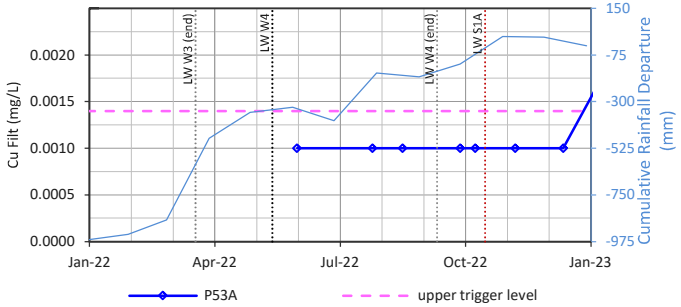


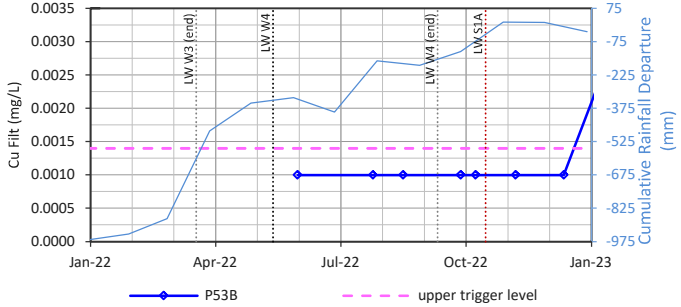
No Data Available for Mn Filt (mg/L)

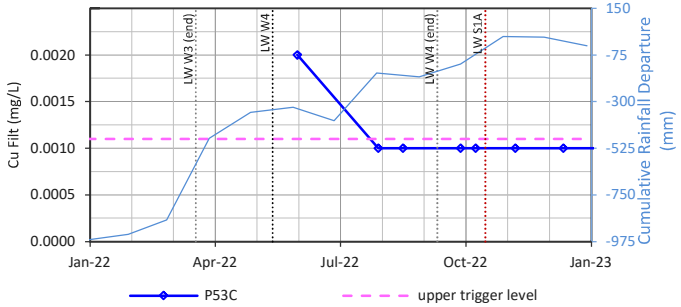


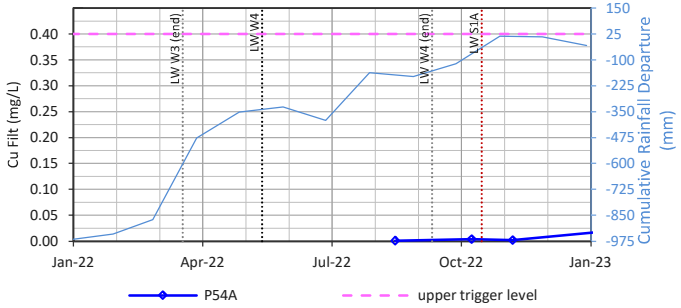


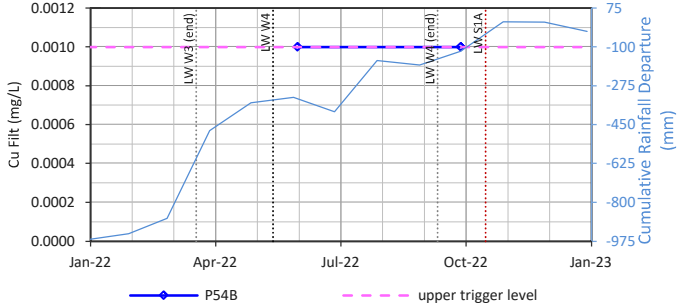


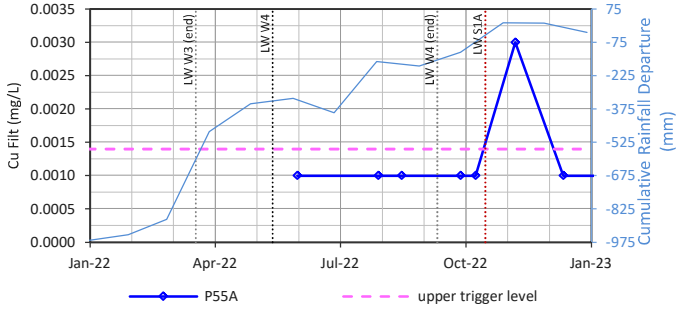

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

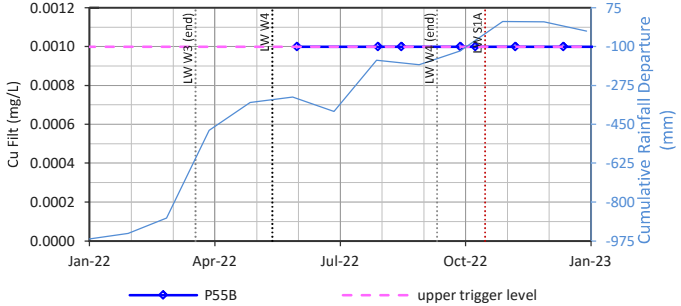

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

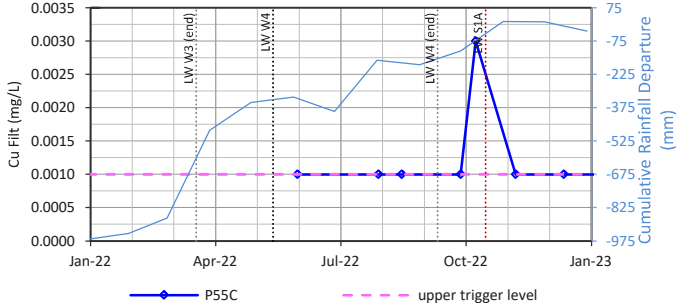

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

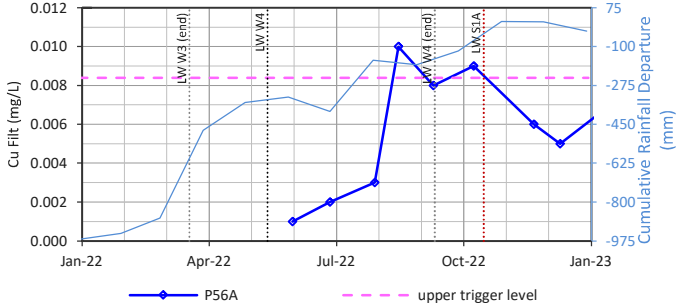

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

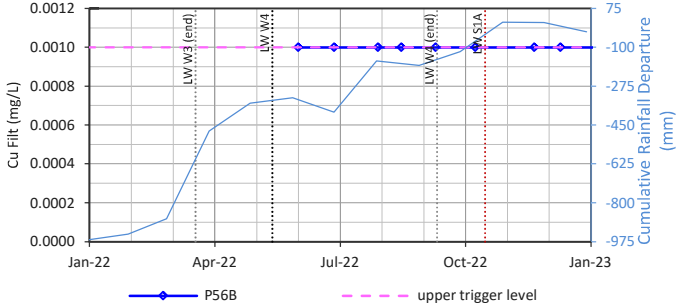

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

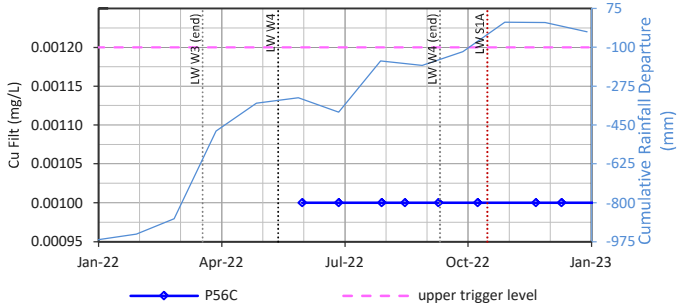

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

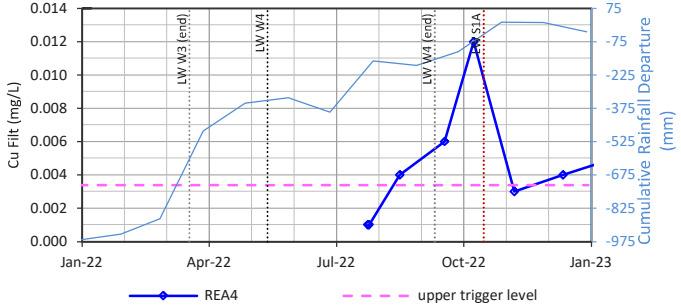

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

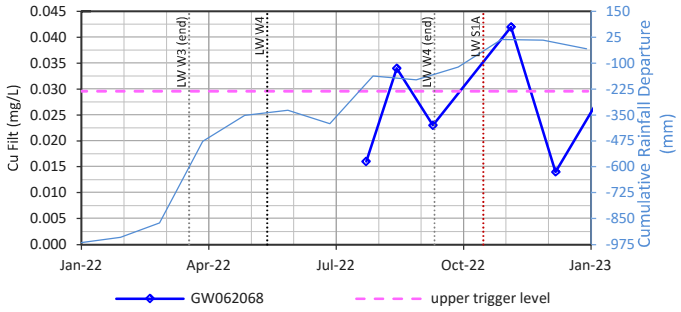

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

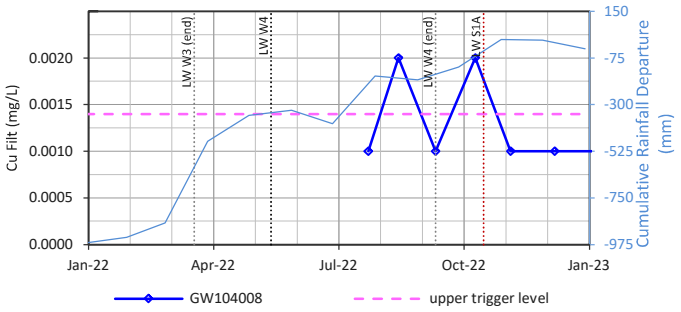

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

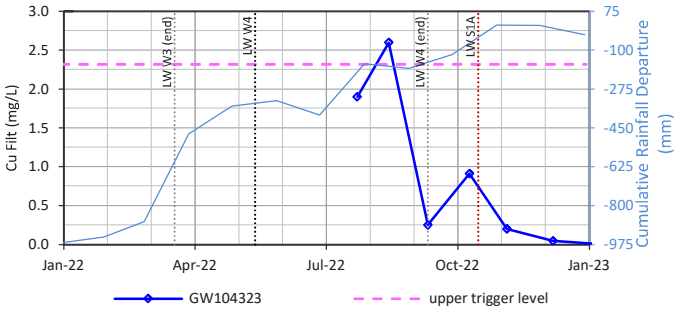

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

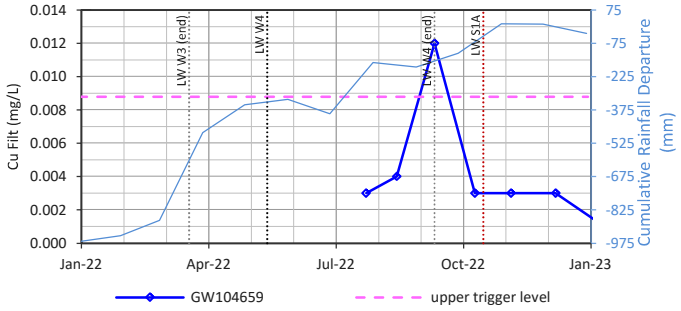

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

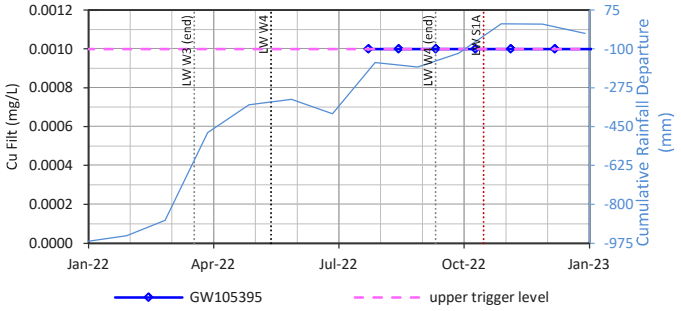

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

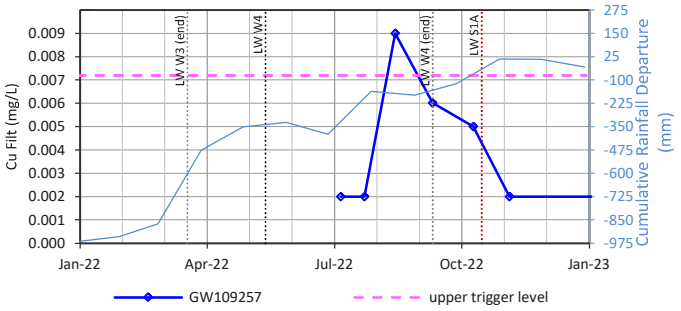


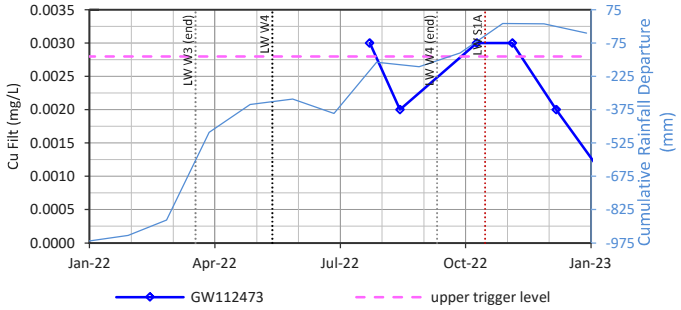




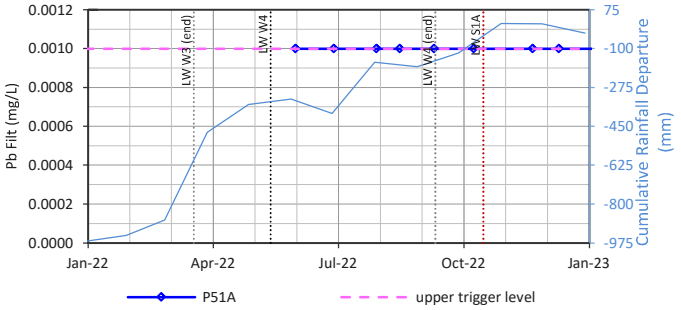


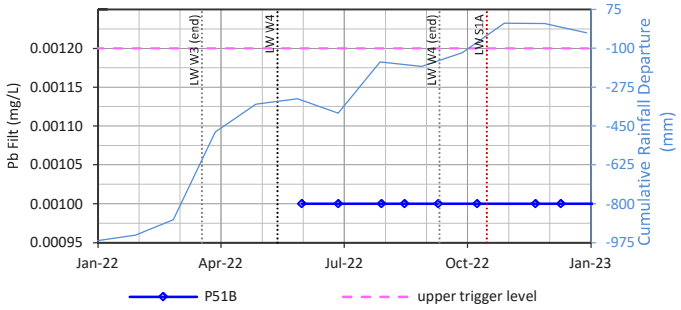


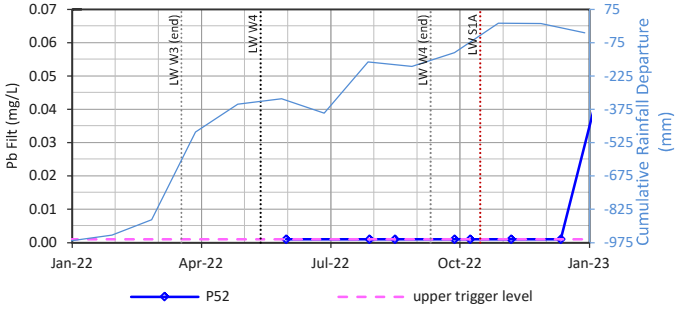


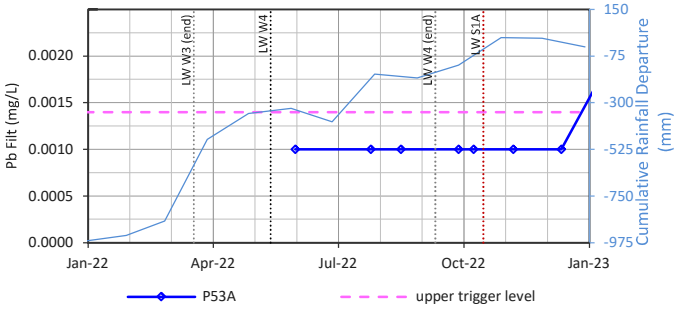


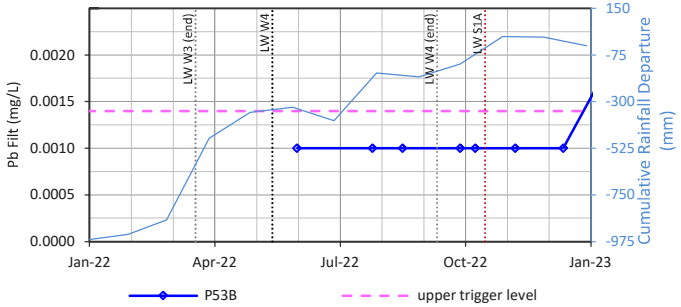
No Data Available for Cu Filt (mg/L)

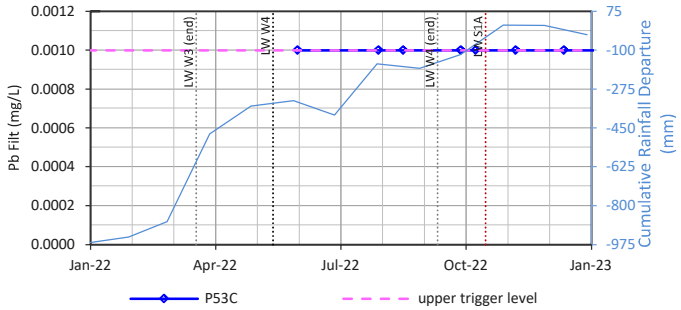


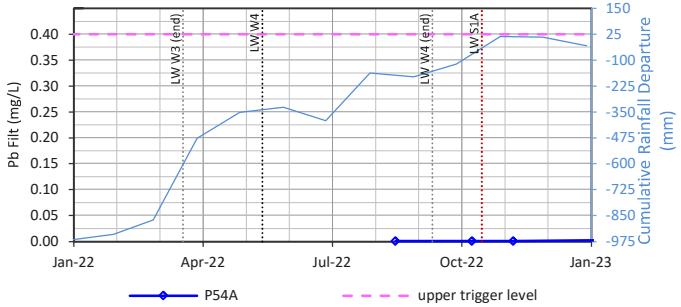


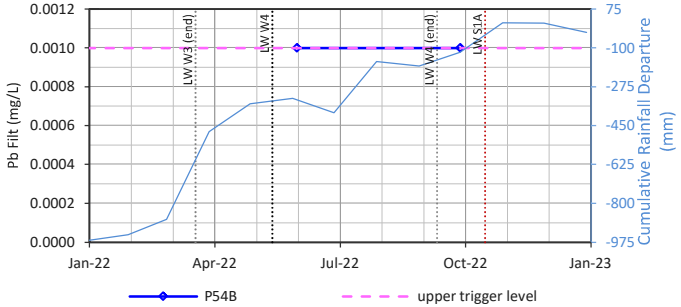


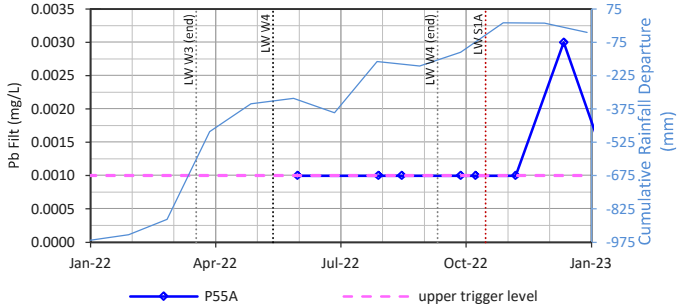


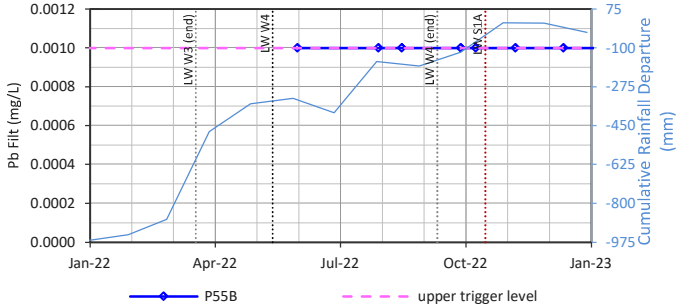

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

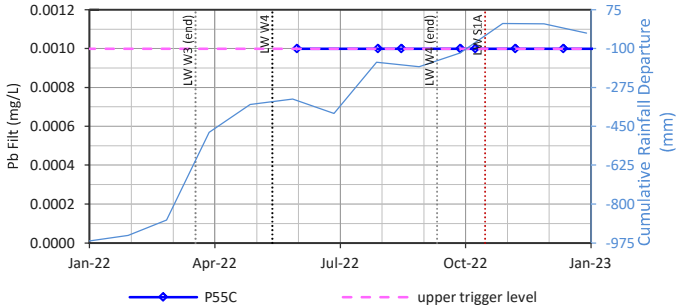

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

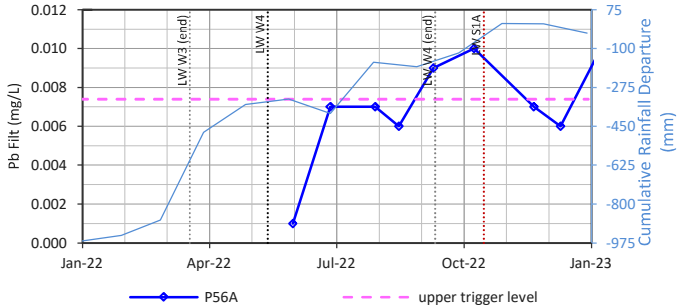

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

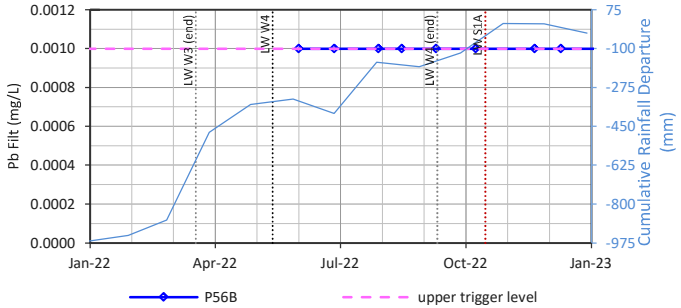

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

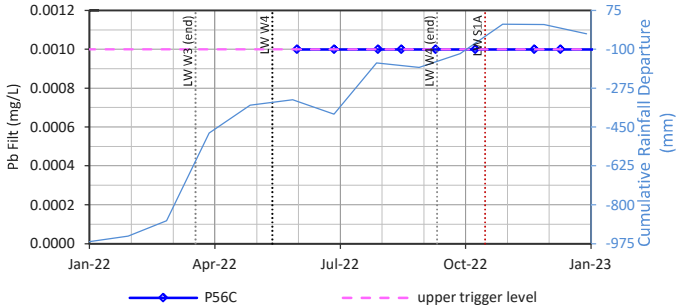

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

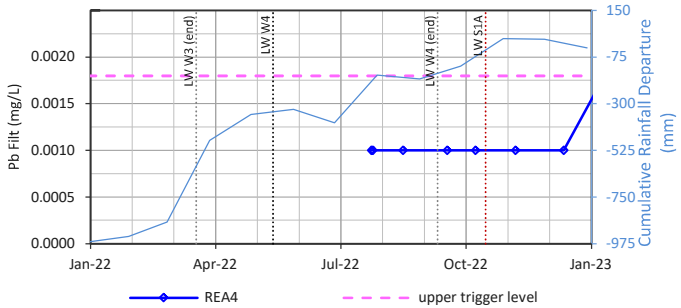

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

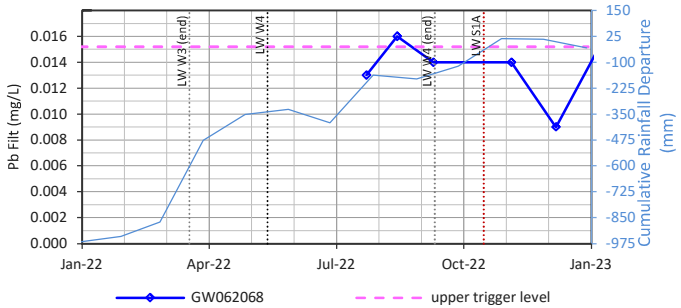

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

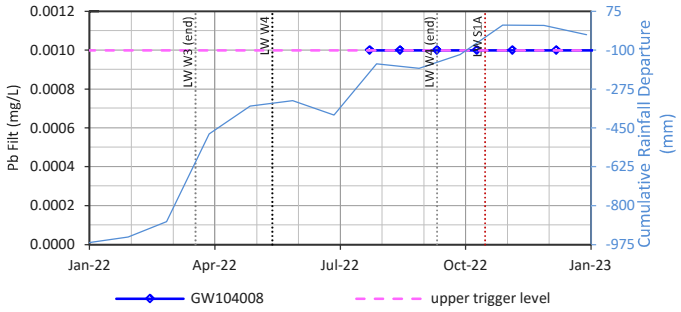

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

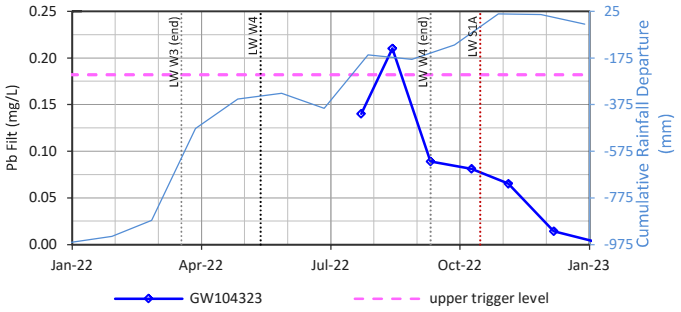

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

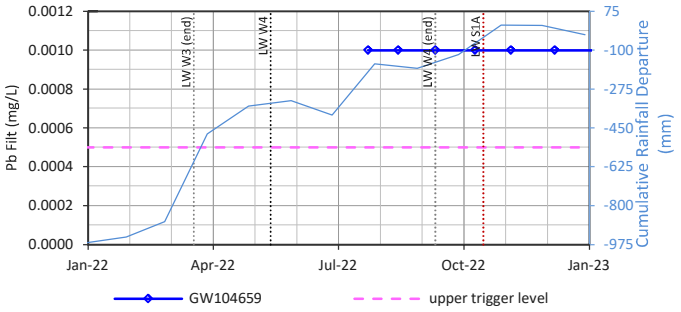

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

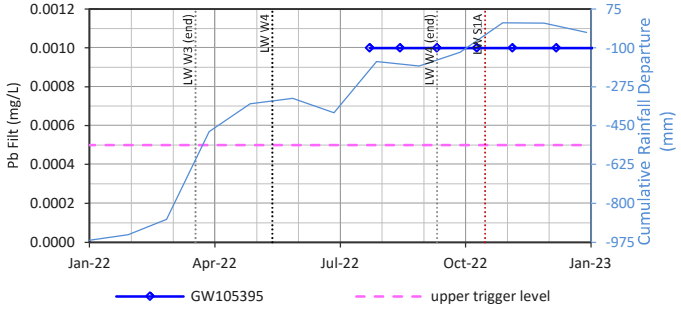

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

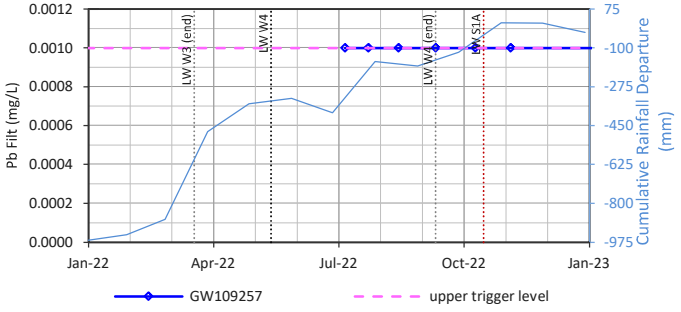

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

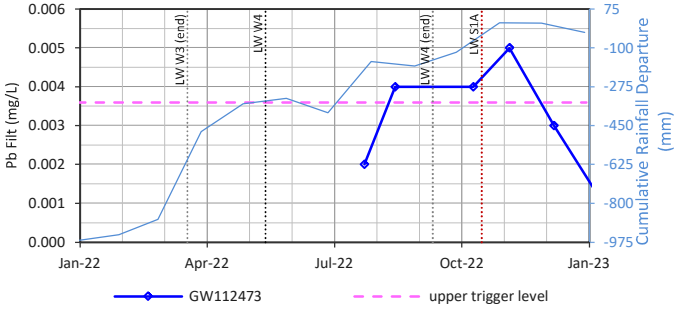




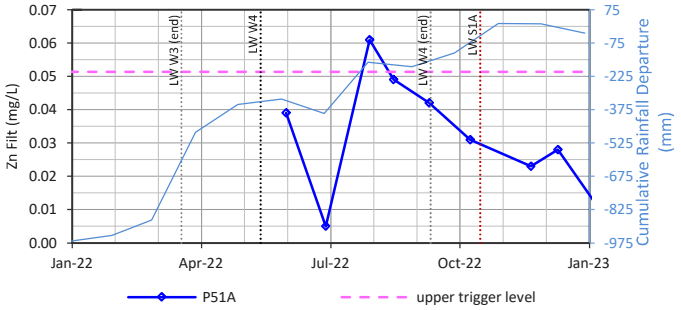


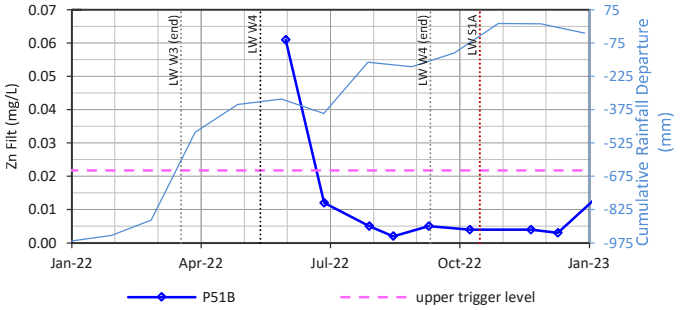


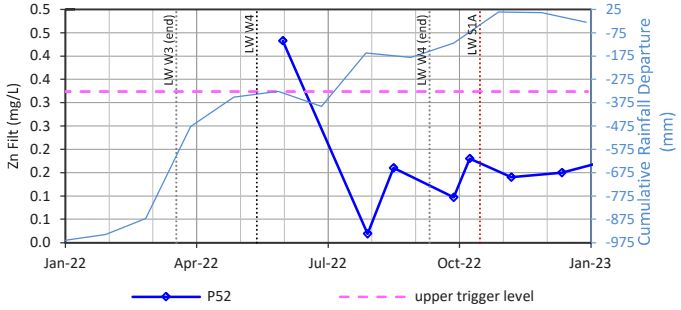


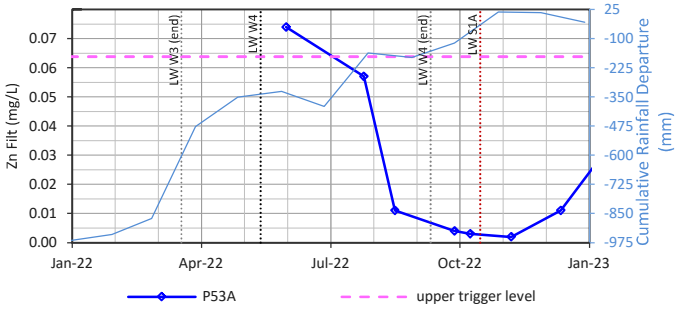


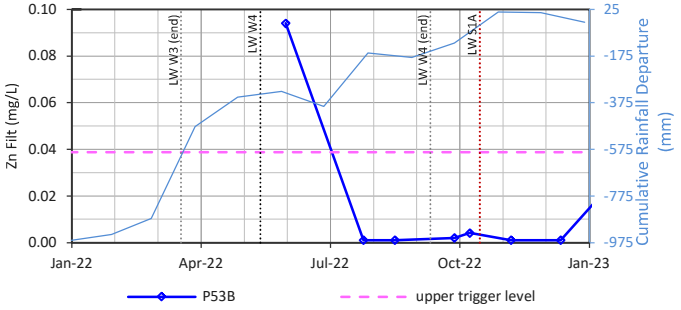
No Data Available for Pb Filt (mg/L)

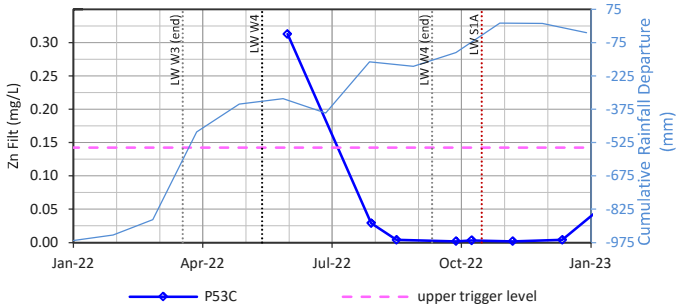


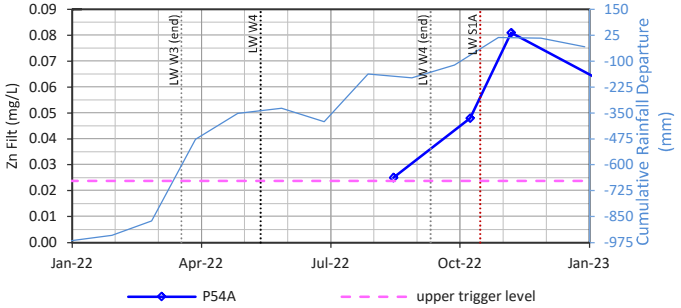


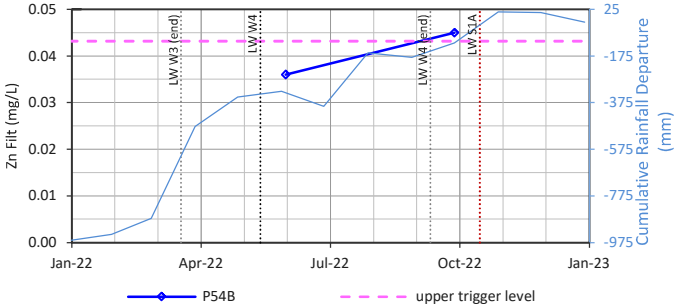


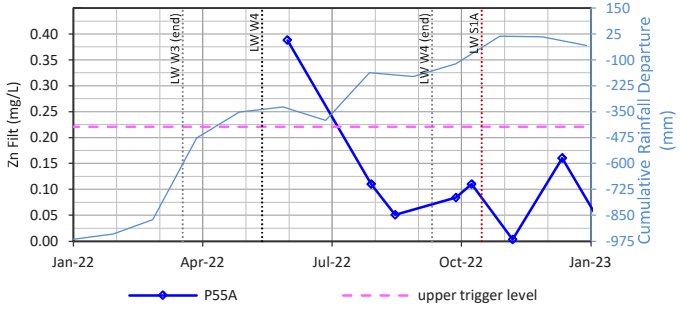


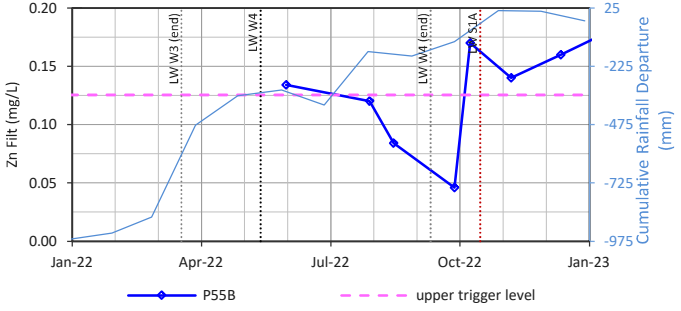


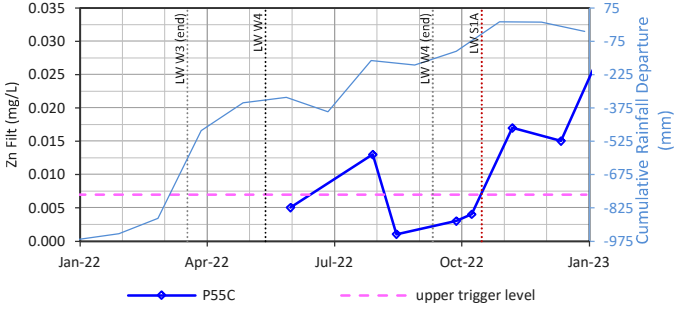

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

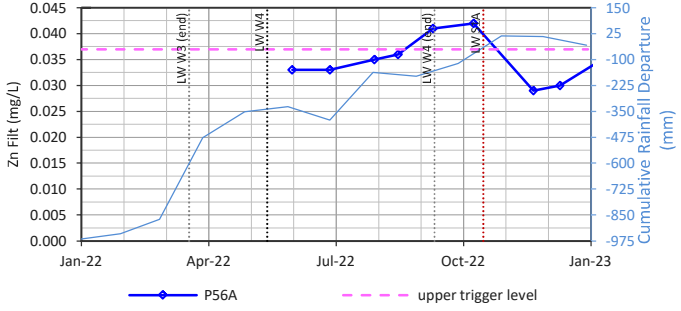

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

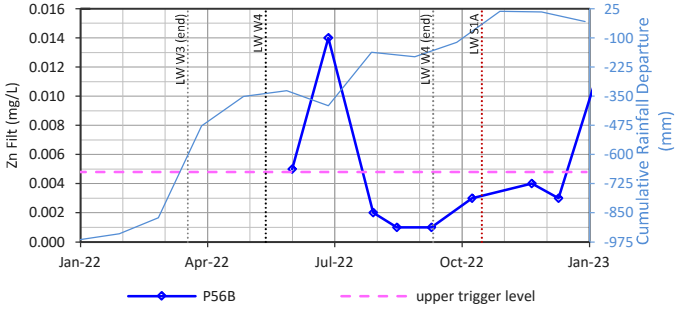

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

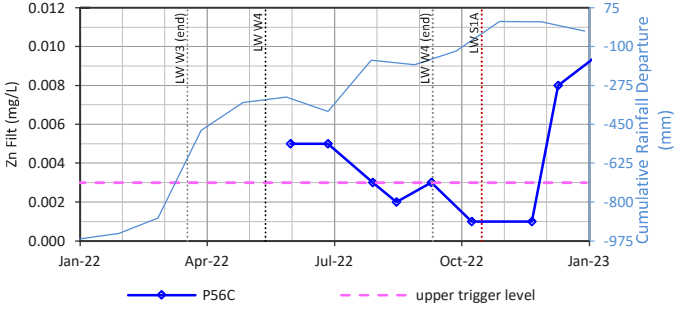

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

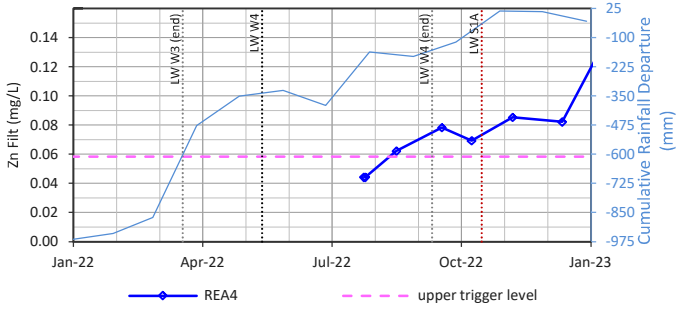

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

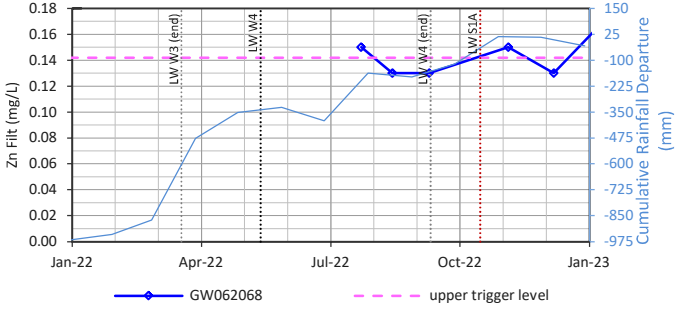

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

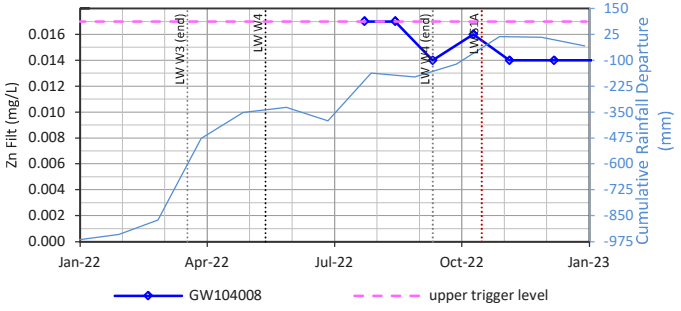

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

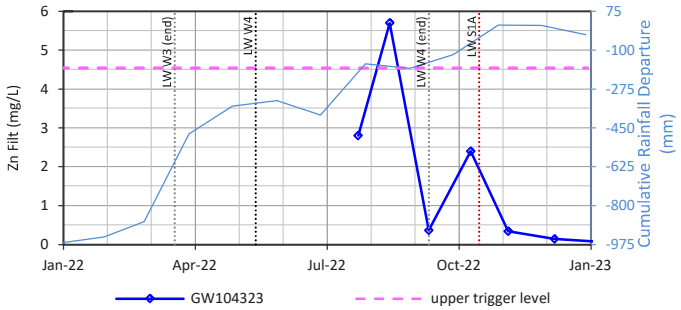

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

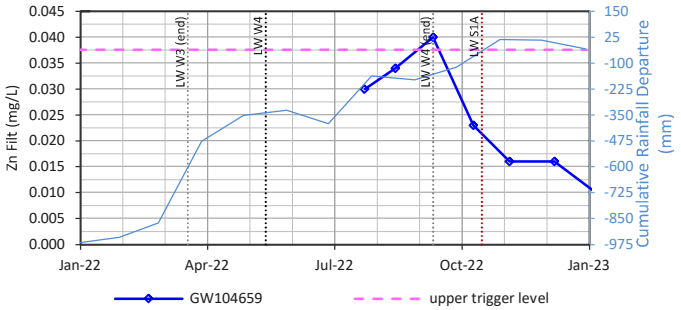

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

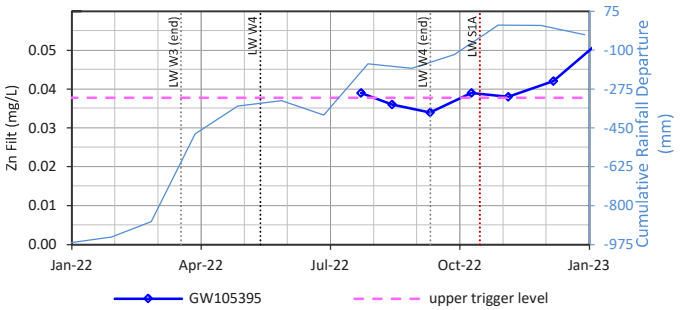

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

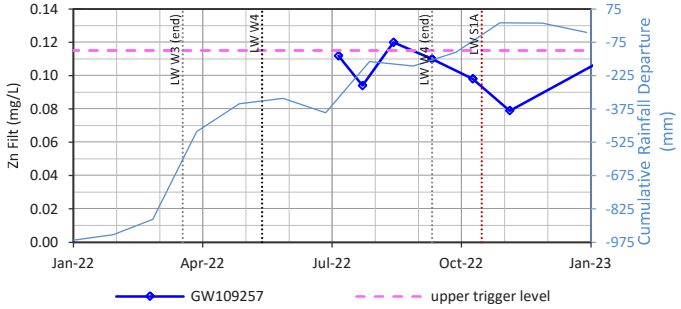

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

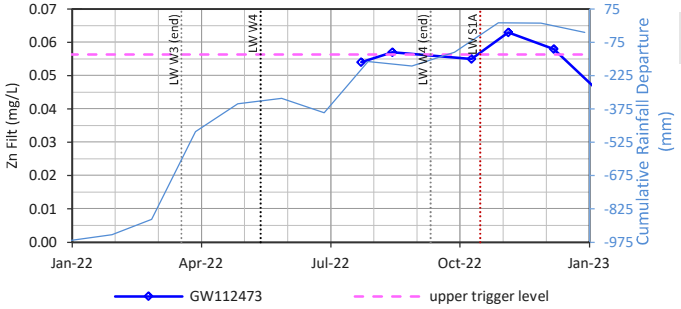

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level



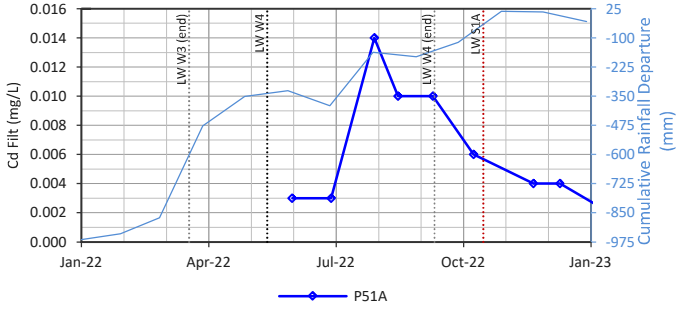


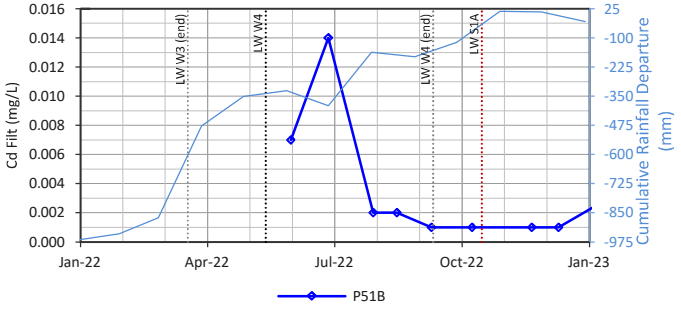


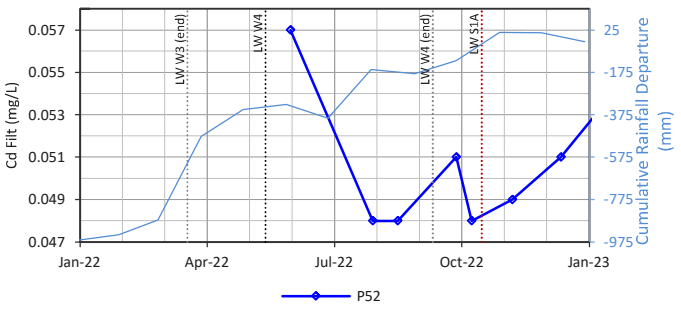


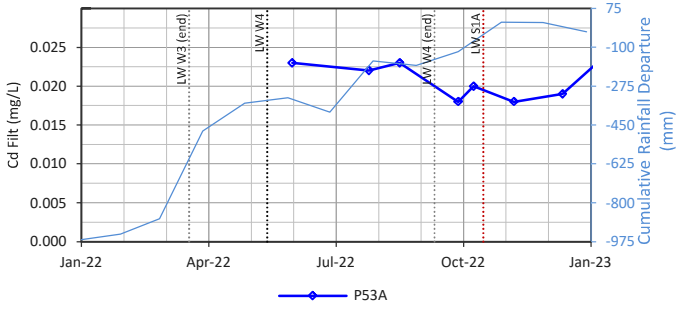


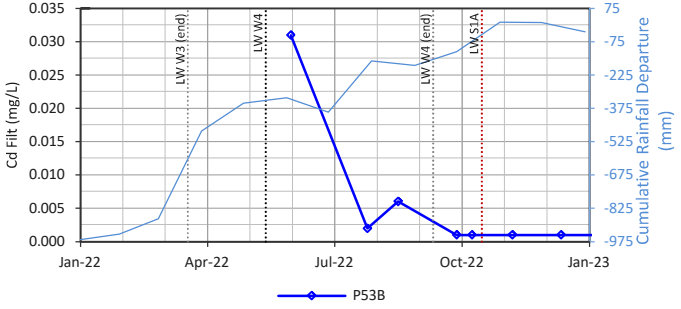
No Data Available for Zn Filt (mg/L)

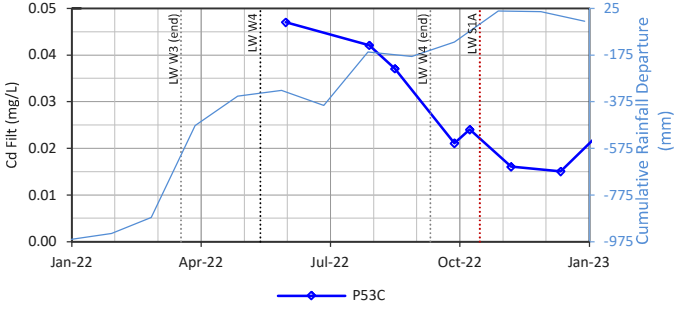


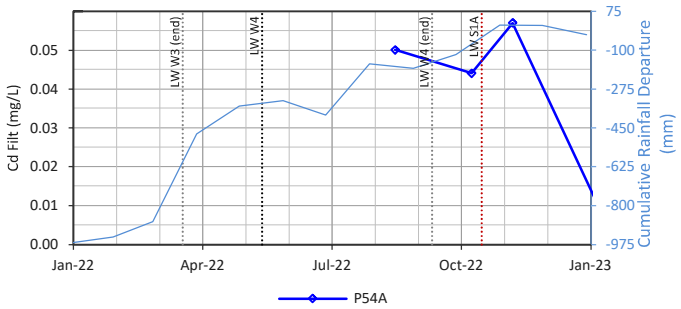


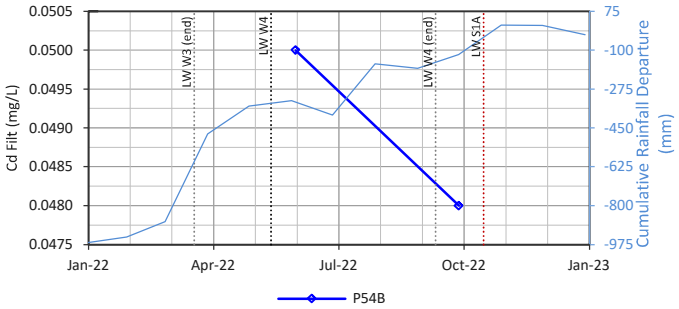


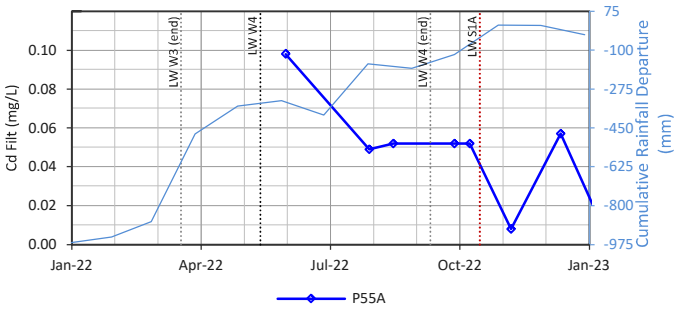


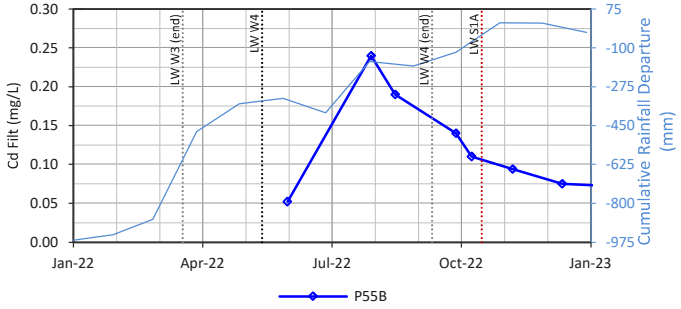


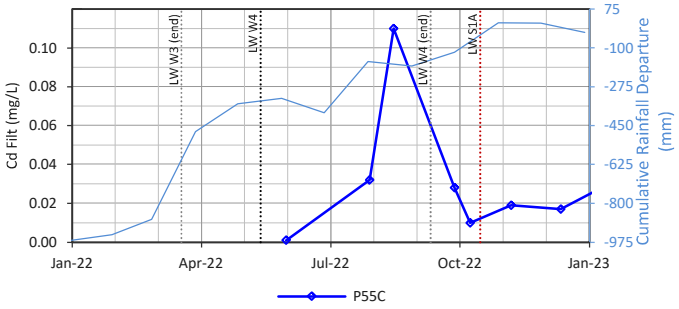


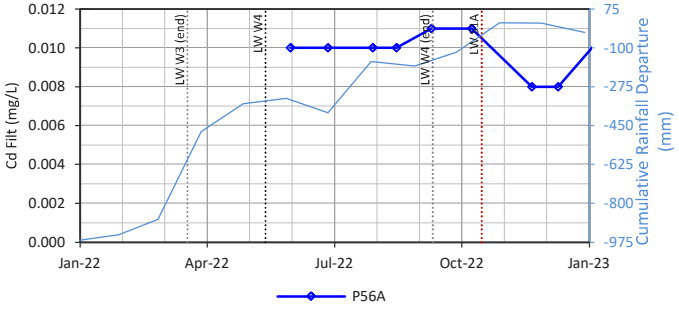

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A

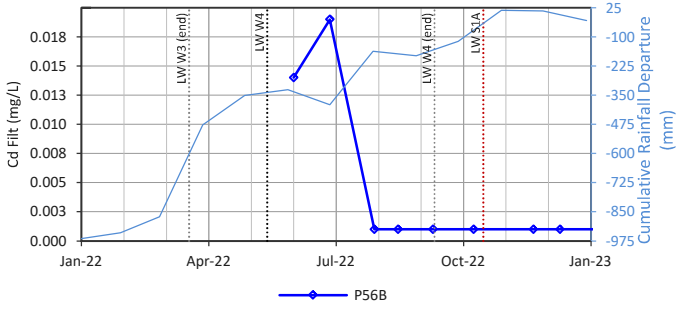

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B

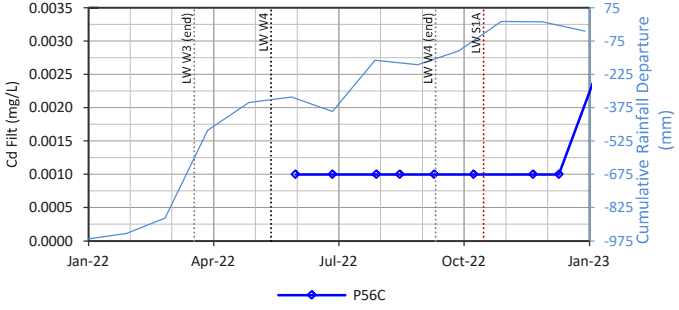

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A

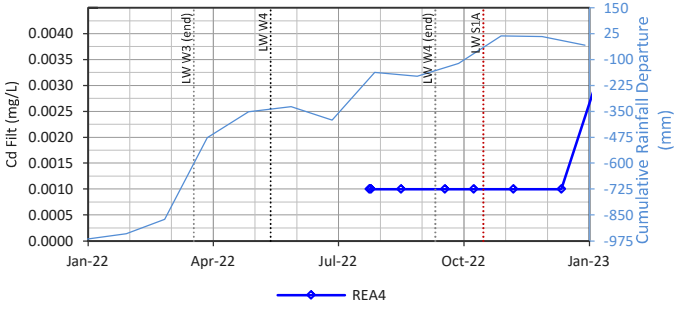

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B

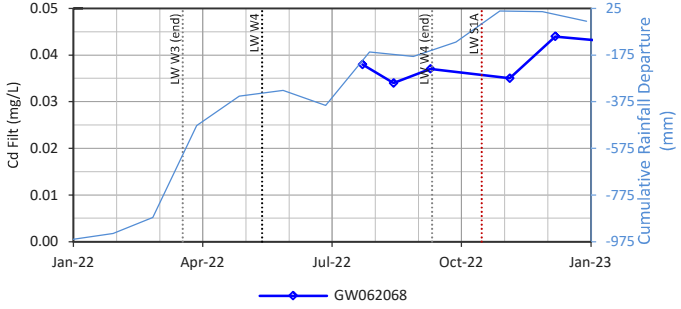

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C

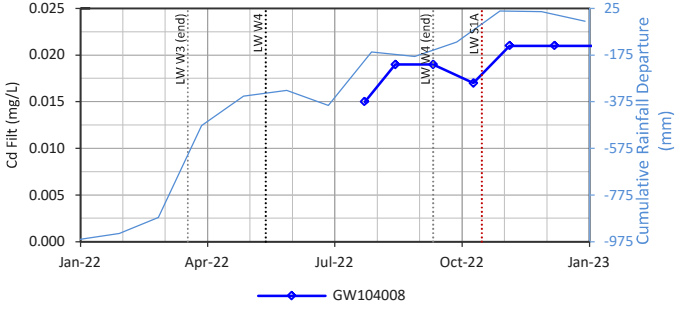

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A

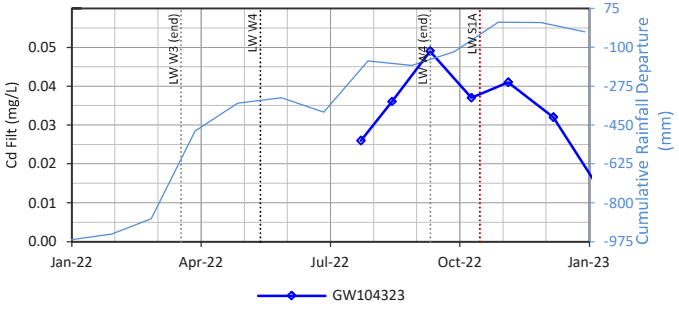

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B

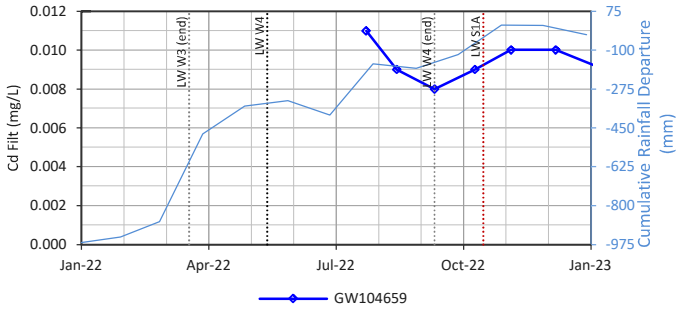

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C

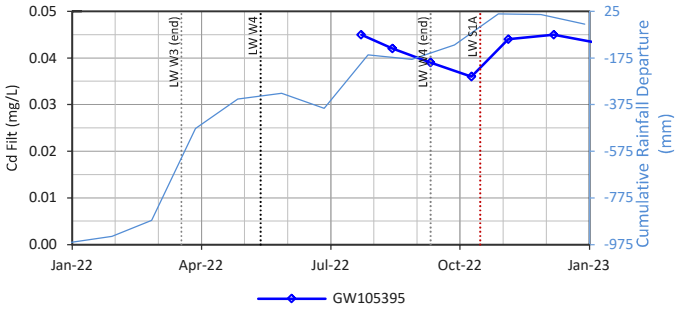

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4

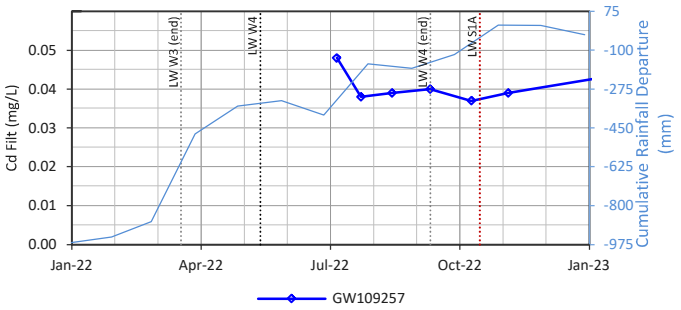

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068

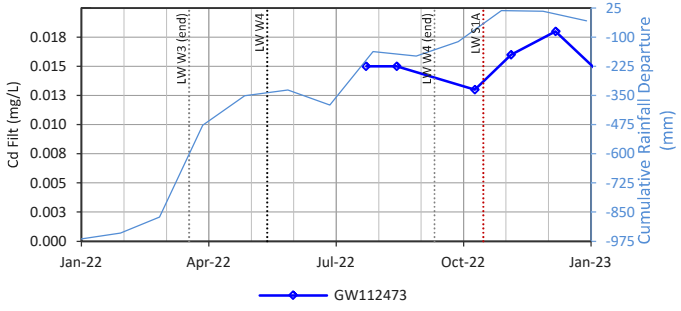

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323

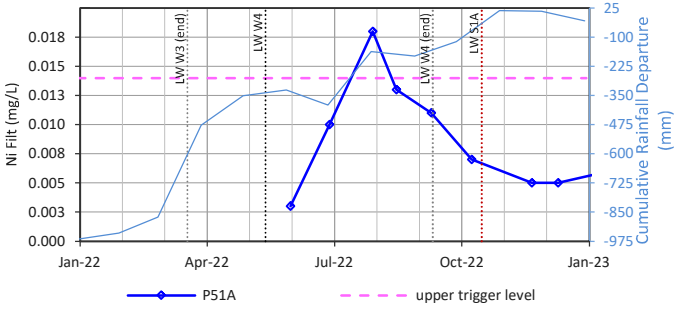


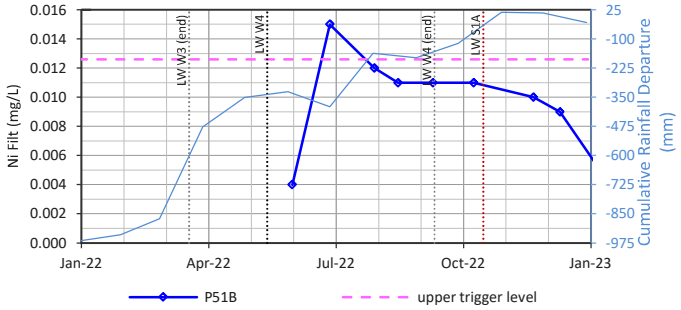


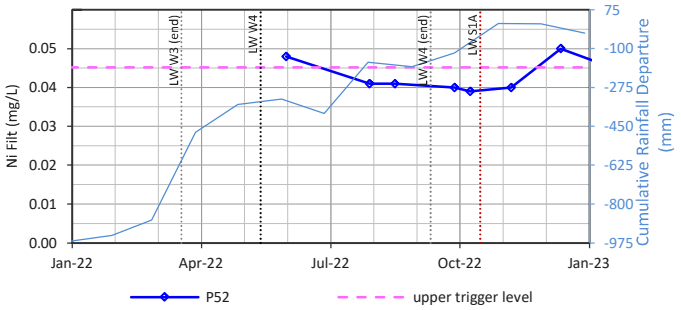


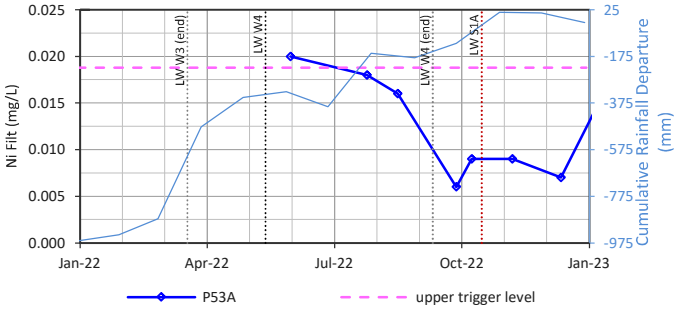


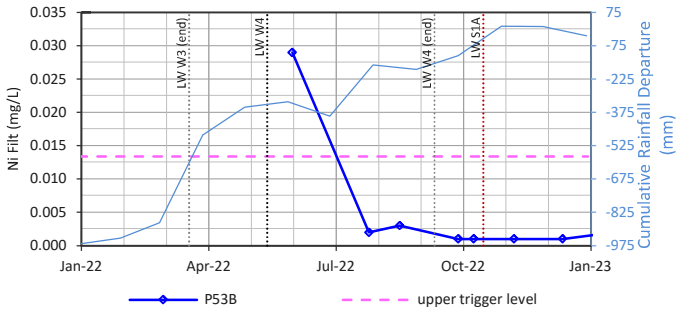
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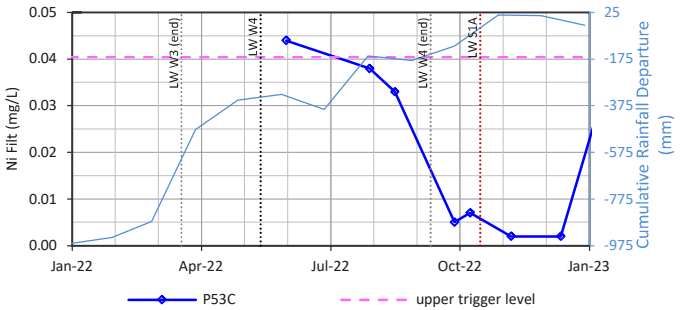


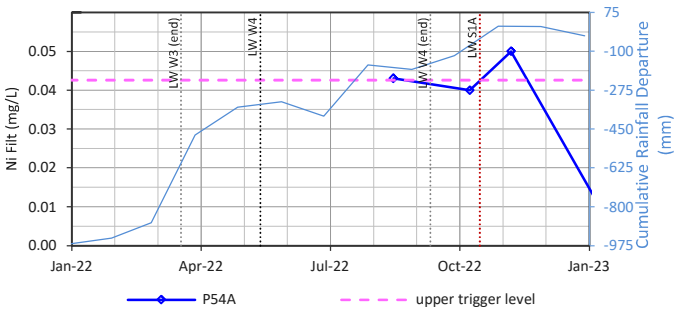


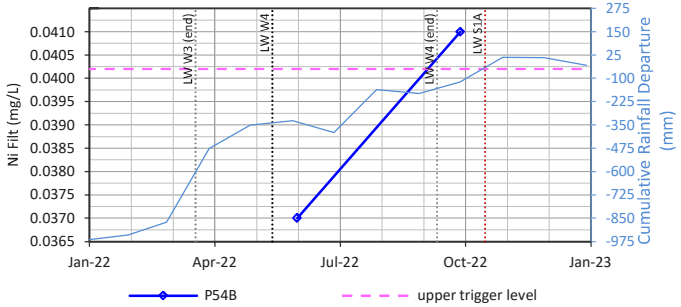


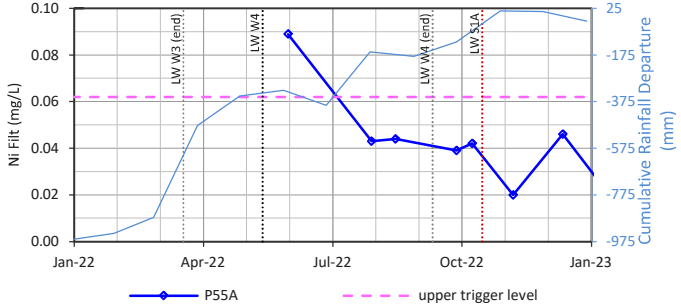


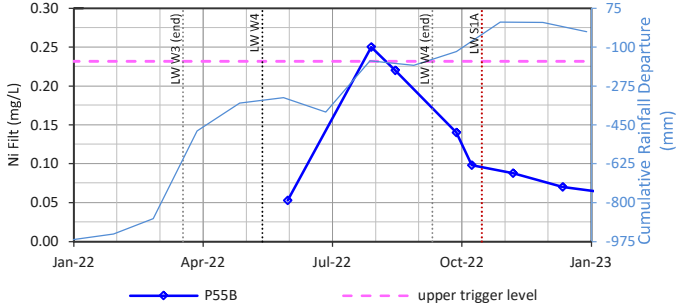


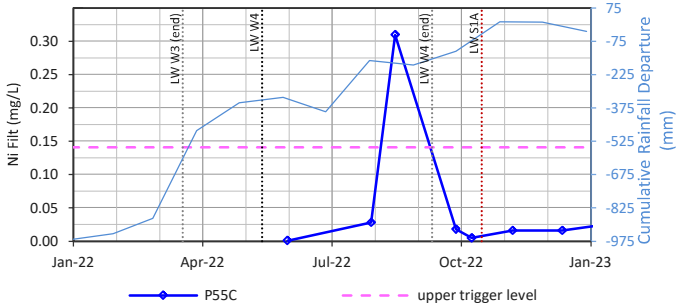


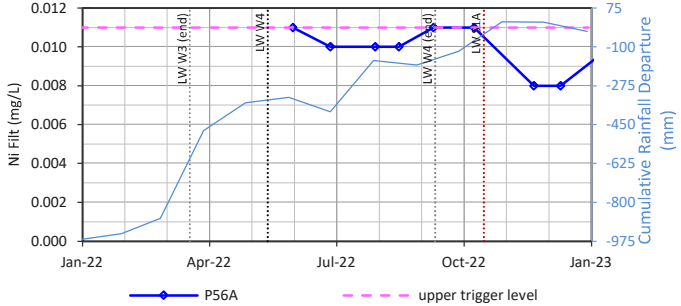


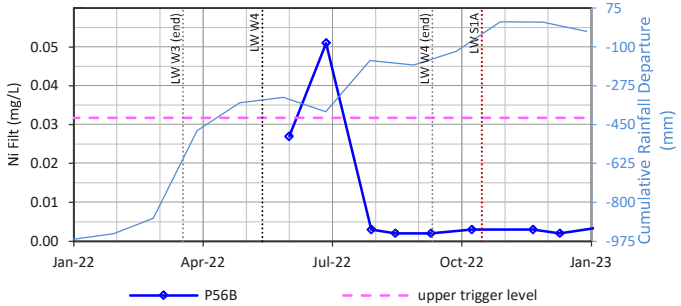

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

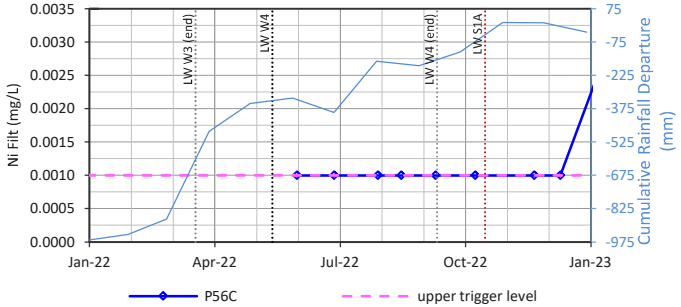

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

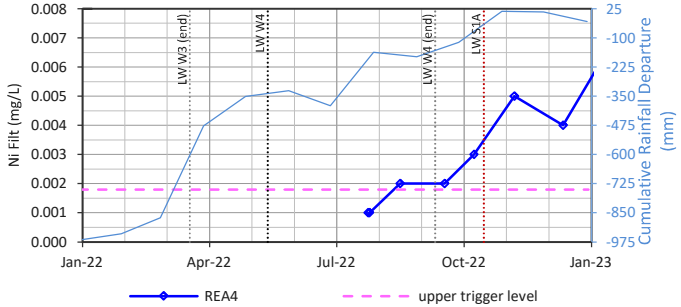

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

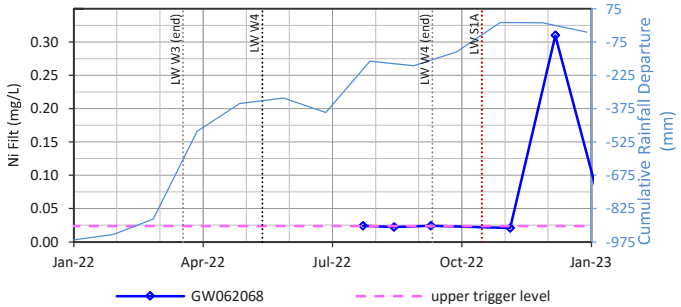

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

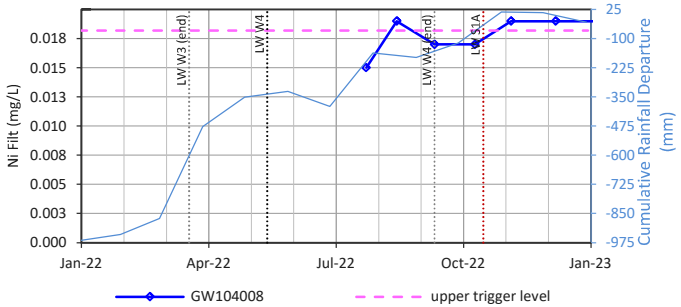

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

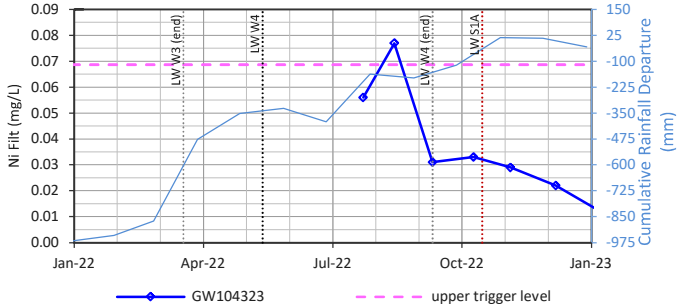

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

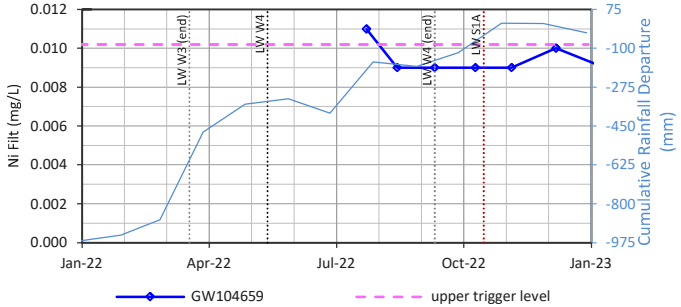

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

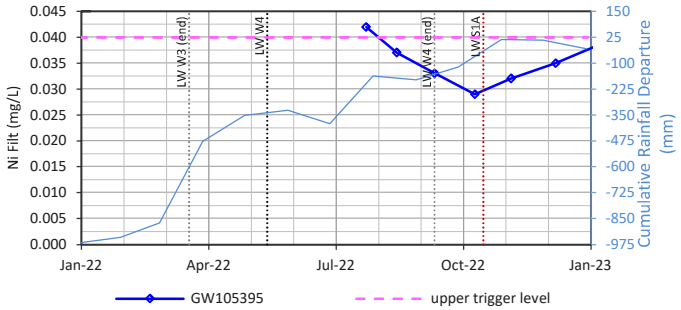

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

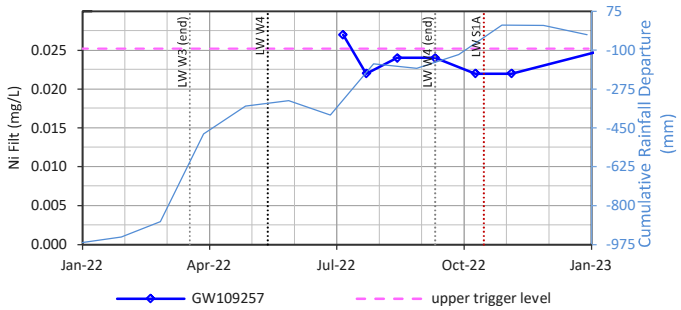

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

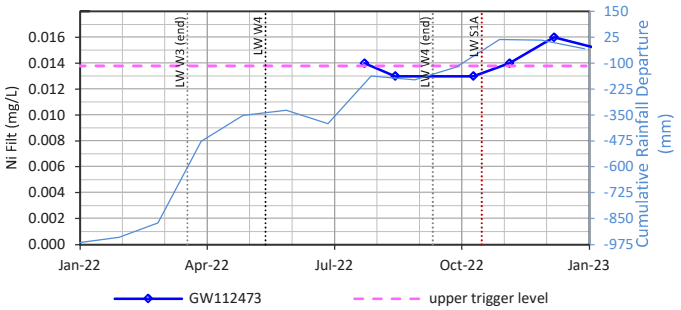

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level


Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323
upper trigger level

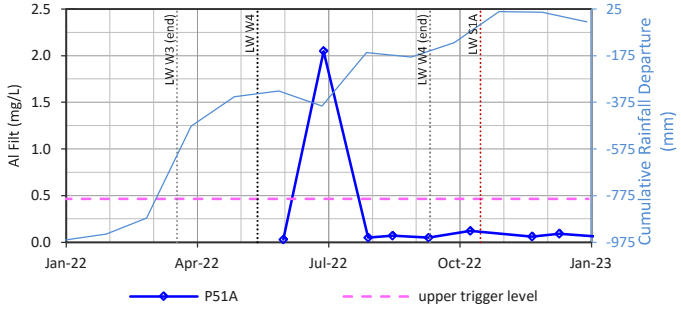

Ni Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104659
upper trigger level

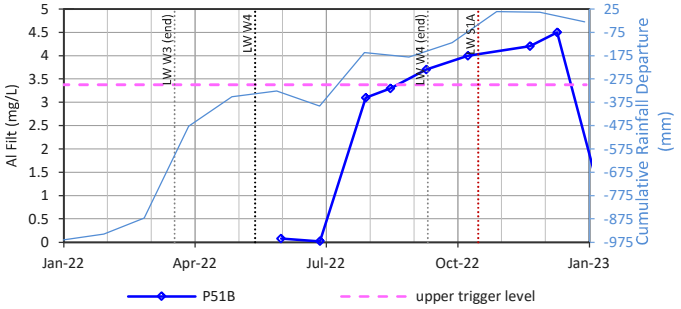


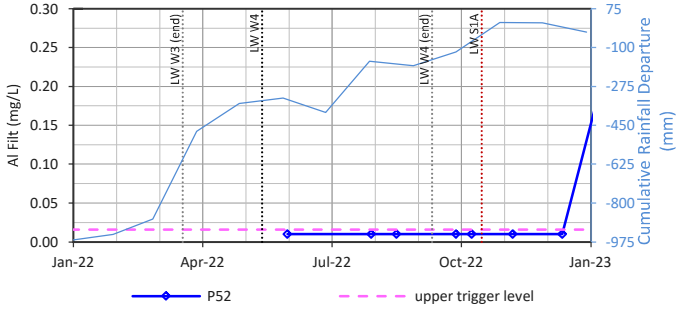


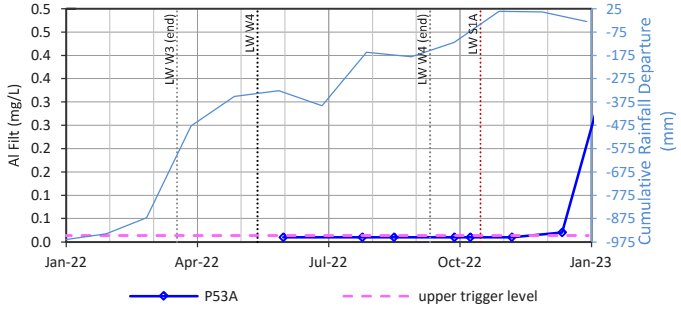


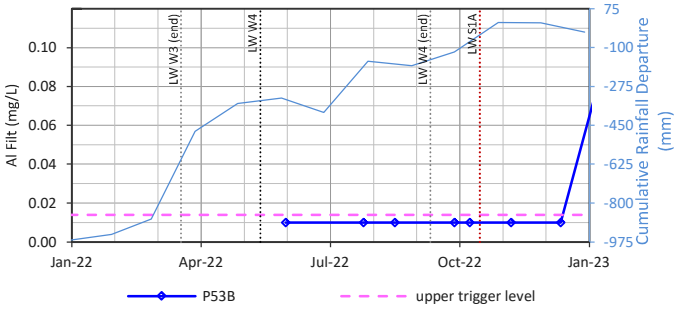
No Data Available for Ni Filt (mg/L)

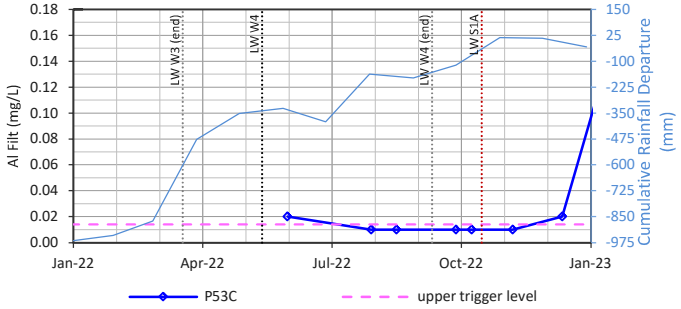


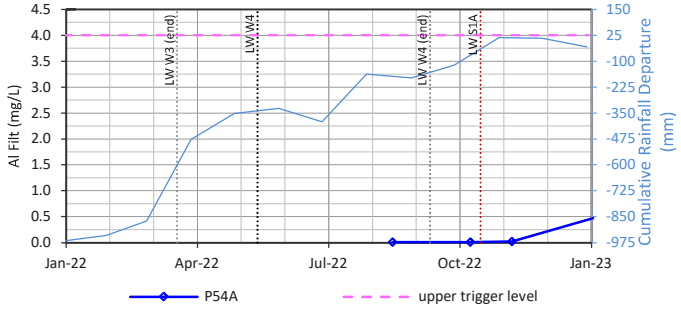


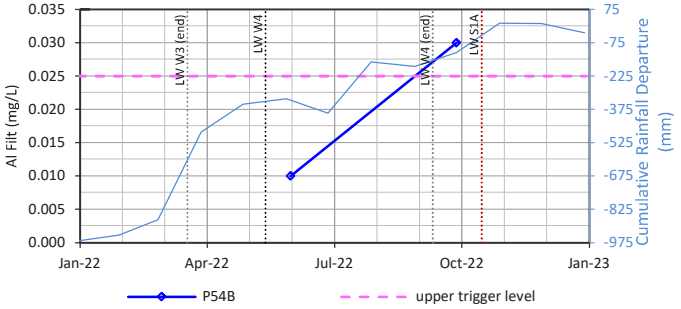


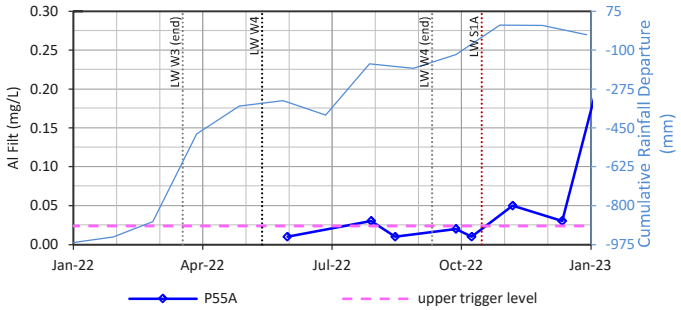


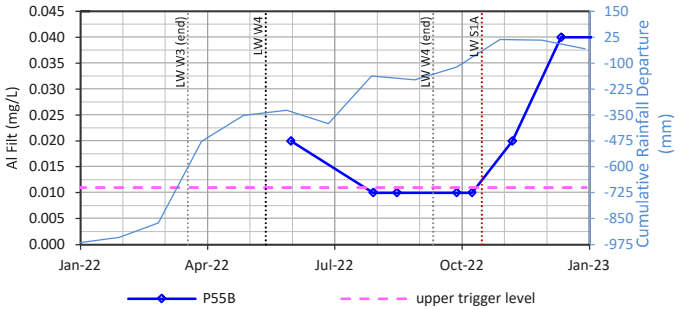


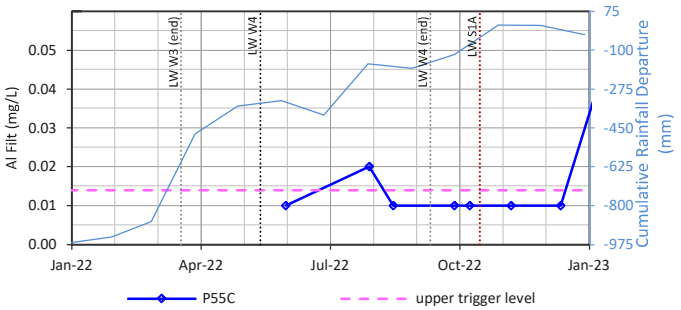


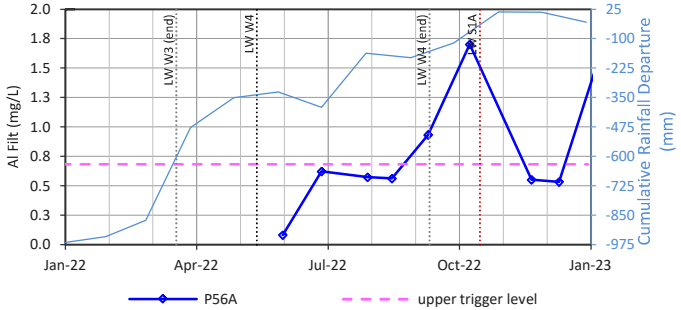


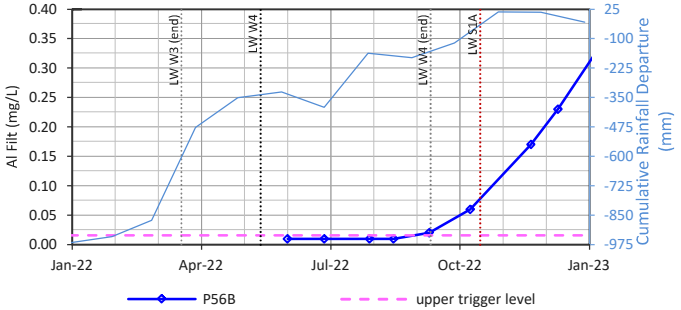


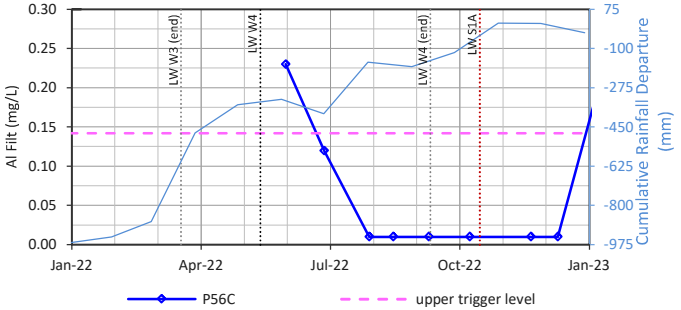

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

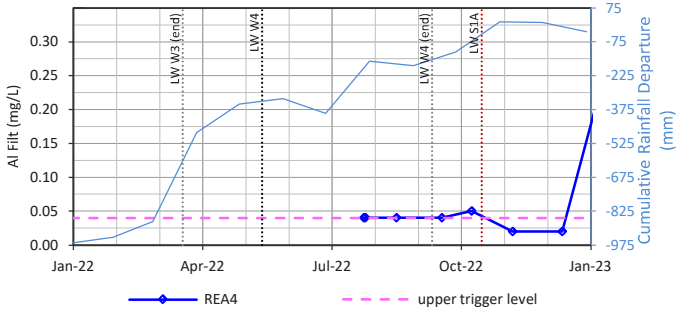

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

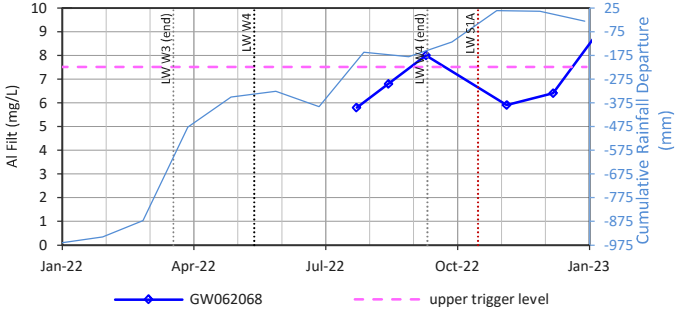

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

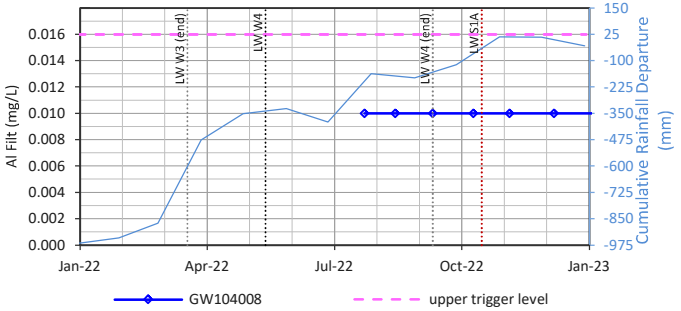

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

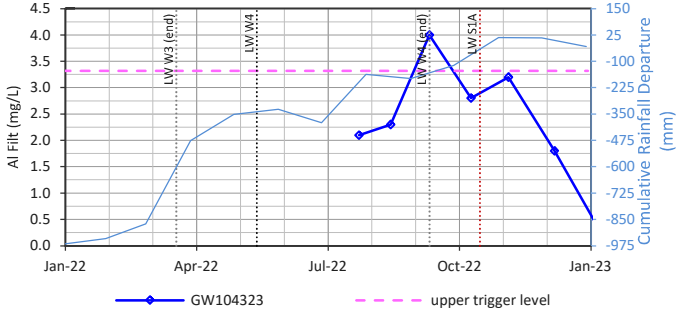

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

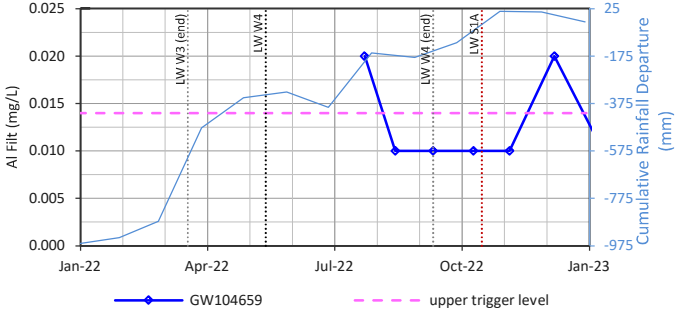

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

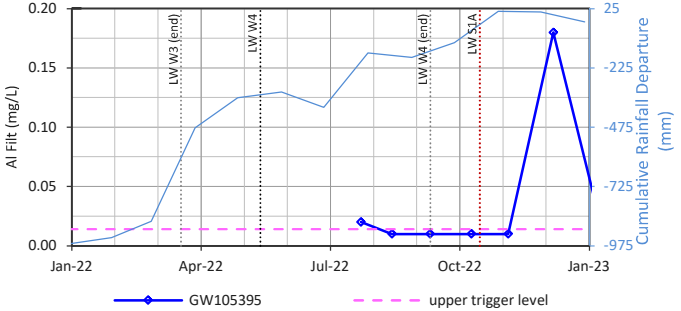

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

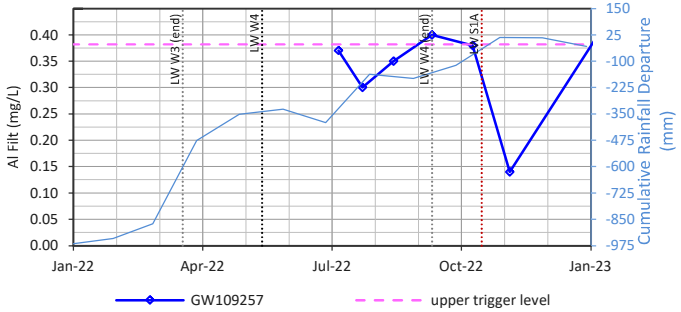

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

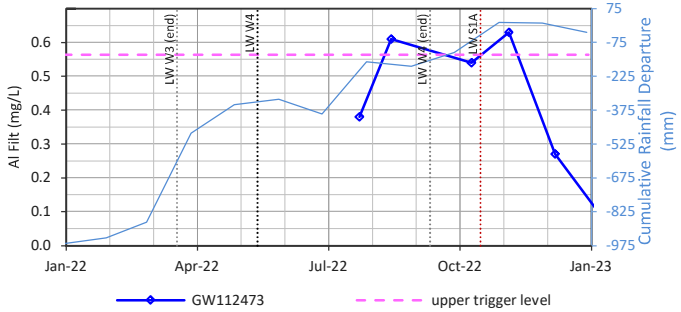

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level


Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323
upper trigger level

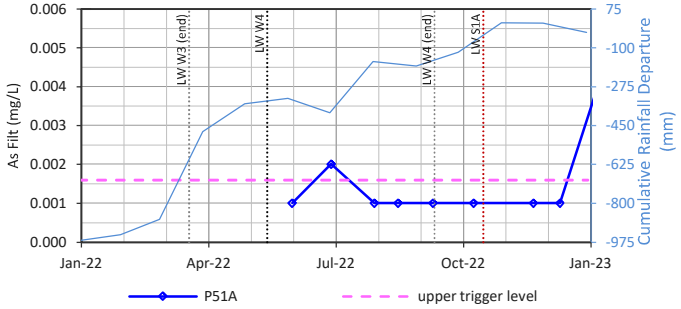

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104659
upper trigger level

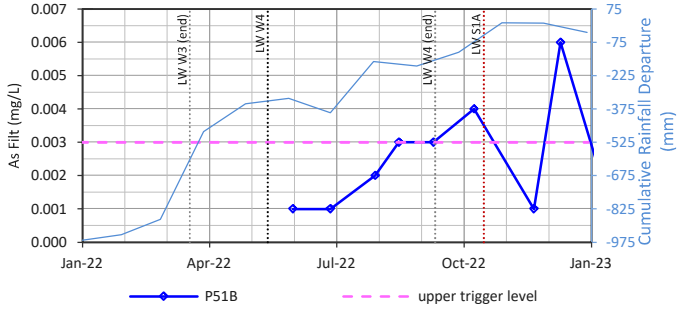

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW105395
upper trigger level

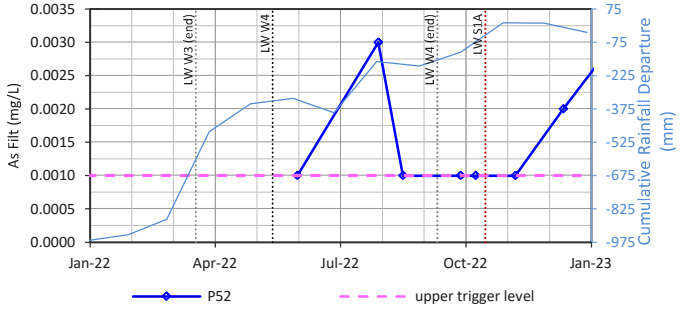


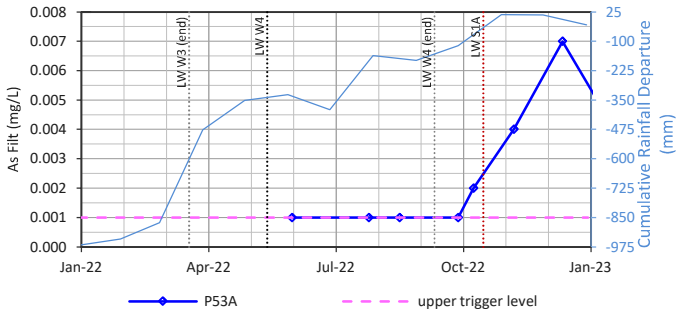


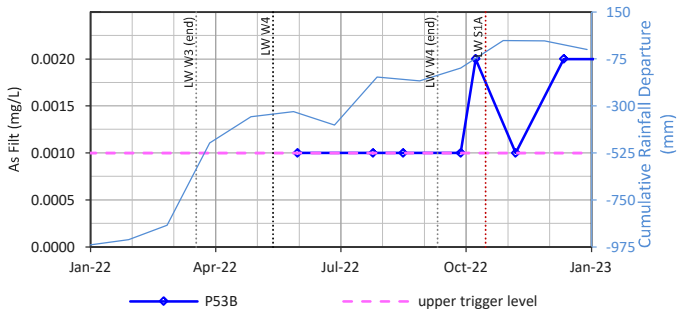
No Data Available for Al Filt (mg/L)

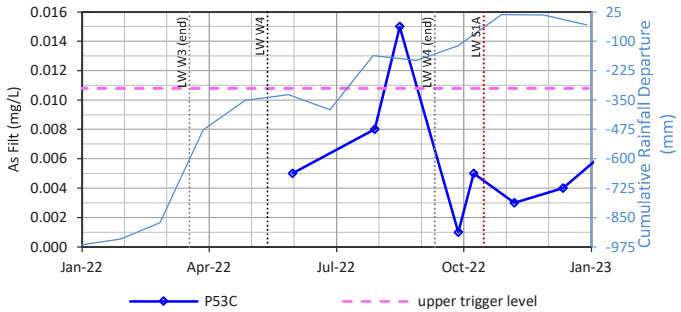


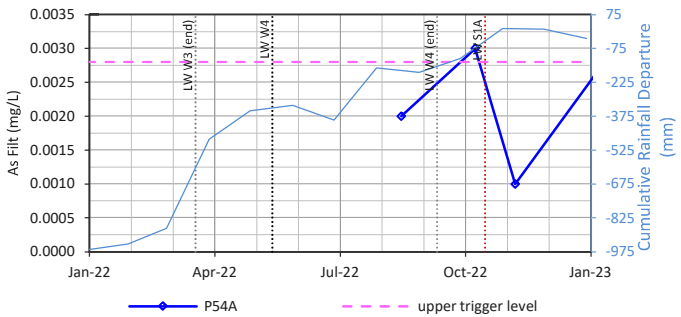


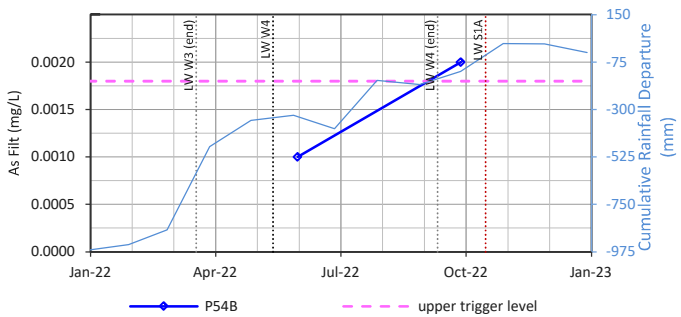


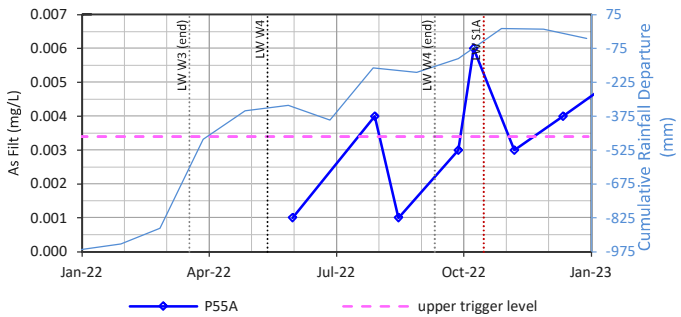


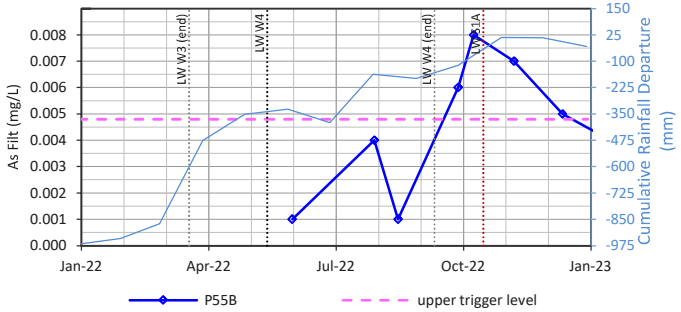


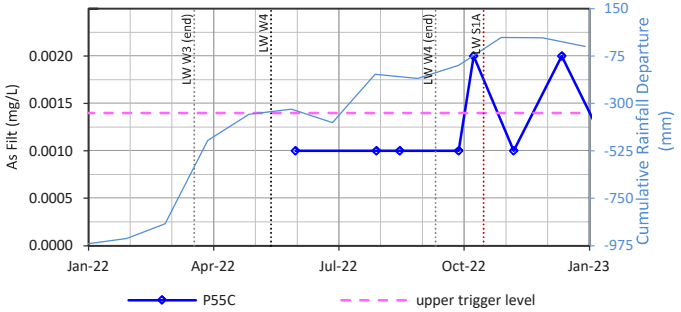


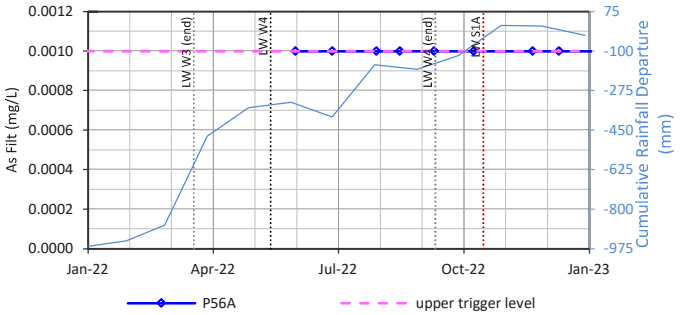


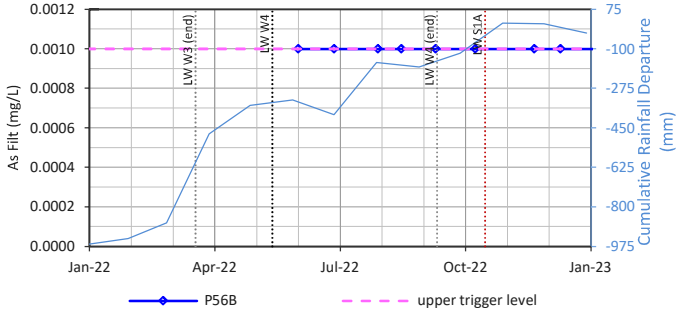


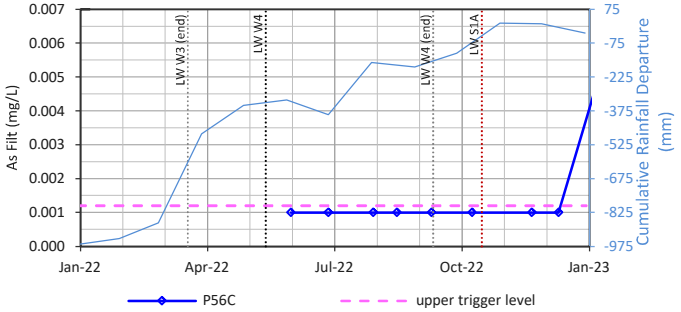


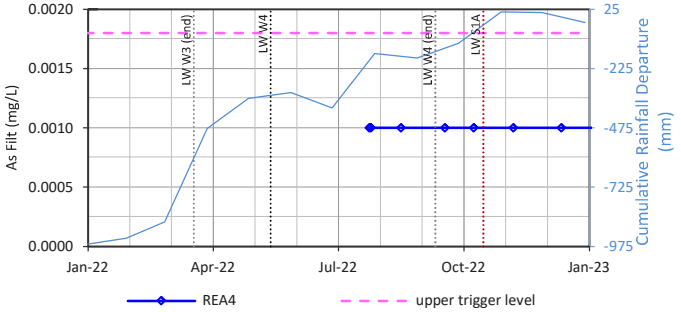

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

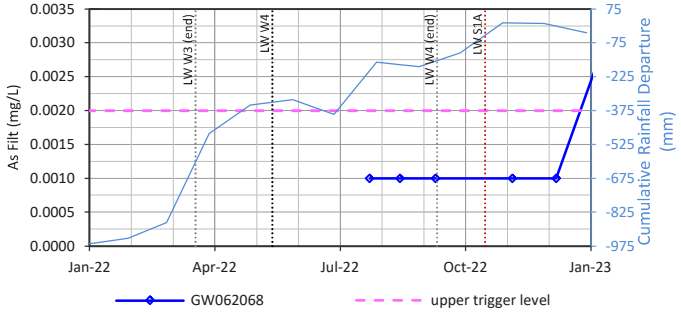

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

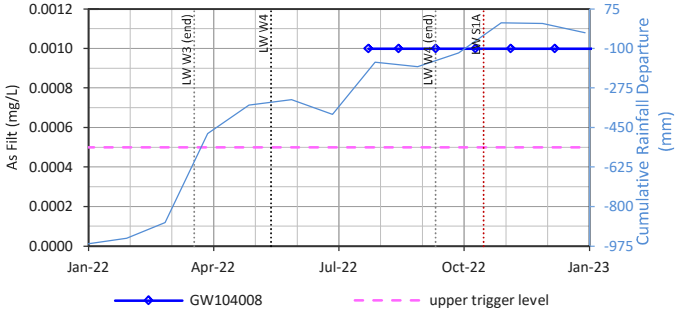

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

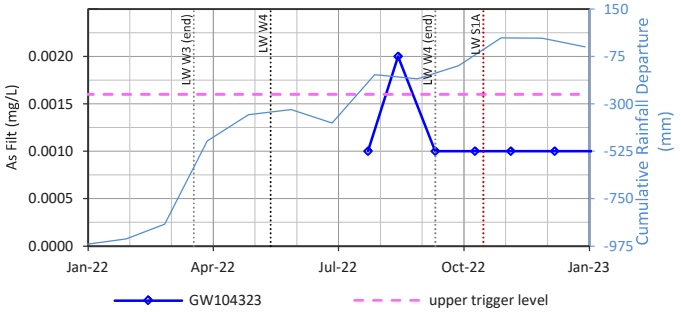

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

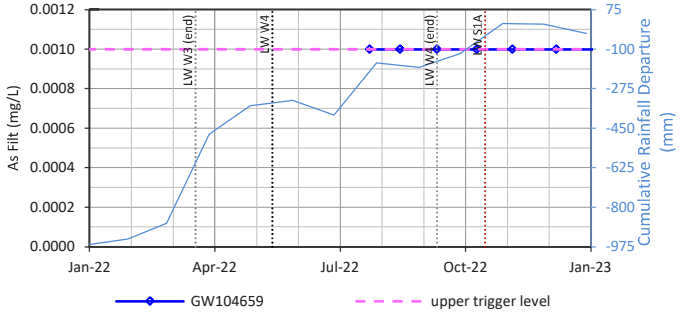

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

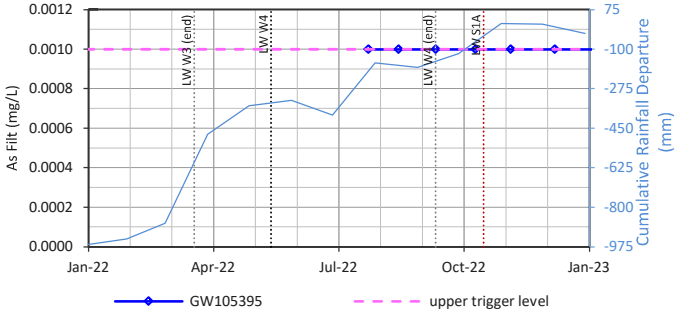

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

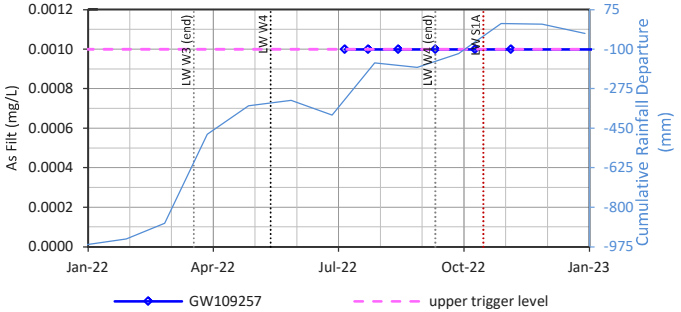

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

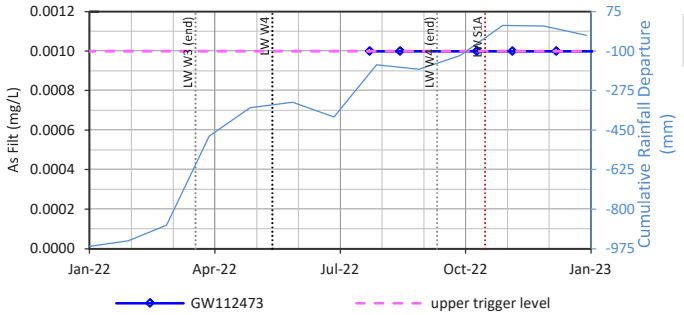

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level


As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323
upper trigger level

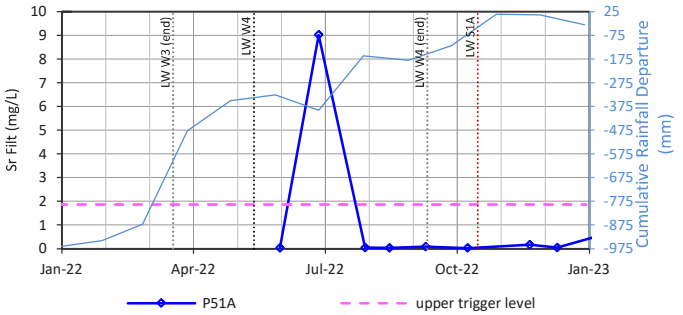

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104659
upper trigger level

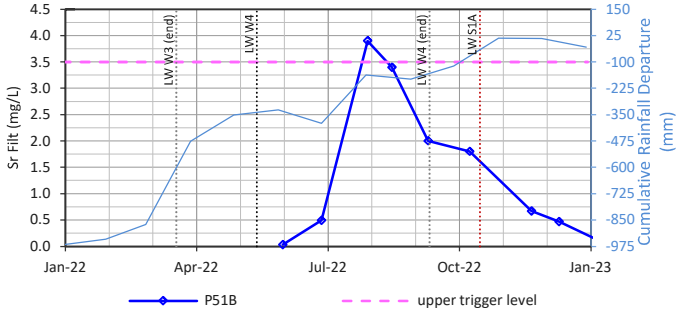

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW105395
upper trigger level

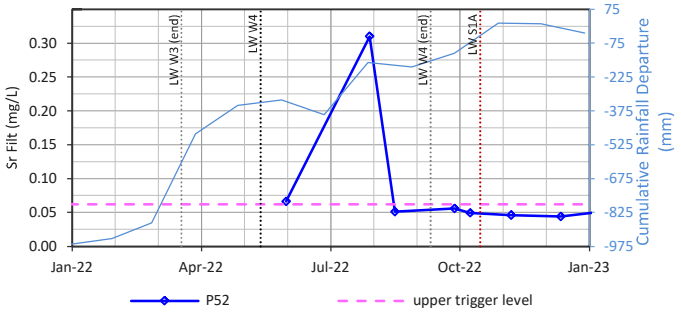

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW109257
upper trigger level

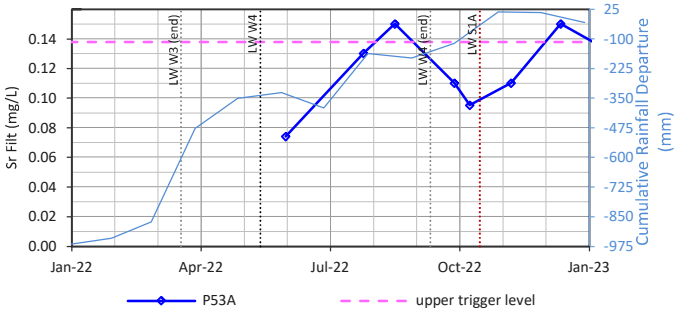


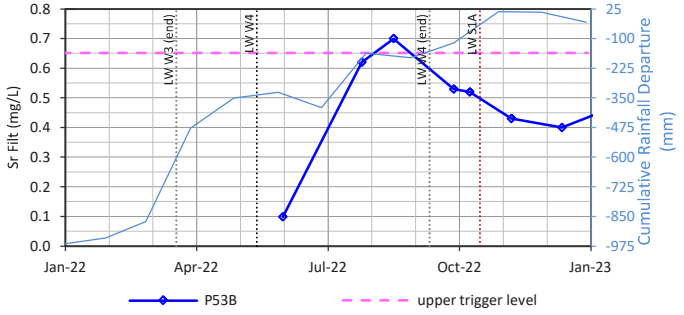
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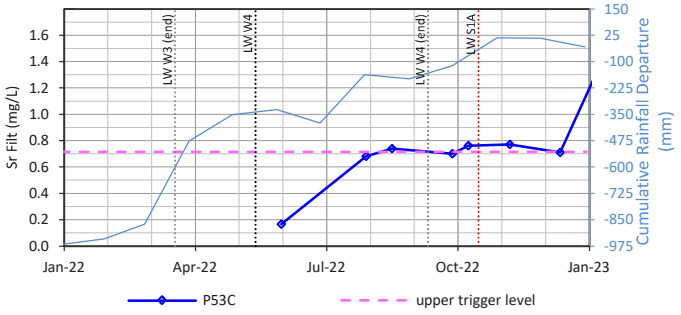


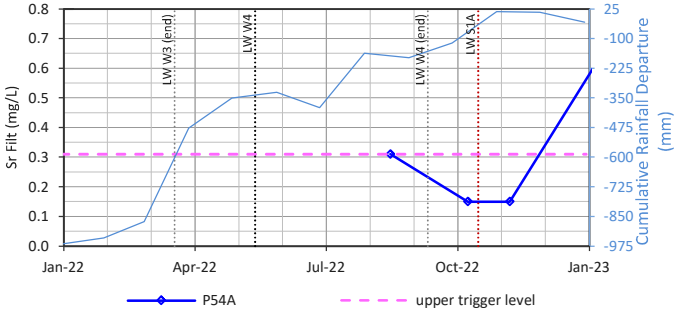


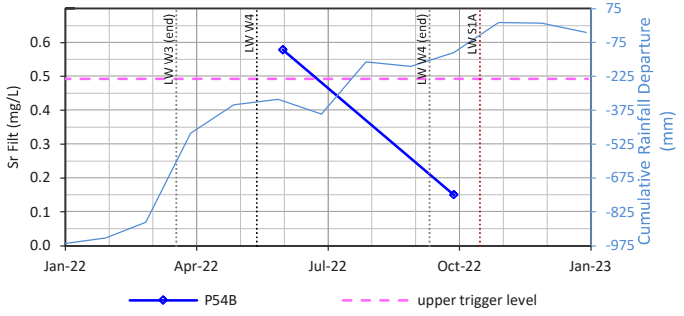


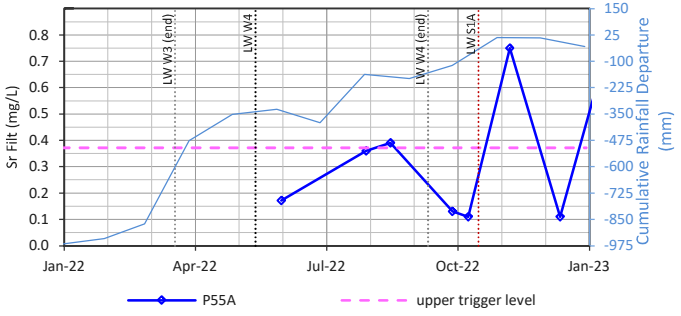


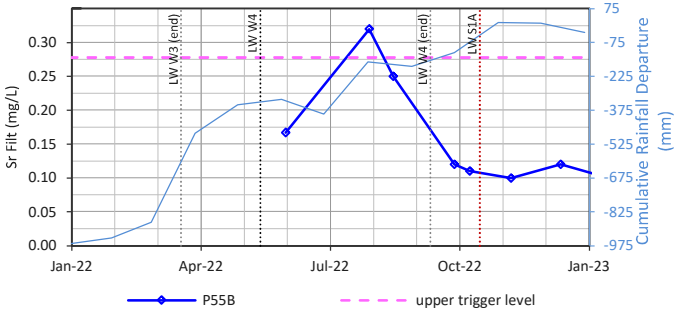


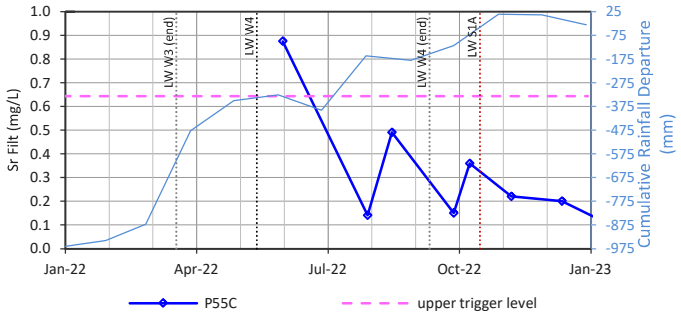


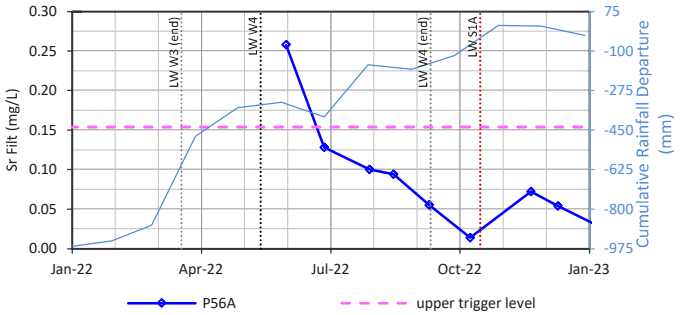


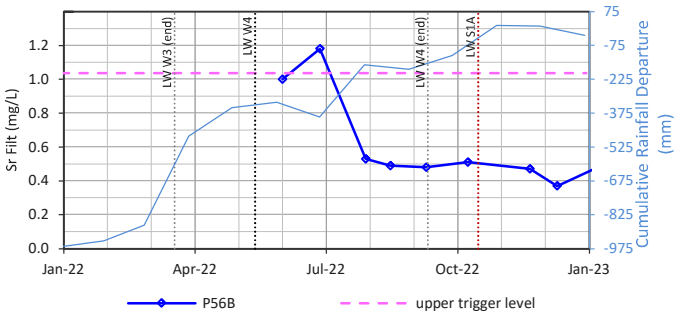


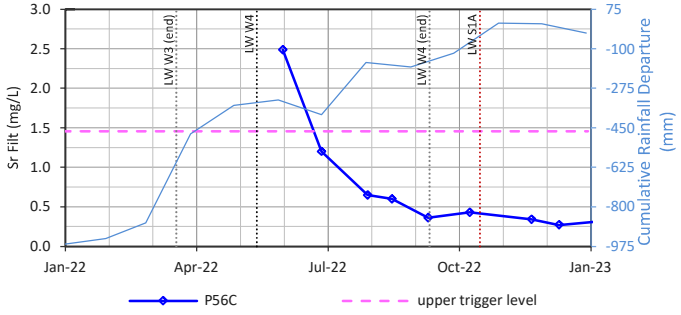


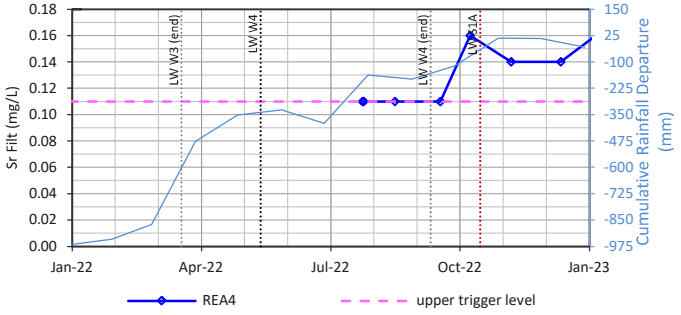


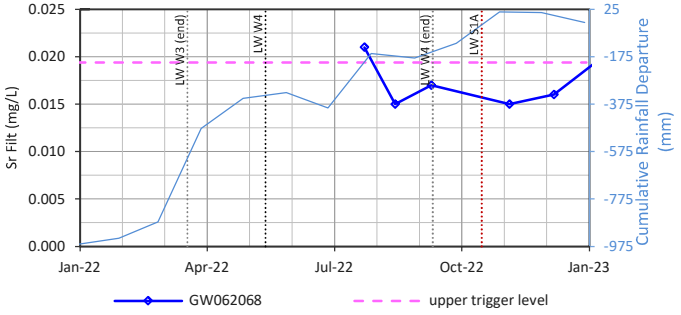

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

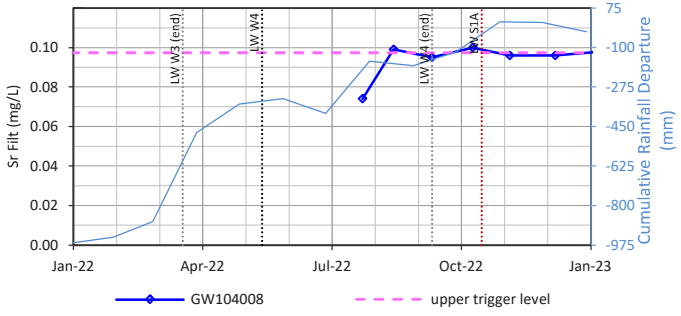

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

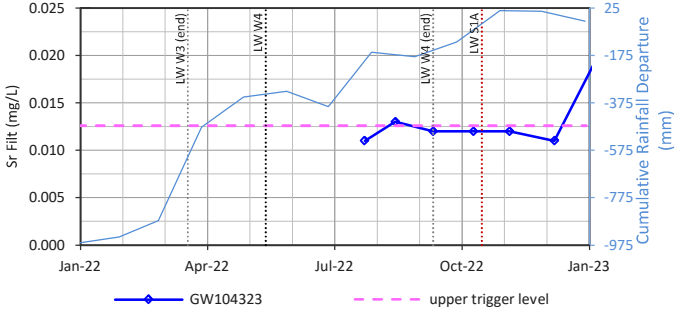

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

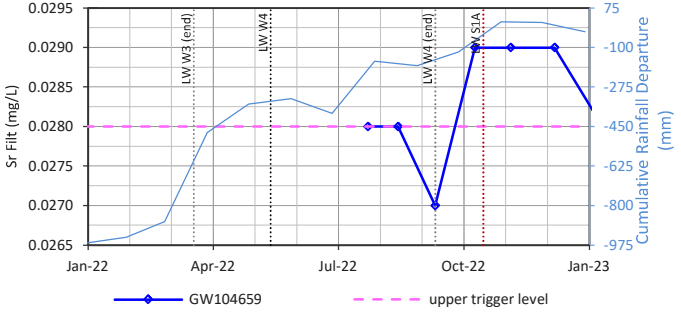

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

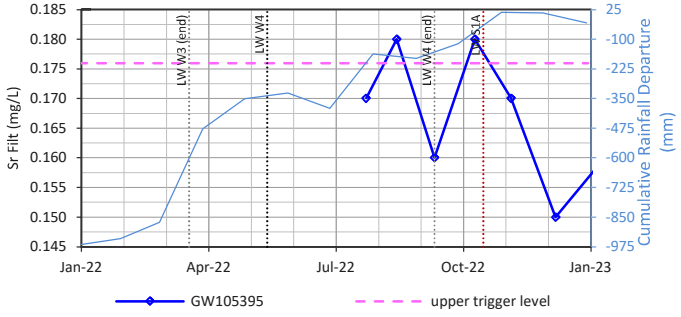

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

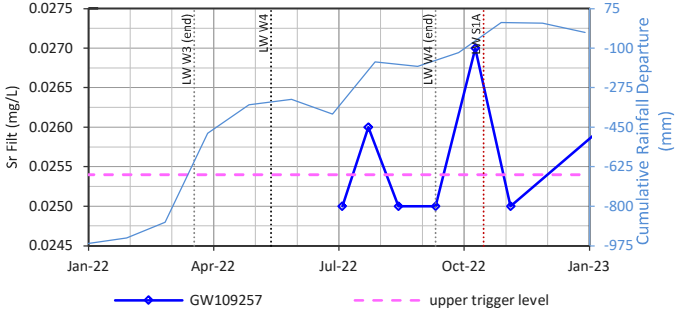

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

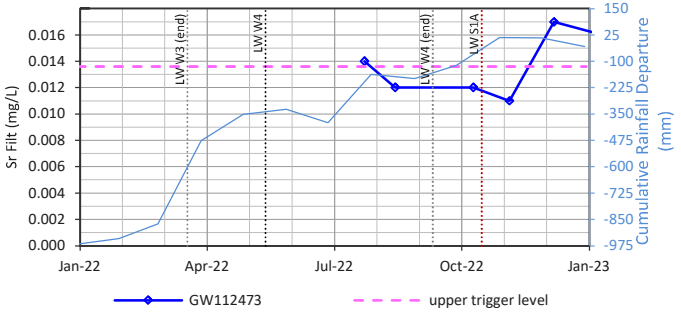

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level


Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323
upper trigger level

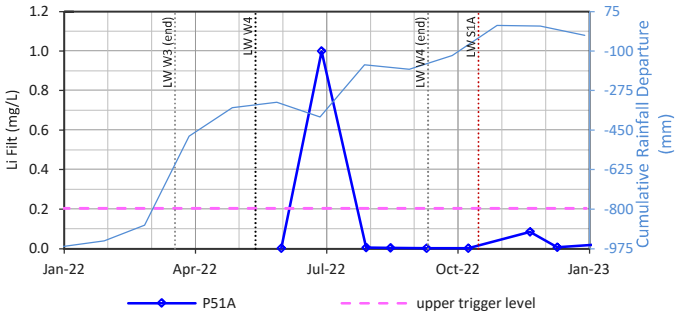

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104659
upper trigger level

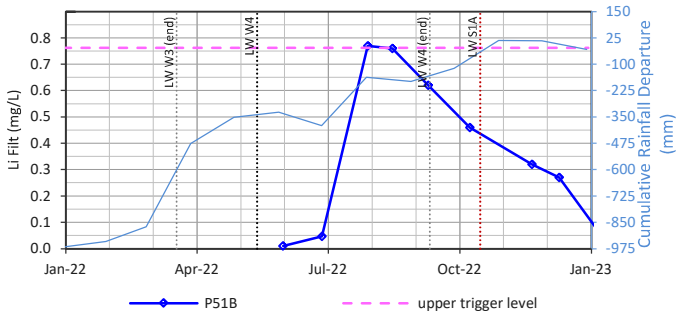

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW105395
upper trigger level

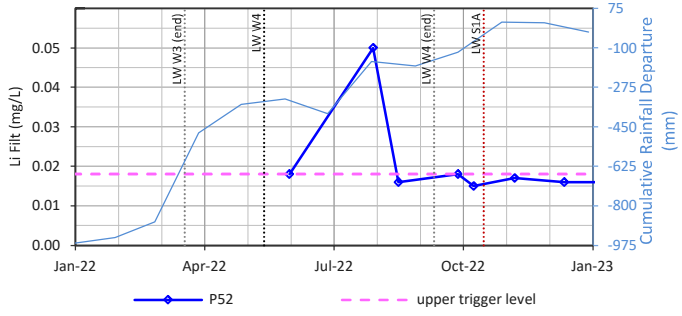

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW109257
upper trigger level

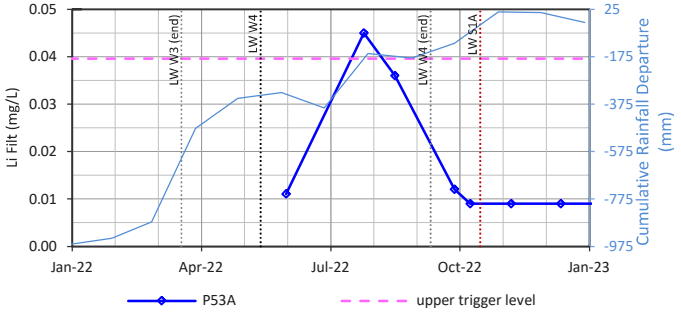

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW112473
upper trigger level

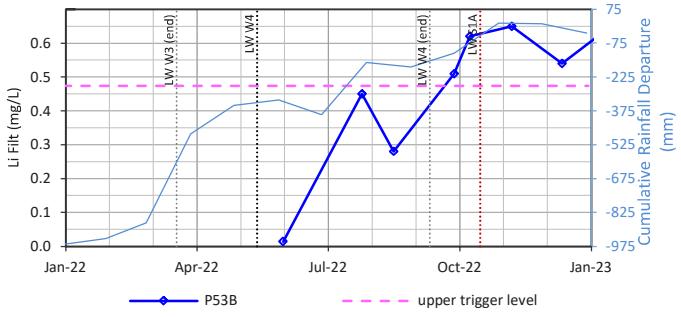
No Data Available for Sr Filt (mg/L)

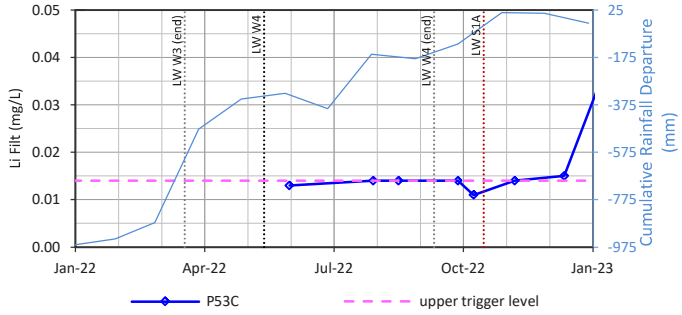


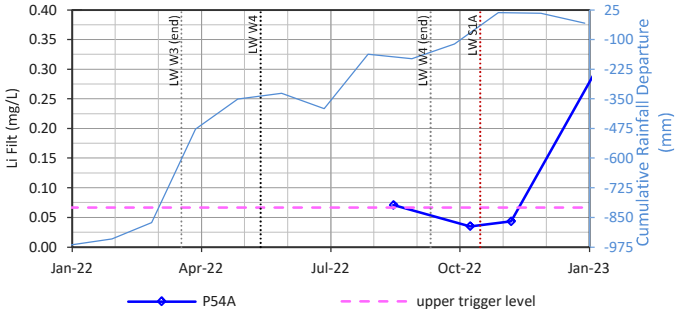


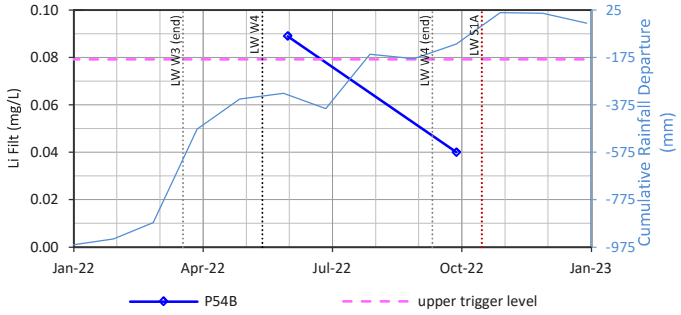


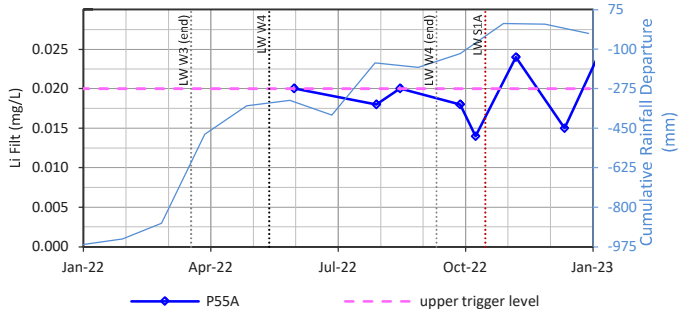


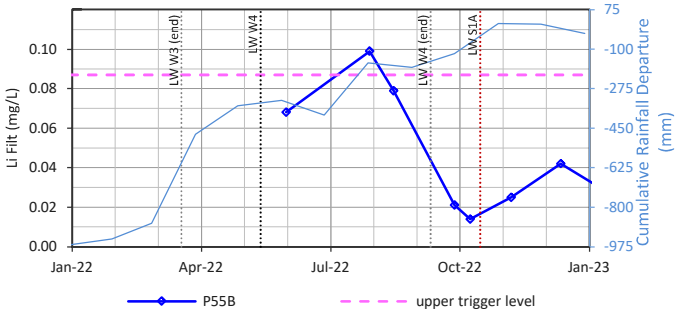


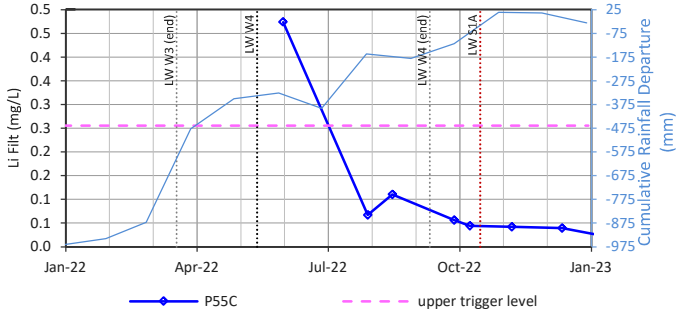


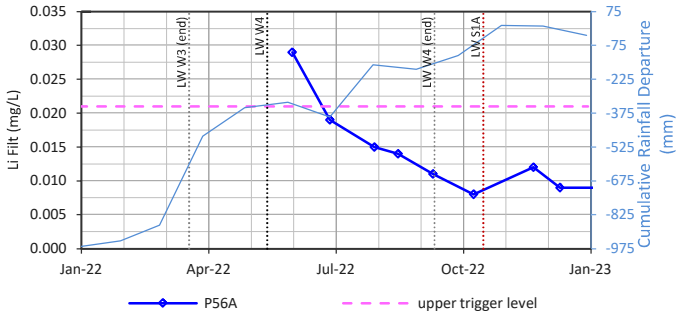


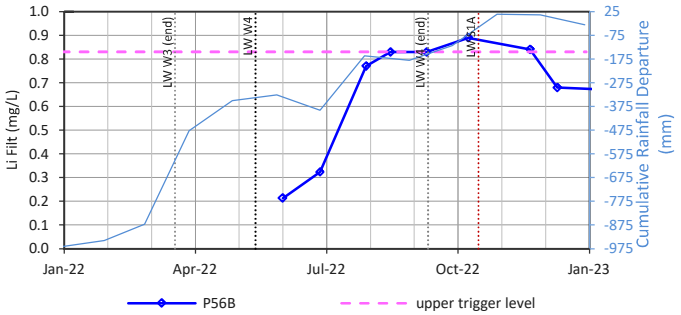


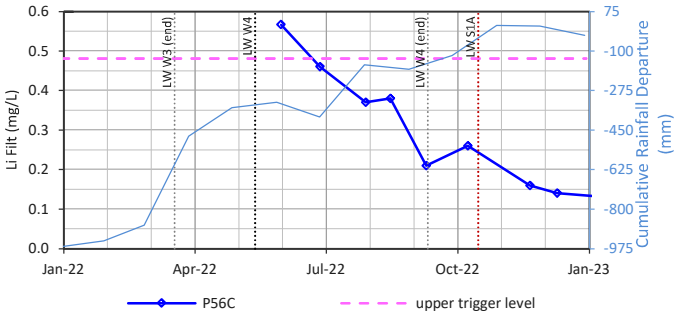


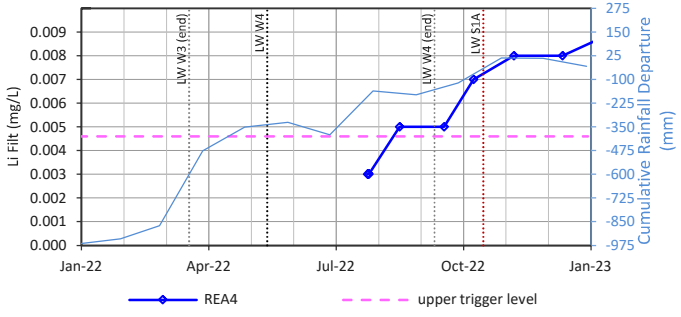


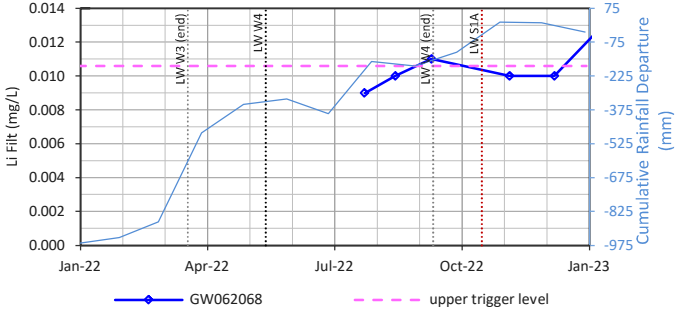


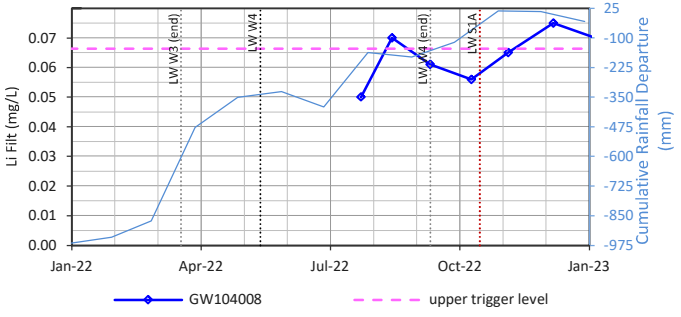


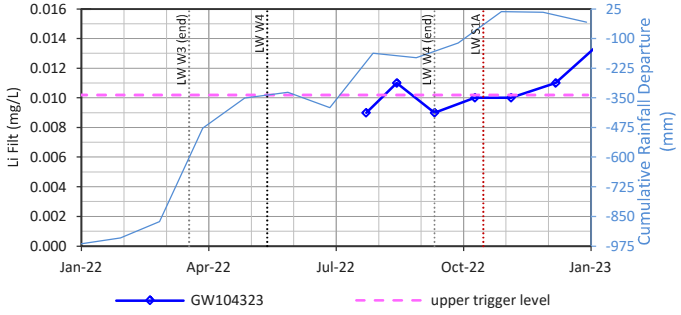


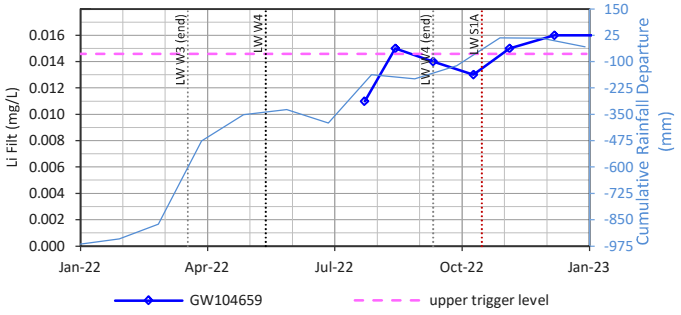


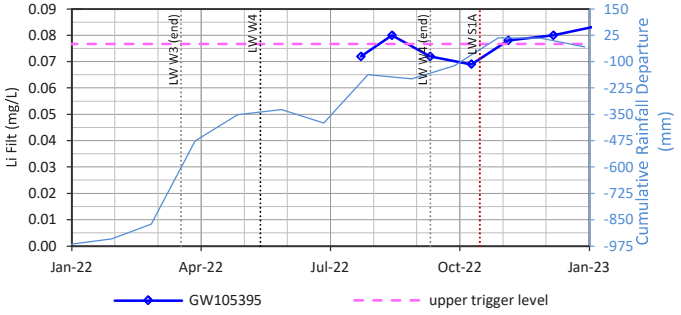


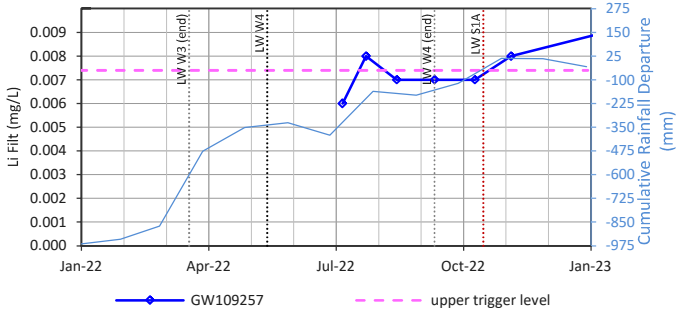


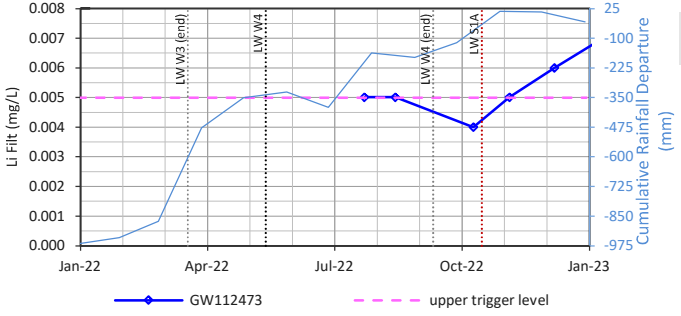




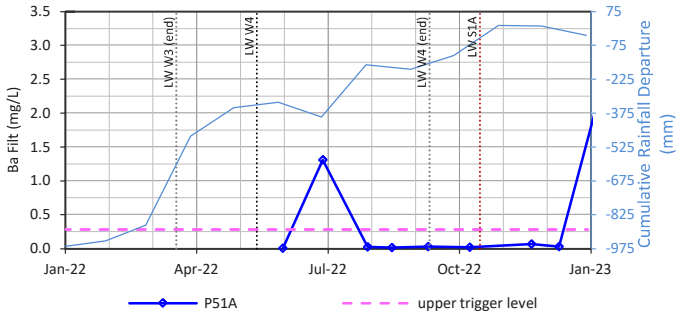


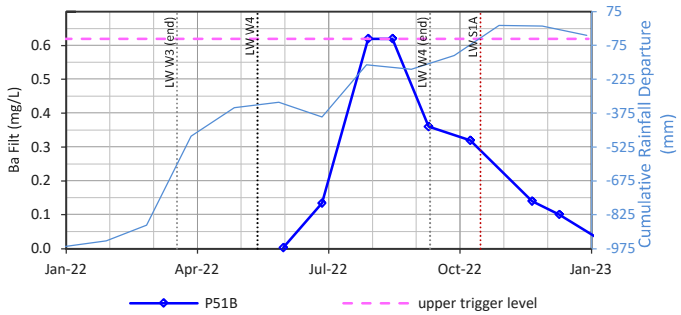


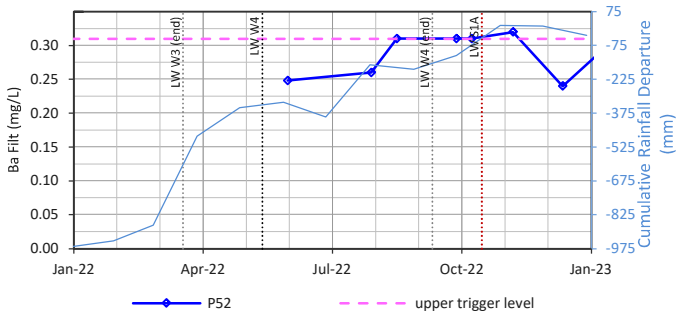


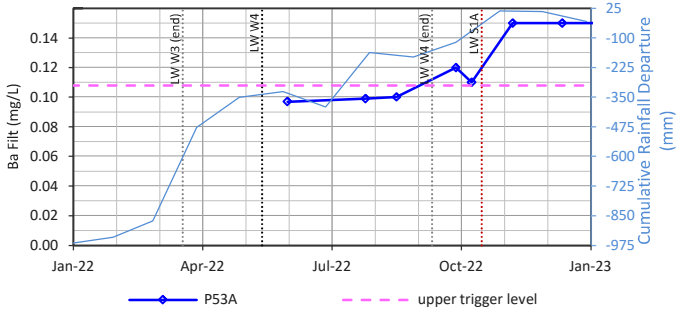


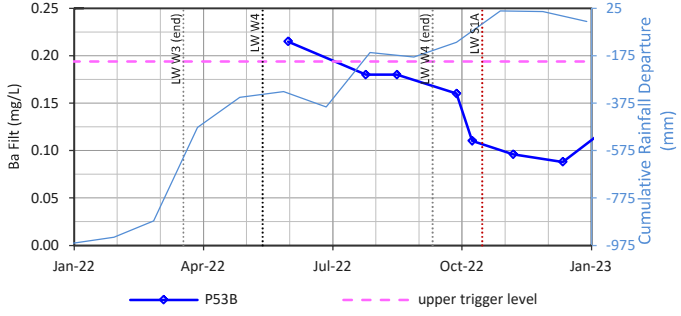
No Data Available for Li Filt (mg/L)

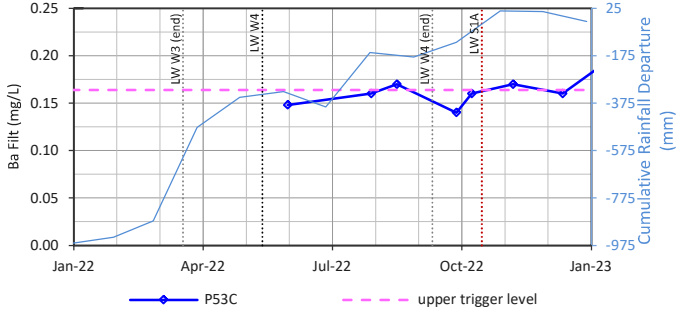

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51A
upper trigger level

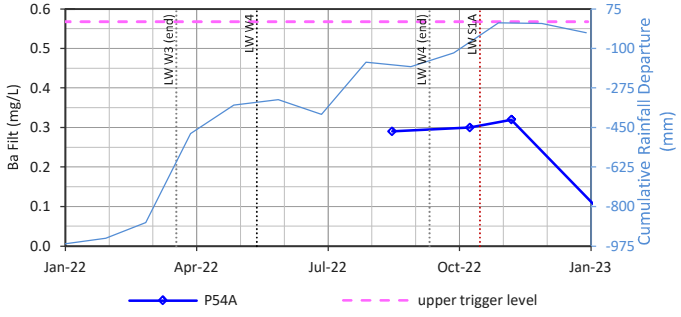

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B
upper trigger level

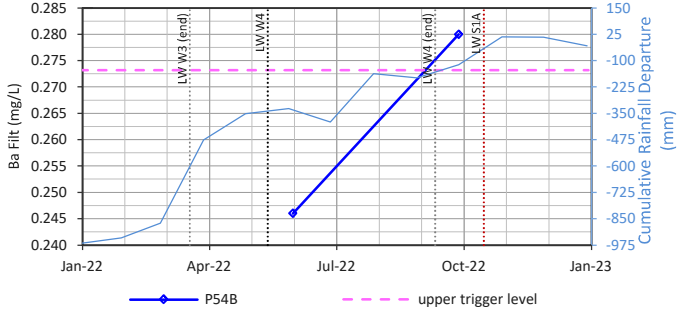

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

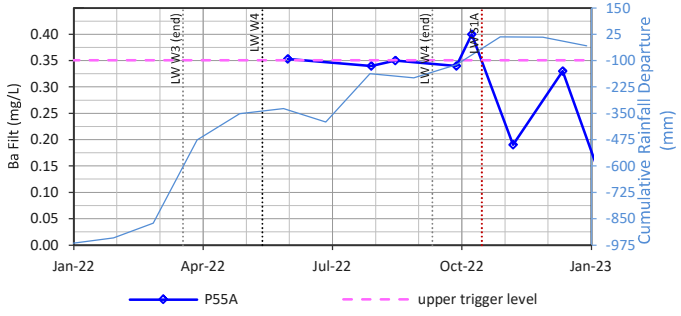

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

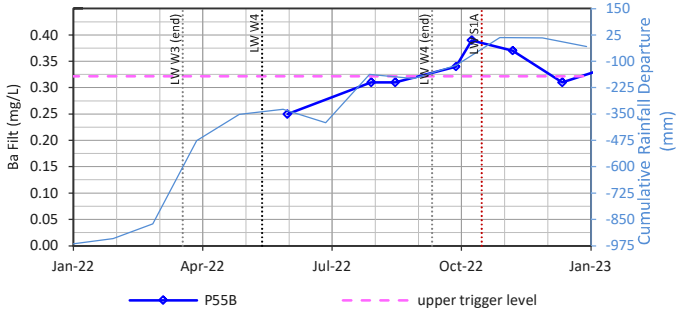

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

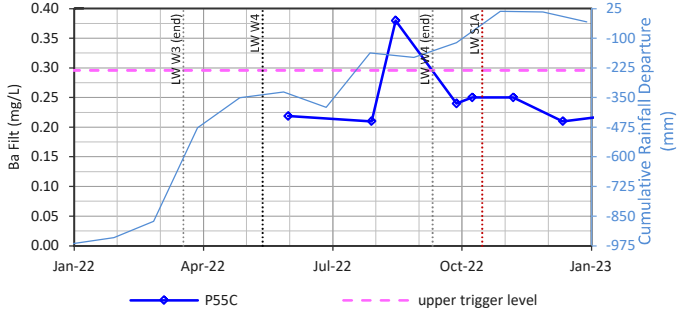

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

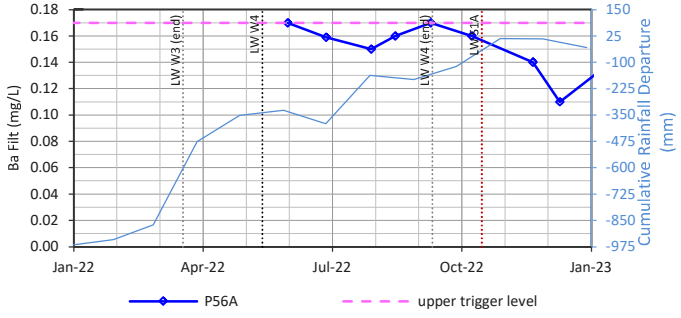

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

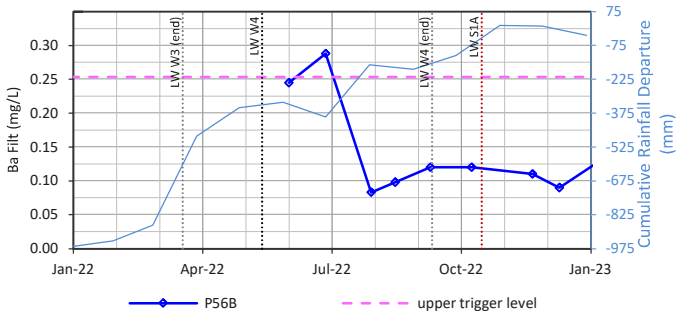

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

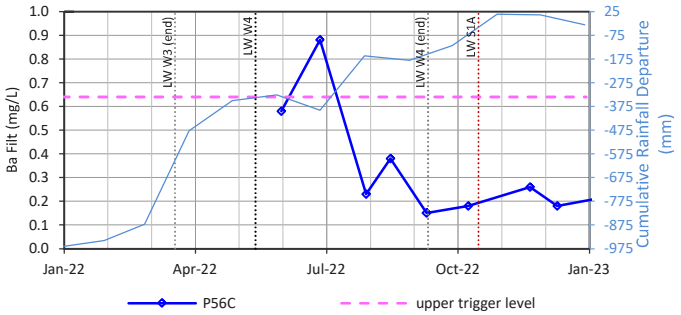

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

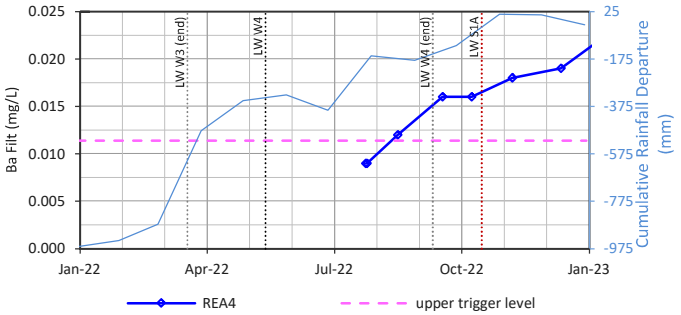

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

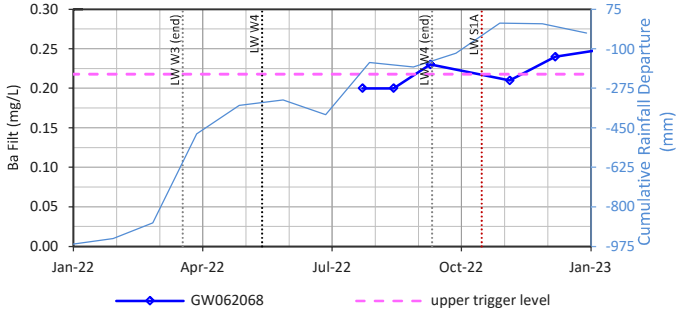

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

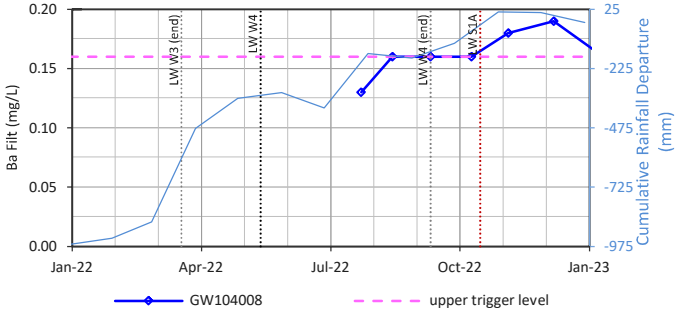

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

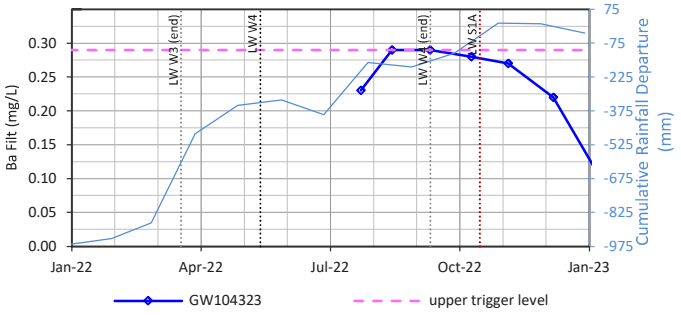


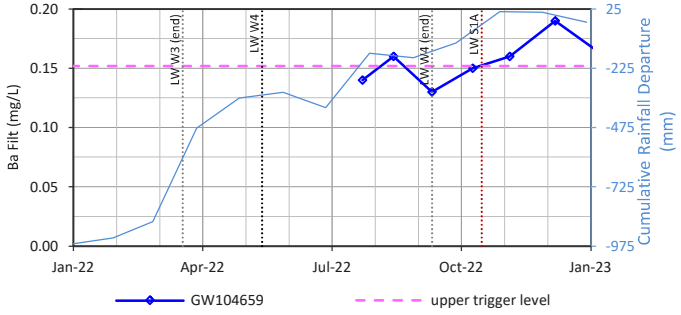


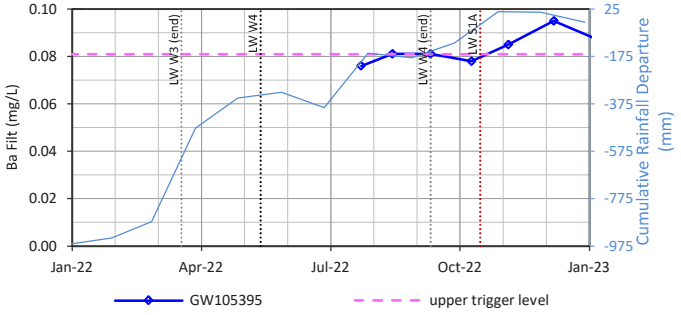


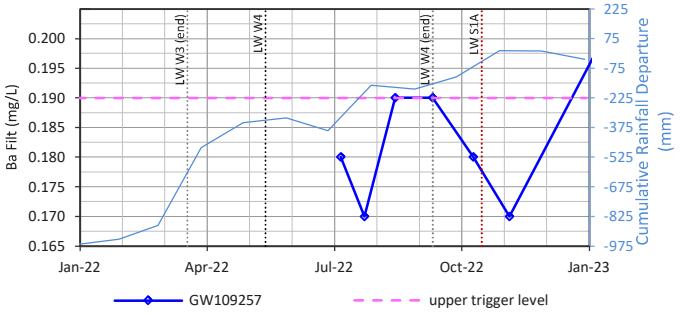


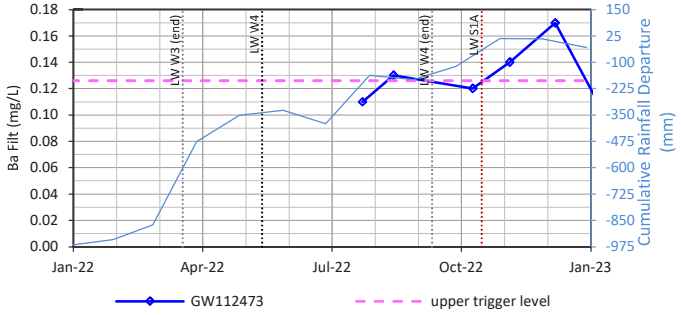




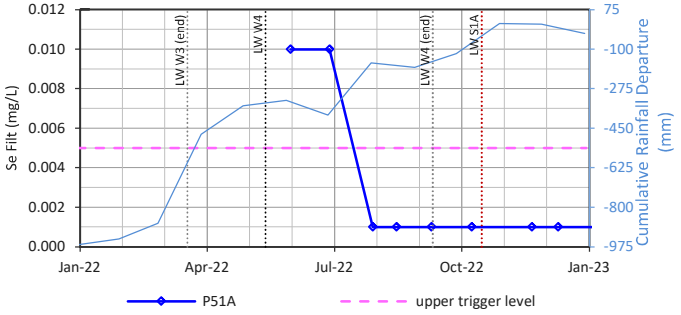


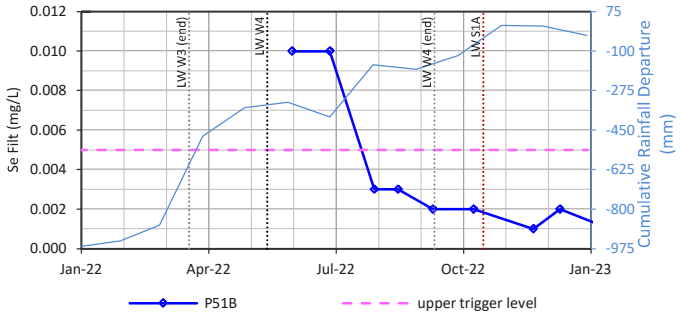


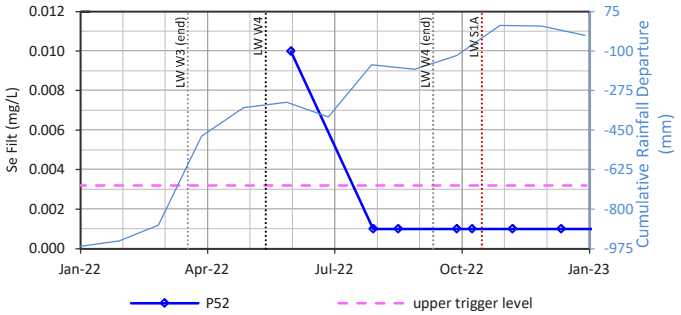


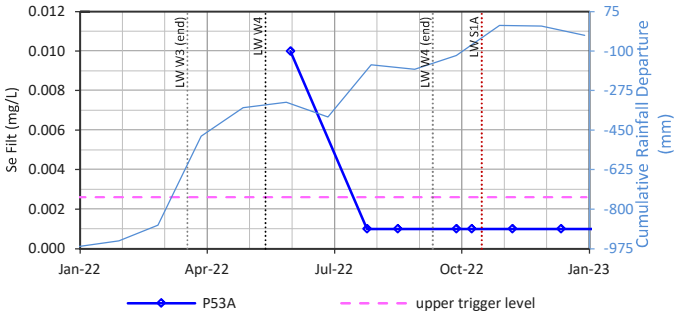


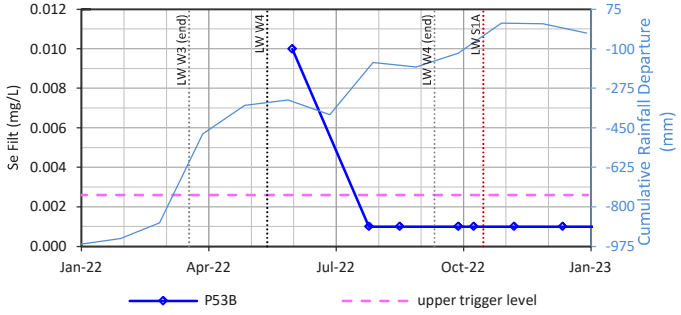
No Data Available for Ba Filt (mg/L)

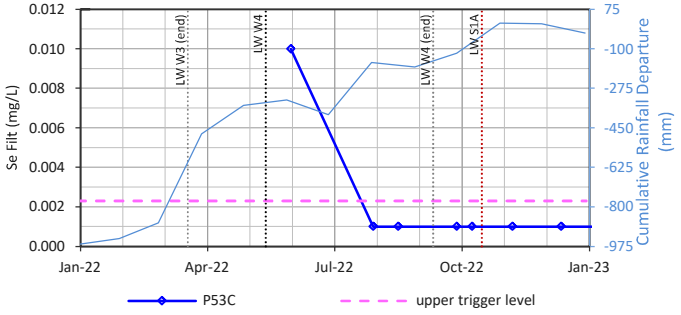


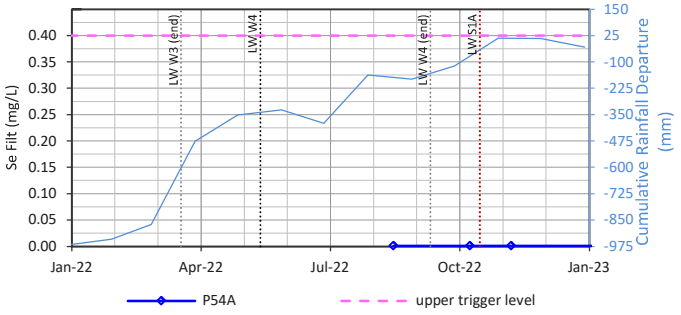

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B
upper trigger level

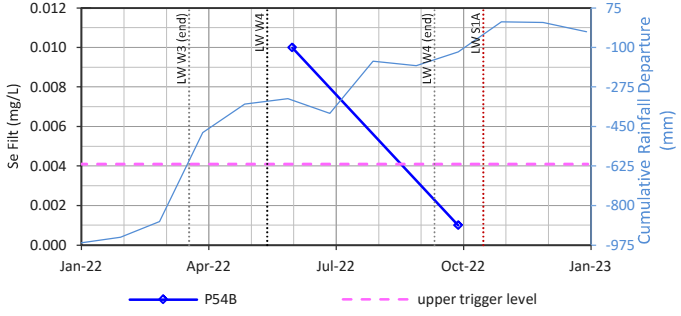

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

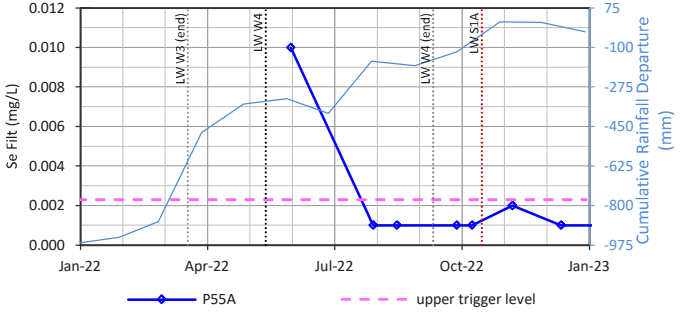

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

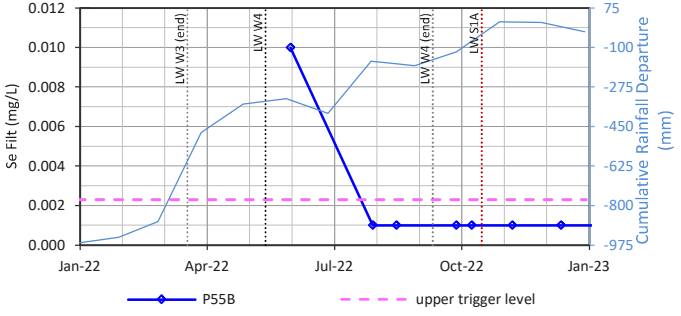

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

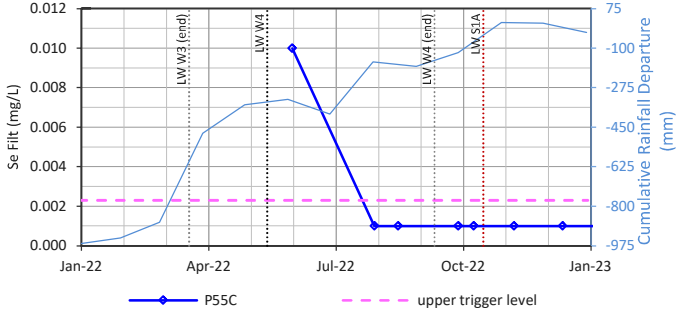

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

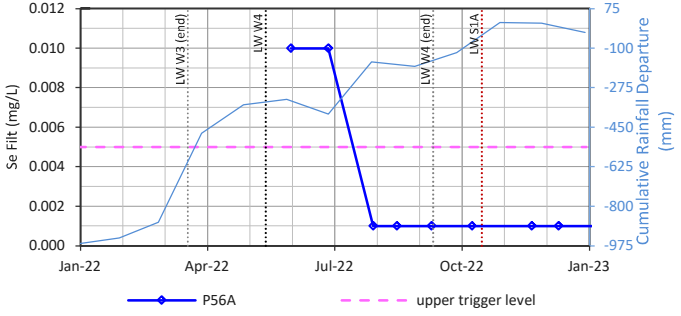

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

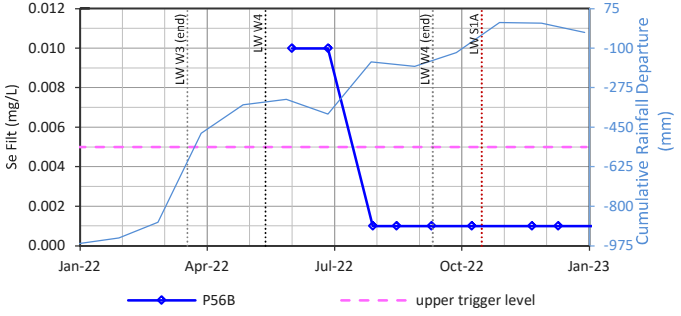

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

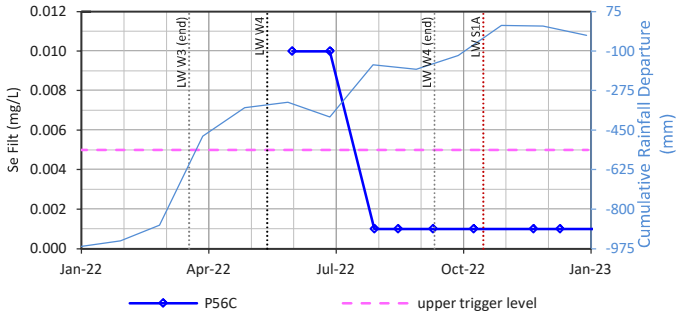

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

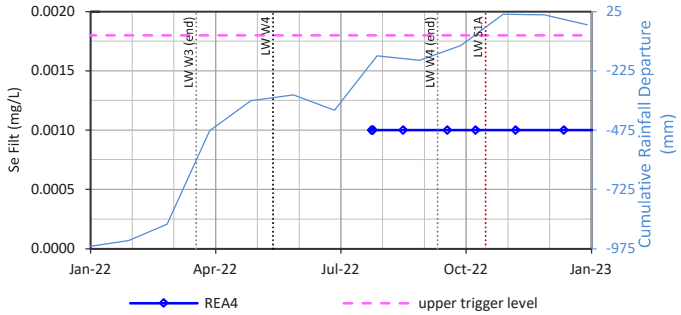

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

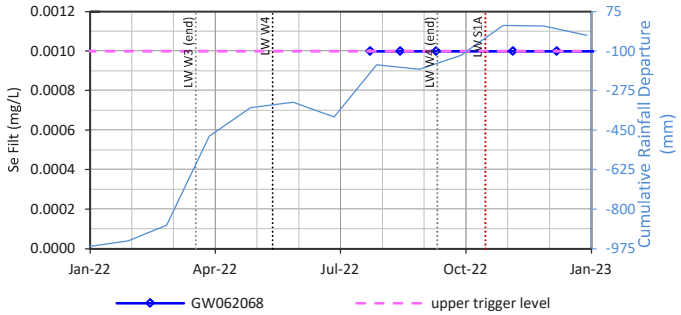

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

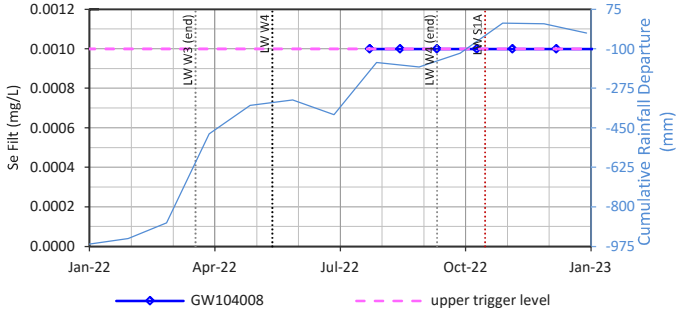

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

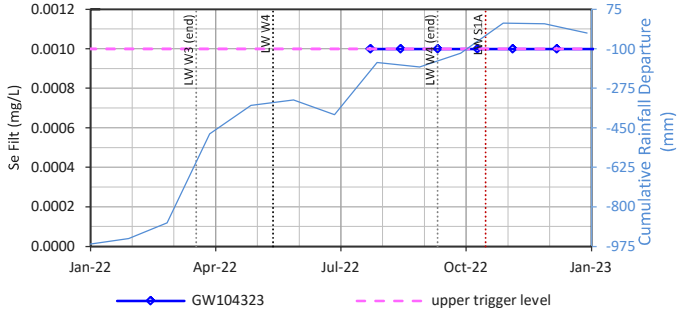

Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

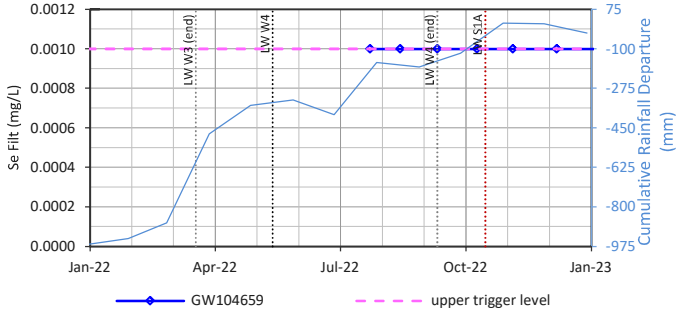


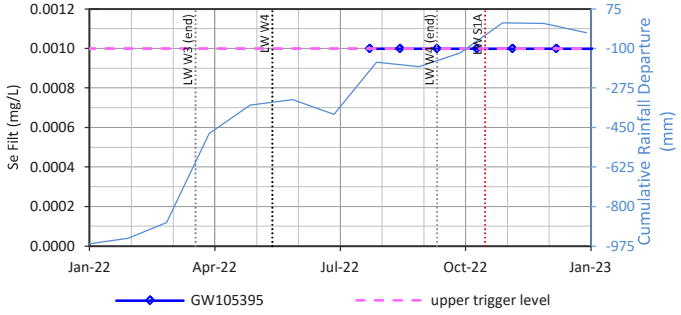


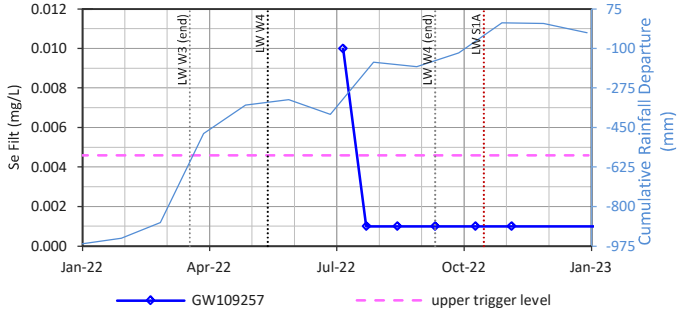


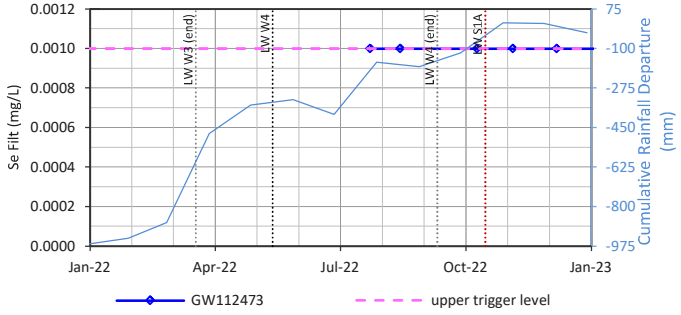












No Data Available for Se Filt (mg/L)