

**Whitehaven Vickery Extension Project
Community Consultative Committee**

FINAL DRAFT MINUTES

Meeting Date: 24 October 2024

Venue: WHC Boardroom, Gunnedah Conadilly Street, Gunnedah, 2380 and Zoom

Invitees	
Community Representatives	Whitehaven Coal Megan Martin, Environmental Superintendent (MM) Matthew Sparkes, Manager Operations (MS)
Gunnedah Shire Council Wade Hudson, Manager Development Assessment Gunnedah Shire Council (WH)	Independent Chairperson Professor Roberta Ryan (RR) Minute taker Isa Crossland Stone (ICS)
Apologies	
Darren Swain – Whitehaven Coal (DS)	
Barry Thompson, Community Representative (BT)	
Keith Blanch, Community Representative (KB)	
<i>Narrabri Shire Council Representatives</i>	

Item	Description	Action
1	Welcome, agenda, apologies, declarations - RR	
	<p>There are no declarations.</p> <p>WH confirms the previous minutes.</p>	
2	Actions arising	
	<p>1. Group to touch on community member recruitment for 2025.</p> <p>RR says that the committee has previously been assembled primarily by word of mouth and existing social connections. Newspaper notices have not been particularly successful to date.</p> <p>WH suggests that future advertisement should note that meetings can be attended virtually; this may be a point of encouragement for some community members.</p> <p>RR says this is a good idea. She asks MM if Whitehaven distributes regular newsletters. Perhaps a CCC recruitment piece could be included in that?</p> <p>MM says that they are soon going to deliver a project update letter to the community, but otherwise they do not tend or intend to make regular letterbox distributions.</p> <p>WH suggests that the Councils can include links on the Council Facebook pages and websites, as the group agrees that recruitment is likely to be most successful through Council and direct community connections.</p> <p>WH asks of there is an upper limit for community members on a committee.</p> <p>RR says that there is not a specific number. Generally, 5-7 community members is the standard amount.</p> <p>Community member attendance on this committee has not historically been an issue, so she will follow up with community members about how best to proceed with community presence and participation on the committee.</p> <p>The group agrees that Whitehaven should issue a newspaper notice for recruitment in both the Gunnedah Shire Times and the Narrabri Shire Times.</p> <p>WH will also follow up about the Council's use of social media to get the word out.</p>	<p>RR to follow up with community members about how best to proceed with increased community presence and participation on the committee.</p>

	<p>All of these recruitment notices will specify the option for virtual attendance via Zoom in order to widen the possible network of community input.</p> <p>MM and JdK will draft up this advert and share it with RR and then distribute it.</p> <p>RR notes that there are no current Terms of Reference for this committee – many committees do not have them. However, one can easily be drafted if people would like one. In the meantime, RR can discuss the key terms of the CCC (which are included in the Department Guidelines) with any potential committee members.</p> <p>The question of whether a ToR document should be drafted will be brought forward at the next meeting to the community members.</p>	<p>MM/JdK to draft up a CCC recruitment advert and share it with RR before distributing it.</p> <p>Group to discuss whether a ToR document should be drafted for the CCC.</p>
3	Environmental report - MM	
	<p>MM shares the Whitehaven Vickery Environmental report and notes that the dust gauges are a requirement of SSD-5000 which we still comply with. This presentation slides are attached to these minutes.</p> <p>WH asks if the original approval is less onerous than the original project approval.</p> <p>MM says it is, the VEP consent has more monitoring conditions.</p> <p>MM will let RR know when the MOD1 response to submissions is available, early next calendar year. RR will share it with the group.</p> <p>RR asks what the water-related concerns in the submissions (identified in MM’s slides) relate to specifically.</p> <p>MM says that mostly they have arisen from questions about how much water will be pumped and how the project will be managed. These concerns and questions will all be addressed in the Response to Submissions and supported with technical evidence/reporting.</p>	<p>MM to be in touch with RR when the MOD1 response to submissions is available, early next calendar year. RR will share it with the group.</p>
4	Community update - MM	
	<p>MM presents the Whitehaven Vickery Community Update on behalf of JDK, who was not able to attend today.</p> <p>MM’s presentation slides, which include outlines of community investment strategy, are attached to these minutes.</p>	

	<p>WH asks about the ‘discretionary sources’ of funding. Is this distinct from investment commitments?</p> <p>MM confirms that it is additional and does not take away from any other community investment. This additional funding is allocated in response to funding applications, so MM encourages community members to apply.</p>	
5	Project / approvals update and next steps - MS	
	<p>MS presents the Whitehaven Vickery Project update. The presentation slides are attached to these minutes.</p> <p>RR asks where the workforce is being sourced from. Are they local candidates?</p> <p>MS says that they are favoring local candidates (partially in order to manage fatigue levels, relating to safety compliance concerns).</p> <p>MS notes that there were no recordable injuries in the first quarter of this year. There are comprehensive safety education and management strategies, and these appear to have been very successful.</p> <p>WH asks if workers from Werris Creek are tending to transfer to Vickery.</p> <p>MS says yes, there is a high level of transfer.</p> <p>There have also been several new local recruitments for the project.</p>	
6	General Business	
	<p>The group discusses future meeting dates. Given that there are not many key issues anticipated in the coming months, the group agrees on dates for the four upcoming meetings.</p> <p>ICS will send hold notification to the group for each of the following dates in 2025:</p> <ul style="list-style-type: none"> • February 6th • May 1st • July 24th • October 23rd <p>RR thanks the attendees for their presence and discussion at the meeting today and wishes them well.</p>	

Vickery Coal Mine Community Consultative Committee Meeting #20

Quarterly Environmental Monitoring Report
Jul, 2024 – Sept, 2024



Vickery Project

This report has been prepared for the Community Consultative Committee (CCC) meeting to show environmental monitoring performance at Vickery Coal Mine (VCM) for the reporting period from July 2024 to September 2024.

Noise Monitoring

Attended noise was conducted during this period.

Attended noise monitoring was conducted at “Lanreef” (N-AT2) and “Broadwater” (N-AT1) properties once a month during this reporting period. Noise criteria for the mine is 40dB(A) Leq (15 min) during day time and 35dB(A) Leq (15 min) during evening/night time and 52 LA_{max} for instantaneous night readings. Please refer to EPL Monitoring locations map in Appendix B for the location of these monitoring points.

Results below show that noise emissions from the mine did not exceed operational criteria at “Lanreef” or “Broadwater” monitoring locations during the monitoring period.

Table 1 July 2024 Attended Noise Monitoring

Table 4								
VCM Operational Noise Monitoring Results Leq(15min) – 30 th July 2024 (Day)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	1:28pm	46	IA	45 ¹	5.2 / 169	C	Birds (45), traffic (37), wind in trees (35), VCM (IA)	No
N-AT2 / 8	3:46pm	47	IA	45 ¹	4.7 / 164	D	Traffic (46), birds (38), VCM (IA)	No
Table 5								
VCM Operational Noise Monitoring Results Leq(15min) – 30 th July 2024 (Evening)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	9:23pm	30	28	35	0.7 / 126	E	VCM (28) , frogs (26)	No
N-AT2 / 8	8:16pm	39	25	37	1.4 / 165	F	Traffic (39), VCM (25) , frogs (22)	No
Table 6								
VCM Operational Noise Monitoring Results Leq(15min) – 30 th July 2024 (Night)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	10:00pm	33	21	35	1.6 / 110	E	Cows (31), frogs (28), VCM (21)	No
N-AT2 / 8	11:50pm	41	IA	37	2.1 / 099	D	Horses (39), traffic (37), VCM (IA)	No
Table 7								
VCM Operational Noise Monitoring Results LA _{max} – 30 th July 2024								
Location	Time	dB(A), LA _{max}	VCM Contribution dB(A), LA _{max}	Criterion dB(A), LA _{max}	Wind speed (m/s),dir	Stability Class	LA _{max} Noise Source	Exceedance (Yes/No)
N-AT1 / 7	10:00pm	55	24	52	1.6 / 110	E	Cow	No
N-AT2 / 8	11:50pm	68	IA	52	2.1 / 099	D	Horse	No

Table 2 August 2024 Attended Noise Monitoring

Table 4								
VCM Operational Noise Monitoring Results Leq(15min) – 15 th August 2024 (Day)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	1:57pm	45	IA	40	1.4 / 216	C	Birds (43), frogs (38), traffic (35), VCM (IA)	No
N-AT2 / 8	4:12pm	48	IA	40	1.4 / 173	C	Traffic (45), frogs (43), VCM (IA)	No
Table 5								
VCM Operational Noise Monitoring Results Leq(15min) – 15 th August 2024 (Evening)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	9:28pm	32	IA	35	1.7 / 155	D	Traffic (30), wind (26), VCM (IA)	No
N-AT2 / 8	8:19pm	43	IA	37	2.3 / 88	E	Frogs (41), Traffic (37), VCM (IA)	No
Table 6								
VCM Operational Noise Monitoring Results Leq(15min) – 15 th August 2024 (Night)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	10:01pm	33	22	35	0.9 / 158	D	Traffic (30), cattle (30), VCM (22)	No
N-AT2 / 8	11:48pm	39	IA	37	1.2 / 165	D	Traffic (37), frogs (34), VCM (IA)	No
Table 7								
VCM Operational Noise Monitoring Results LA _{max} – 15 th August 2024								
Location	Time	dB(A), LA _{max}	VCM Contribution dB(A), LA _{max}	Criterion dB(A), LA _{max}	Wind speed (m/s),dir	Stability Class	LA _{max} Noise Source	Exceedance (Yes/No)
N-AT1 / 7	10:01pm	55	26	52	0.9 / 158	D	Bird	No
N-AT2 / 8	11:48pm	61	IA	52	1.2 / 165	D	Horse	No

Table 3 September 2024 Attended Noise Monitoring

Table 4								
VCM Operational Noise Monitoring Results Leq(15min) – 24th September 2024 (Day)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	1:40pm	37	IA	40	2.7 / 300	C	Birds (37), wind (25), aeroplanes (21), VCM (IA)	No
N-AT2 / 8	3:53pm	46	IA	451	3.2 / 301	D	Birds (44), wind (41), VCM (IA)	No
Table 5								
VCM Operational Noise Monitoring Results Leq(15min) – 24th September 2024 (Evening)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	9:20pm	32	IA	401	3.6 / 028	E	Wind (28), dogs (26), traffic (25), VCM (IA)	No
N-AT2 / 8	8:18pm	38	IA	421	3.6 / 026	E	Traffic (35), wind (34), VCM (IA)	No
Table 6								
VCM Operational Noise Monitoring Results Leq(15min) – 24th September 2024 (Night)								
Location	Time	dB(A), Leq	VCM Contribution dB(A),Leq	Criterion dB(A),Leq	Wind speed (m/s),dir	Stability Class	Identified Noise Sources dB(A),Leq	Exceedance (Yes/No)
N-AT1 / 7	10:02pm	36	IA	35	1.3 / 129	E	Insects (36), VCM (IA)	No
N-AT2 / 8	11:40pm	41	IA	37	0.8 / 200	E	Birds (39), traffic (33), insects (33), VCM (IA)	No
Table 7								
VCM Operational Noise Monitoring Results L _{Amax} – 24th September 2024								
Location	Time	dB(A), L _{Amax}	VCM Contribution dB(A), L _{Amax}	Criterion dB(A), L _{Amax}	Wind speed (m/s),dir	Stability Class	L _{Amax} Noise Source	Exceedance (Yes/No)
N-AT1 / 7	10:02pm	66	IA	52	1.3 / 129	E	Insects	No
N-AT2 / 8	11:40pm	63	IA	52	0.8 / 200	E	Birds	No

The real time noise monitor located on the “Long Way Round” property remains a management tool, so the noise criteria are not applicable at that site. Levels of noise recorded at that location are managed according to the noise management plan and trigger action response plan.

An additional real time noise monitor has been installed closer to the mine site, at Broadwater property.

Blast Monitoring

Blasting Results

There has been 11 Blasts at VCM from 1st July to 30th September.

The highest recorded overpressure for the reporting period was 115.20dB recorded at B-02 compliance monitor on the 14/08/2024.

The highest recorded ground vibration for the reporting period was 2.29mm/s at B-01 recorded on the 25/09/2024.

VCM overpressure and ground vibration for the quarter was compliant and did not exceed the blasting criteria declared in the project approval and Blast Management Plan (BMP). Please refer to EPL Monitoring locations map in Appendix B for the location of these monitoring points.

Table 4 Max Peak Overpressure and Ground Pressure for the Quarter

Monitor Location	Date	Max. Peak Overpressure (dB)	Criterion (dB)	Date	Max. Peak Ground Pressure (mm/s)	Criterion (mm/s)
B-01	25/09/2024	110.2	133	25/09/2024	2.29	10
B-02	14/08/2024	115.2	N/A	05/08/2024	1.86	80
B-03	14/08/2024	105.1	120	05/08/2024	0.93	10

Air Quality Monitoring

Dust Deposition Results

Standard Australia AS/NZS 3580.10.1:2016, "Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric Method," classifies deposited dust as insoluble solids. Therefore, VCM tests air quality monthly at mine-owned sites for indicative purposes, to infer compliance, against the limit of 4 g/m²/month.

Error! Reference source not found. Table 5 shows deposited dust gauge results over 12 months. All dust monitors that are located on project related or WHC owned land; as such compliance criteria (4g/m²/month) do not apply. While deposited dust trends remain steady during the reporting period (refer graph in Appendix A), some monitors are displaying non-mine related particulate matter deposition more regularly than others.

Non-mine related particulate matter could be attributed to organic matter (such as leaves, mice, frogs, insects or bird faeces that fall in to the bottles), or they may be in farming locations, so during some months dust levels may be higher due to harvesting. Please refer to Dust Deposition Gauges Monitoring locations map in Appendix B for the location of these monitoring points.

Table 5 Deposited Gauge Results [g/m²/month]

Month	D1	D2	D12	D13B	DG1	DG2	V1	V2	V3	V4	V5
<i>Oct-23</i>	1.6	1.3	3.3	0.9	2.5	1.5	1.3	4.5	2.8	1.5	1.6
<i>Nov-23</i>	1.7	1.5	2.6	1	1.4	1.6	1.3	4.4	2.6	1.4	1.5
<i>Dec-23</i>	2	1.5	2.5	1.1	1.6	1.5	1.3	4.3	2.2	1.6	1.4
<i>Jan-24</i>	2.1	1.4	2.7	1.2	2.5	2.1	1.4	4.4	1.4	1.9	1.5
<i>Feb-24</i>	2.4	1.7	1.8	1.2	2.8	2.6	1.4	0.8	1.3	1.9	1.7
<i>Mar-24</i>	2.5	1.7	1.7	1.4	2.9	2.5	1.4	1	1.4	2.2	1.9
<i>Apr-24</i>	2.7	1.6	1.8	1.5	3	2.6	1.5	1	1.3	2.2	1.9
<i>May-24</i>	2.5	1.5	2	1.5	3	2.7	1.5	1	1.4	2.3	2
<i>Jun-24</i>	2.4	1.4	1.9	1.6	2.8	2.5	1.3	0.9	1.3	2.2	2.0
<i>Jul-24</i>	0.4	0.7	0.3	0.4	0.9	0.6	0.6	0.3	1.8	1.0	0.6
<i>Aug-24</i>	0.5	0.2	0.2	0.2	1.4	0.4	0.9	0.3	6.7	0.5	0.4
<i>Sep-24</i>	1.7	0.5	0.4	0.3	3.1	0.5	0.5	0.5	0.5	0.6	0.4
Average	1.9	1.3	1.8	1.0	2.3	1.8	1.2	2.0	2.1	1.6	1.4

Real-time Air Monitoring (PM_{2.5} and PM₁₀)

Two real-time air quality monitoring units are located on private property adjacent to the Vickery Coal Mine. PM1 is located at Lanreef and PM2 at Mirrabinda to the south and south-west of the operations. These are used as both a compliance and an operational management tool. Dust levels nearing or reaching the nominated criteria will trigger actions onsite to assess the source of dust and modify operations if it is determined to be related to Vickery operations. Additional air quality monitoring units are located at Wil-gai and Roseberry and these are used for additional information and operational management in accordance with the Vickery Air Quality Management Plan. These units are also associated with other regional operations at Tarrawonga and Rocglen. Please refer to Air Quality Monitoring locations map in Appendix B for the location of these monitoring points.



Figure 1: TEOM installed at Lanreef

Water Monitoring

Groundwater

Routine groundwater monitoring has been conducted 6 monthly since 2021. In October 2023, Hydra-sleeve monitoring was introduced to Vickery’s groundwater bores. Appendix C contains the Hydrographs for Vickery’s GW bores. Monitoring indicates stable GW levels. Water quality data in a few bores is showing a departure from the interim trigger levels. This will assist to inform the development of the final trigger levels for GW monitoring as described in the Water MP. As mining below the water table has only just begun to occur any triggers of the interim TARP are due to the background levels naturally being different to the generic triggers sourced from external benchmarks. Please refer to Groundwater Monitoring locations map in Appendix B for the location of these monitoring points.

Surface Water

Water storage onsite is expected to be sufficient for at least 12 months. VCM has not undertaken any discharges during the period. Please refer to EPL Monitoring locations map in Appendix B for the location of these monitoring points.

Table 6 Surface Water Results for July, August and September

July	Namoi DS 1	Namoi DS 2	Namoi DS 3	Namoi US
pH	7.29	7.77	7.33	7.39
Electrical Conductivity (µS/cm)	648	672	583	608
TSS	50	56	53	55
Oil & Grease (mg/L)	<5	6	<5	<5
August	Namoi DS 1	Namoi DS 2	Namoi DS 3	Namoi US
pH	8.04	8.06	No Access	8.05
Electrical Conductivity (µS/cm)	570	555	No Access	570
TSS	77	63	No Access	71
Oil & Grease (mg/L)	<5	<5	No Access	<5
September	Namoi DS 1	Namoi DS 2	Namoi DS 3	Namoi US
pH	8.25	8.33	8.3	8.33
Electrical Conductivity (µS/cm)	735	713	698	762
TSS	19	16	28	19
Oil & Grease (mg/L)	<5	6	<5	<5

April	MWD2
pH	8.15
Electrical Conductivity (µS/cm)	3510
Turbidity	1.7
Oil & Grease (mg/L)	<5

VCM has recorded 420 mm of rain for 2024, so far.

Table 7 Annual Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Rain (mm)	29.6	34.4	5	80.4	29.8	63.8	54	58.4	64.6				420
Cumulative (mm)	29.6	64	69	149.4	179.2	243	297	355.4	420				

Clearing

Clearing is currently ongoing at Vickery, approximately 560ha have been cleared during FY24. Topsoil and Subsoil is being stored separately in designated stockpiles areas. The stockpiles will be ripped and seeded to maintain viability for rehabilitation.



Figure 2: Updated Image of Topsoil and Subsoil Stockpiles

Complaints

Six complaints were received during the reporting period.

Five of these complaints were related to blast activities and one related to lighting. All matters have been resolved satisfactorily.

Approvals

The last Environmental Protection Licence (EPL) Variation was received on the 7th December 2023.

An application to transfer this licence to another WHC owned entity has been submitted. This is for internal WHC administrative purposes. The new holding entity will be named 'Vickery Coal Operations Pty Ltd'.

Environmental Management Plans

Approvals

All the approved Management Plans are available on the WHC website.

The Traffic Management Plan has been updated to include amended haulage hours following Tarrawonga Coal Mine's approval of MOD10 to MP11_0047. This was submitted in June and is with the DPHI for review.

MOD1 was submitted in August 2024. As described in April 2024 at the last CCC meeting this Modification is to:

- amend the Blue Vale Road realignment to a lesser impact;
- to allow the export of gravel from the VEP in line with existing approvals at Tarrawonga and the original Vickery Coal Project (SSD-5000);
- Construction and use of water pipelines from additional existing groundwater bores and to the Rocglen Coal Mine;
- Potential relinquishment of the secondary infrastructure area;
- A temporary access road and additional soil stockpile area;
- Temporary concrete batching plant;
- Disposal of waste heavy vehicle tyres;
- Reduction to the open cut extent and improved waste rock emplacement and landform design;
- Extended ROM coal road haulage hours to align with the Tarrawonga Modification 10; and
- Schedule of Lands update.

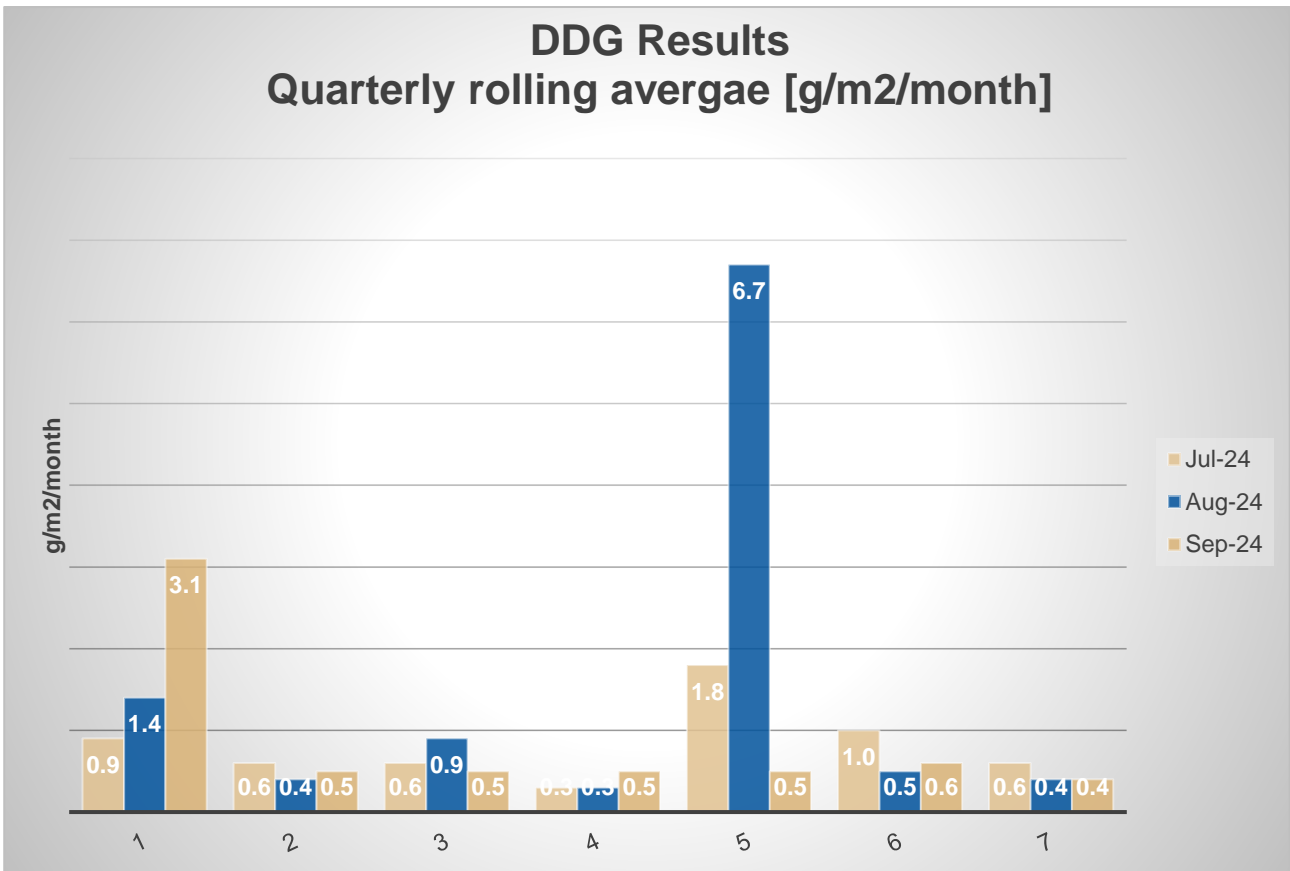
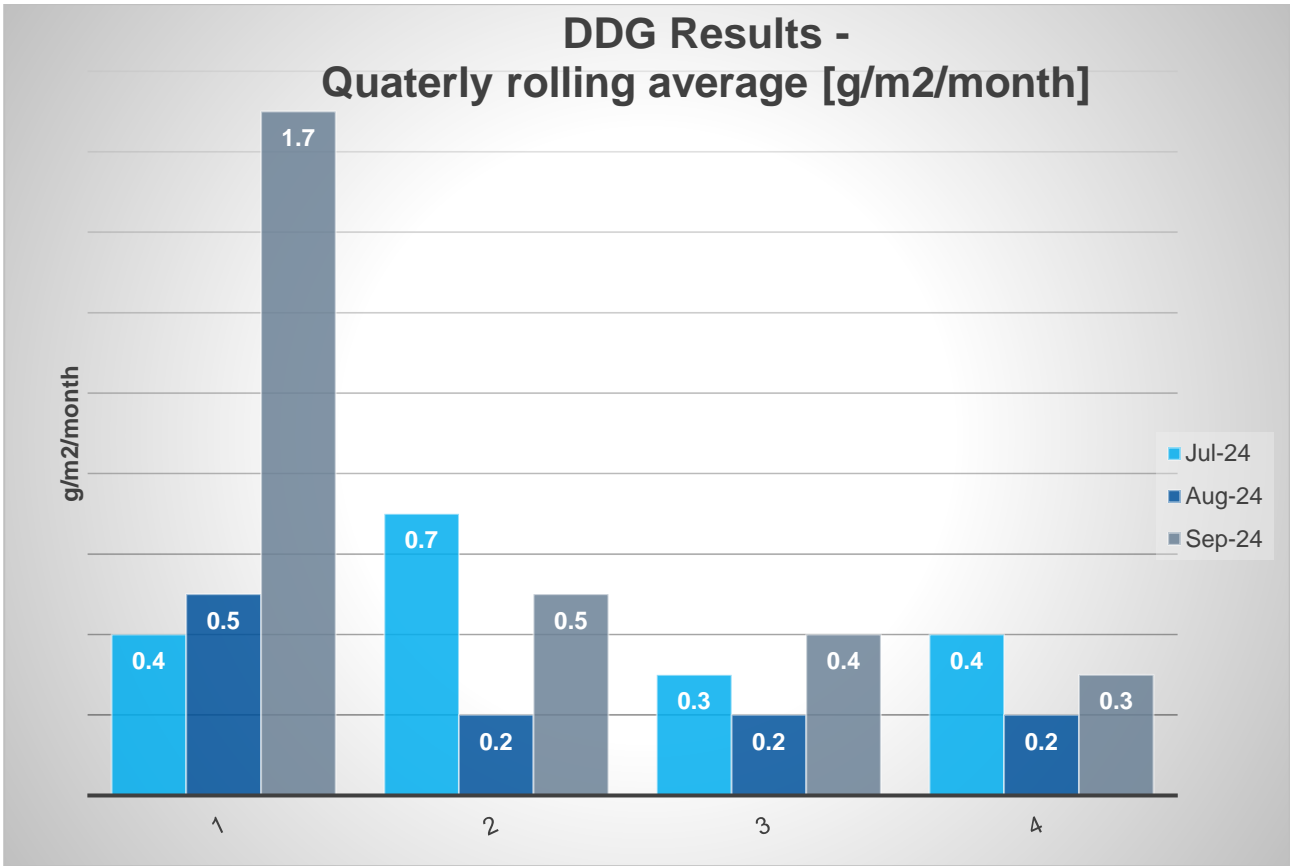
The Water Management Plan was updated and submitted to the DPHI for review.

Proposed amendments

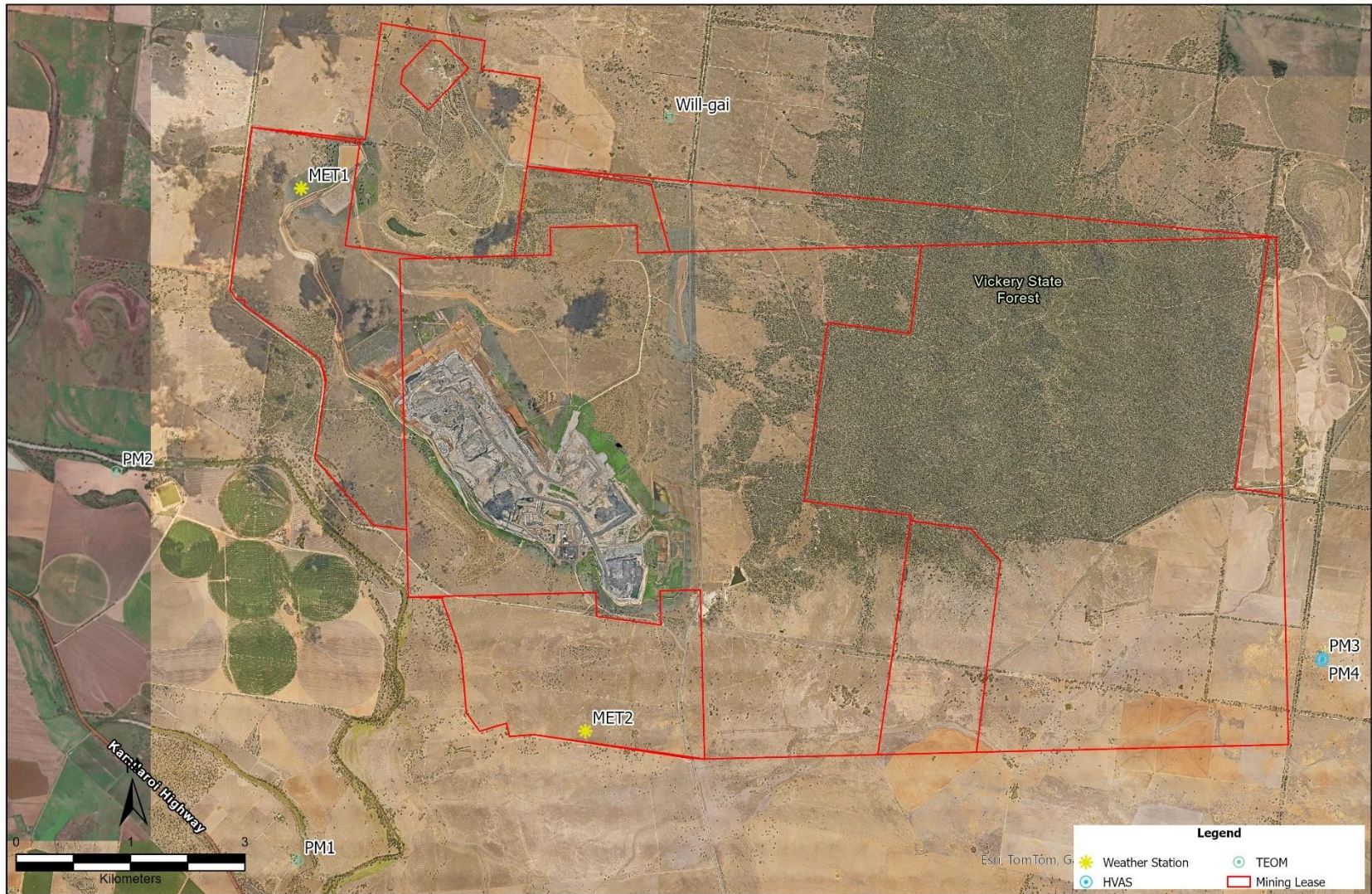
The Noise Management Plan will be updated to reflect the amended monitoring locations and incorporate road noise monitoring conducted by Tarrawonga Coal Mine on the haulage route.

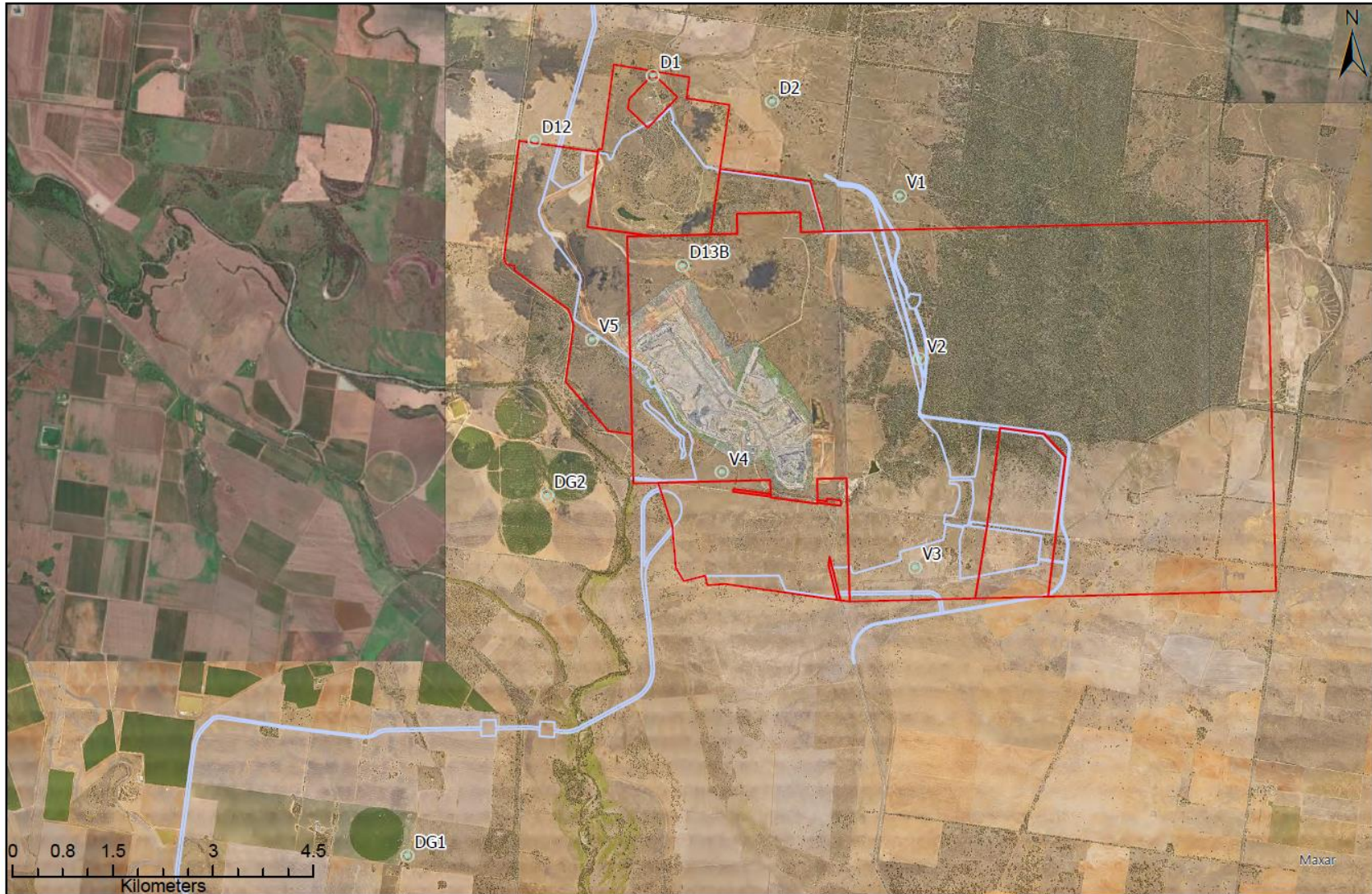
The Air Quality Management Plan will be reviewed and updated.

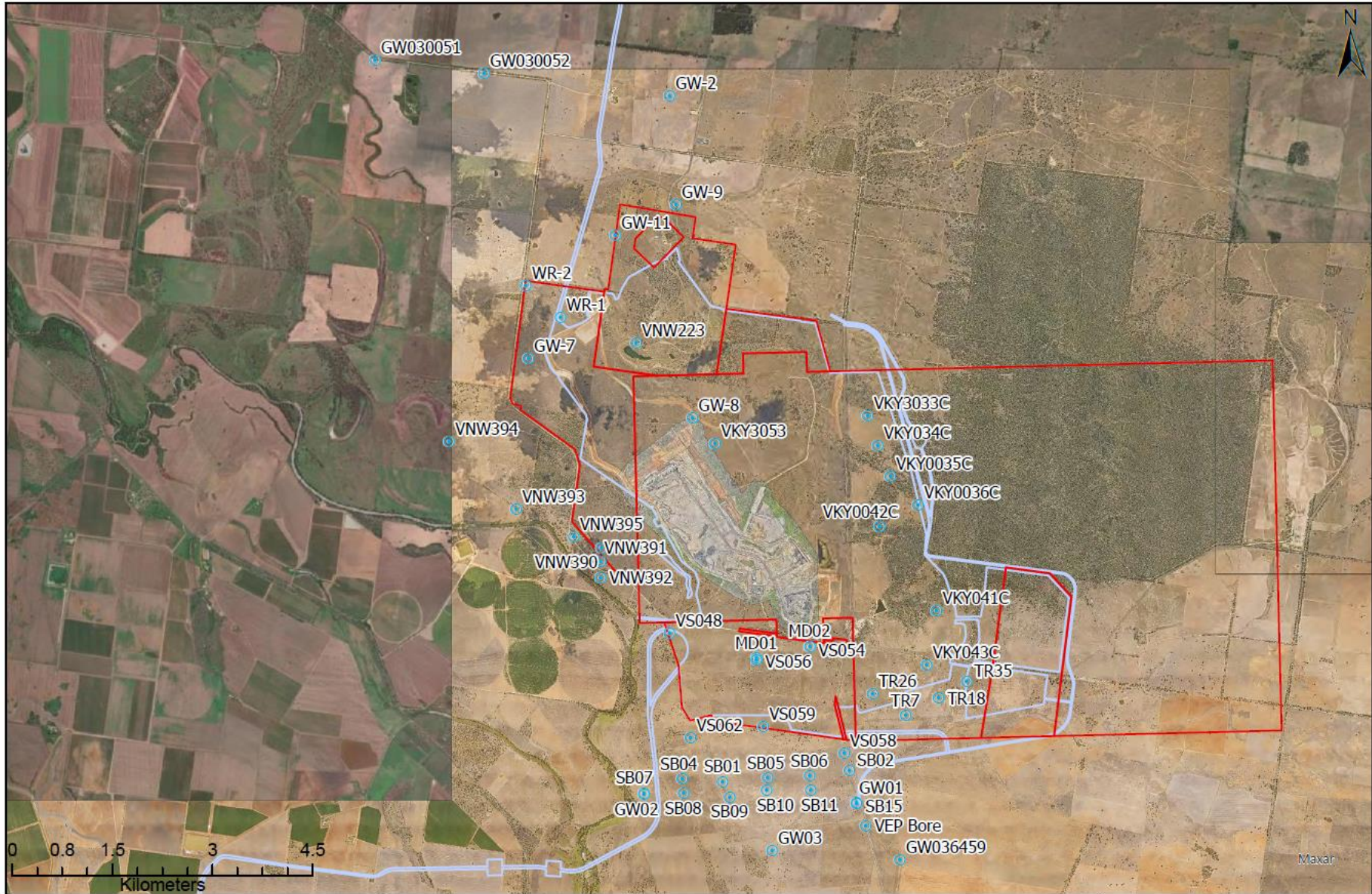
Appendix A



Appendix B

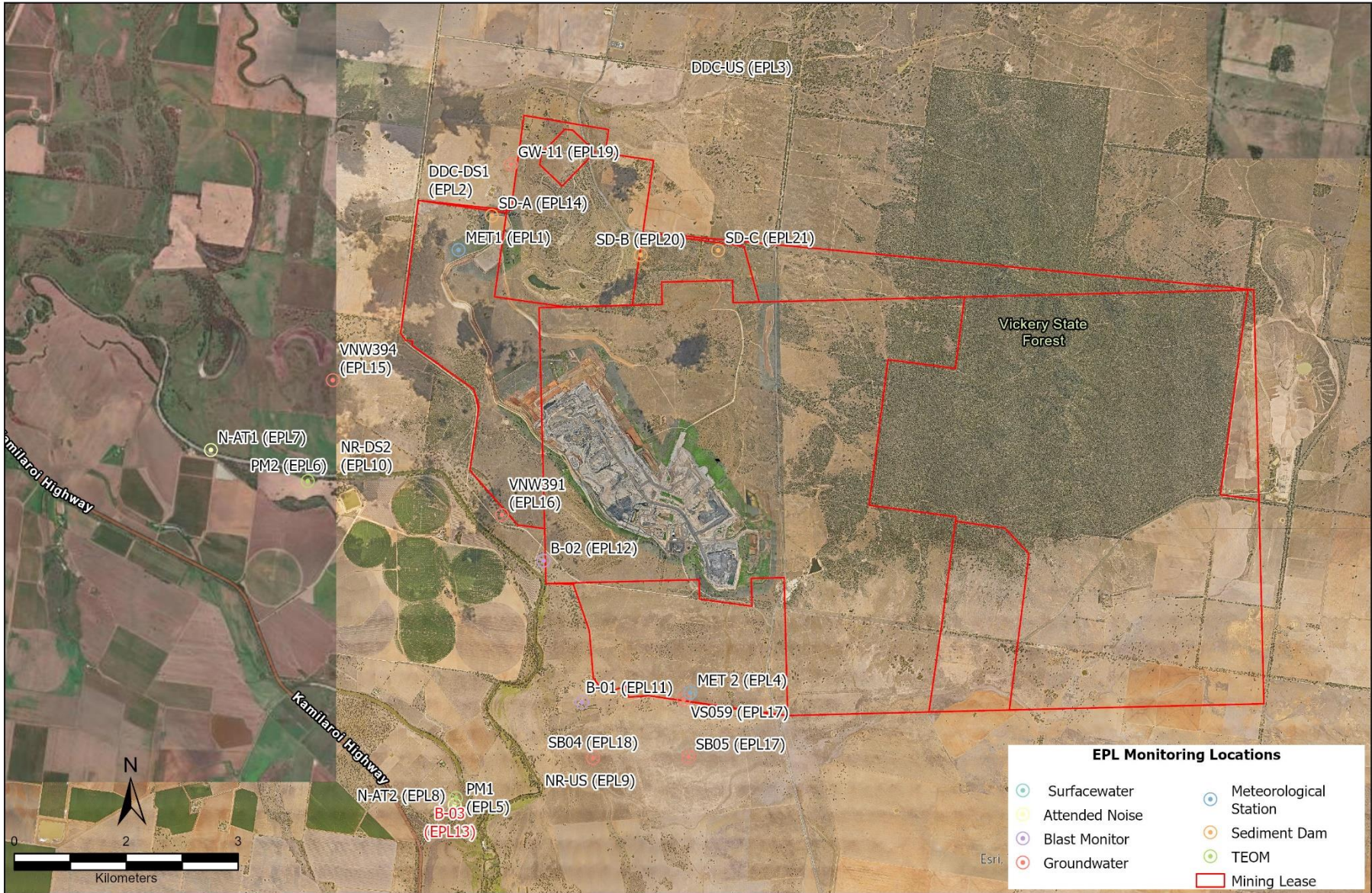




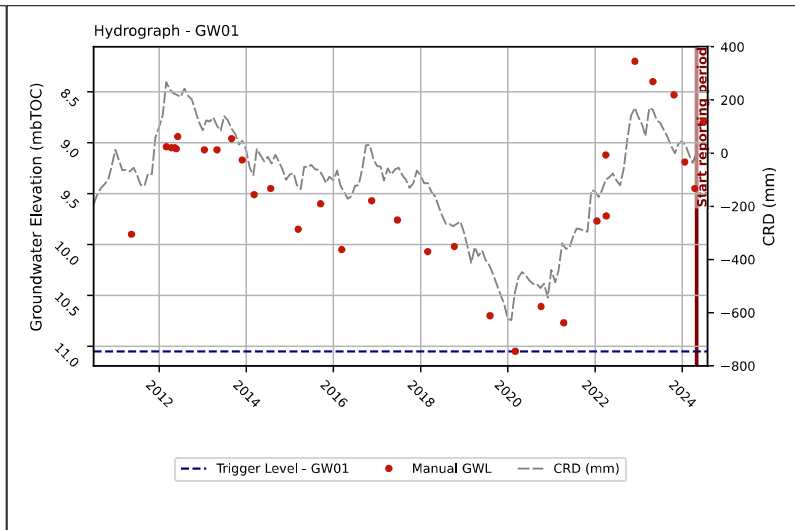
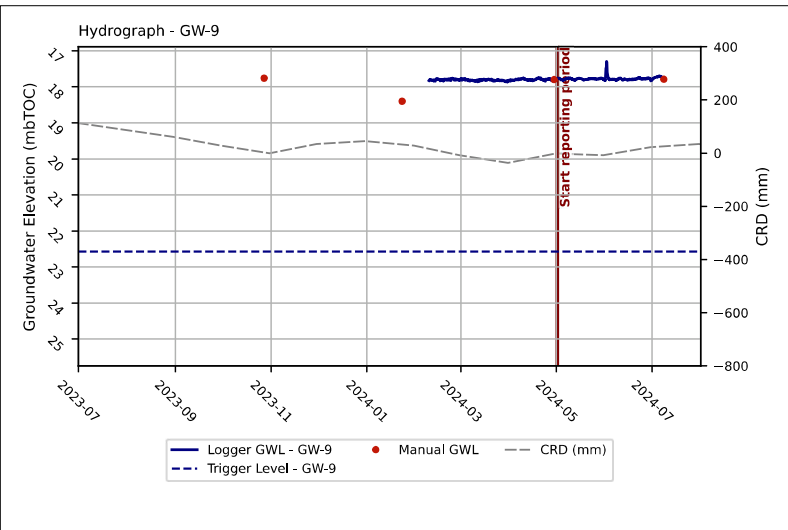
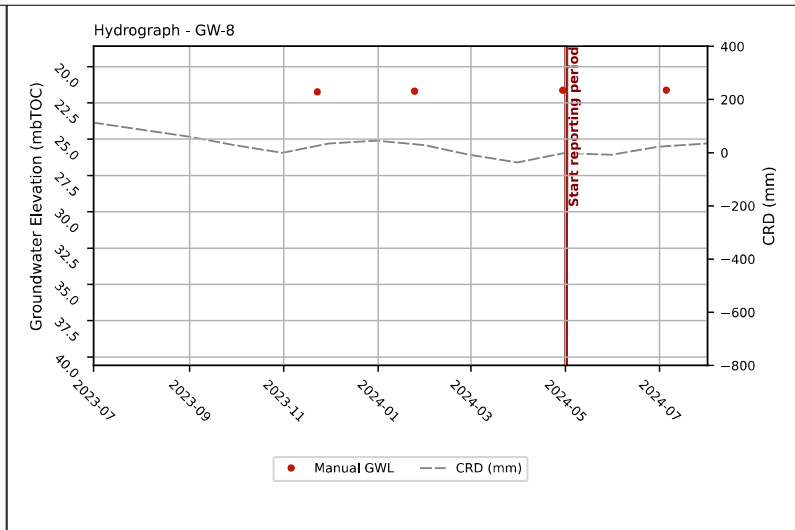
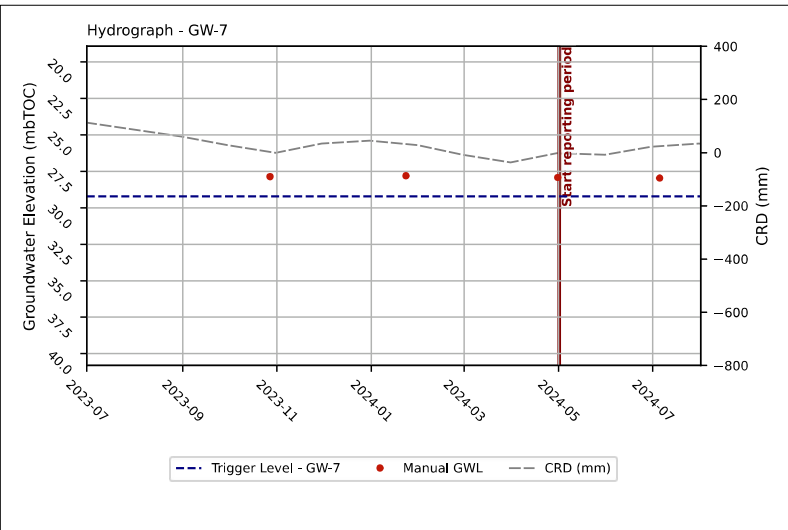
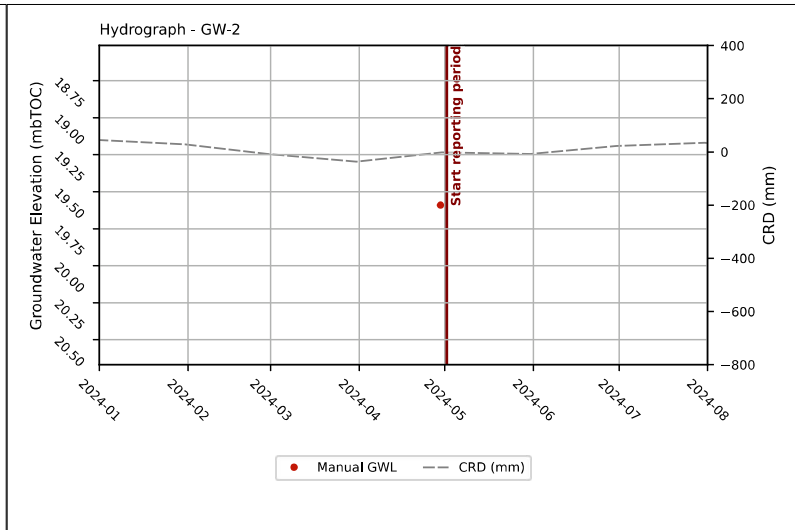
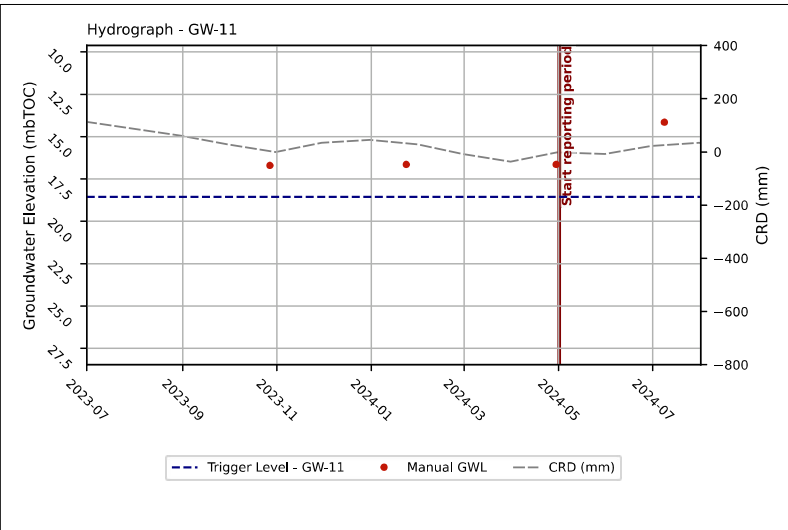


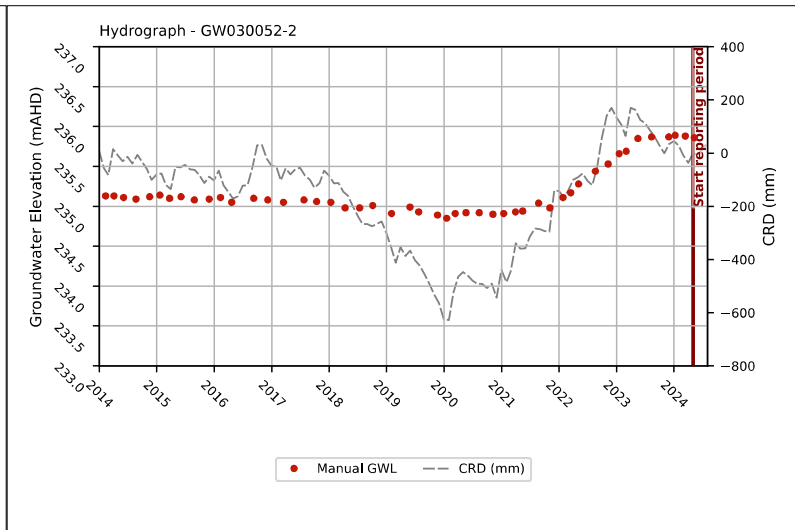
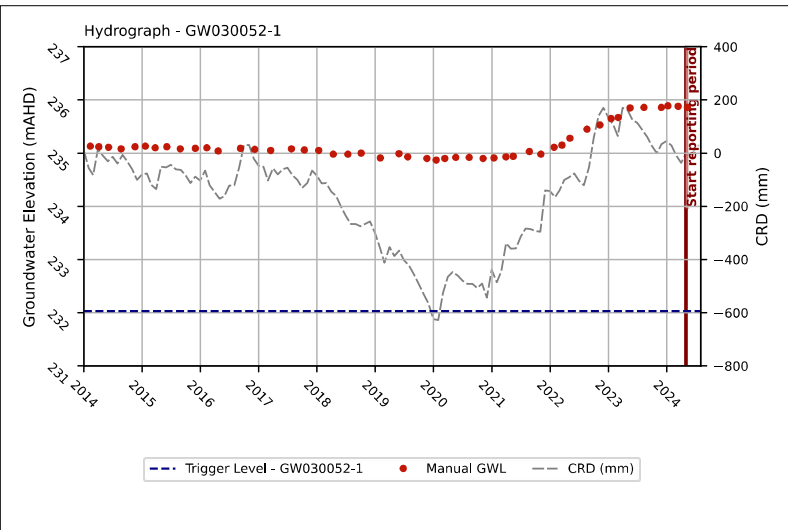
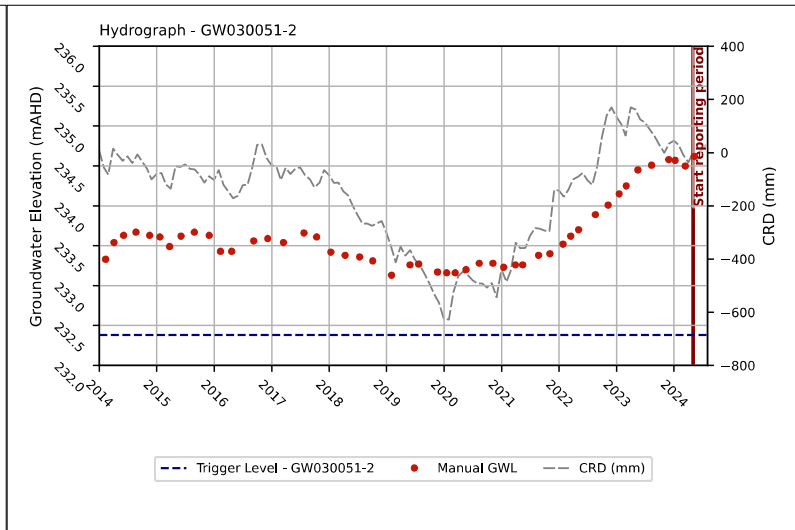
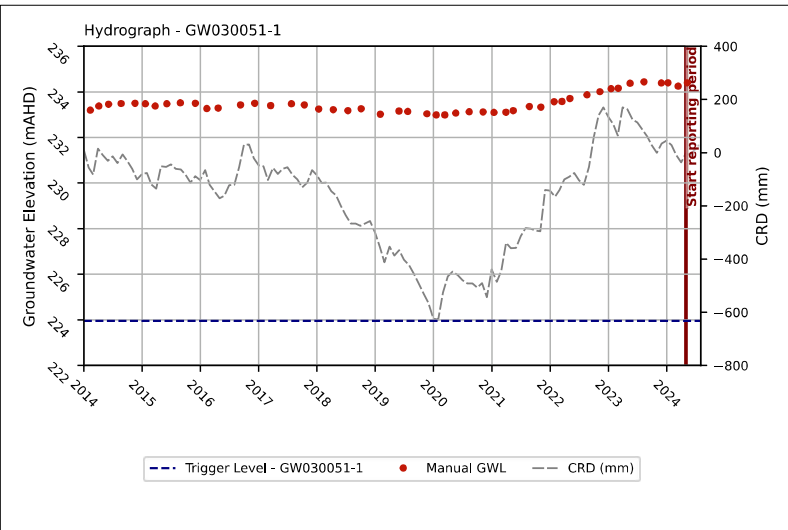
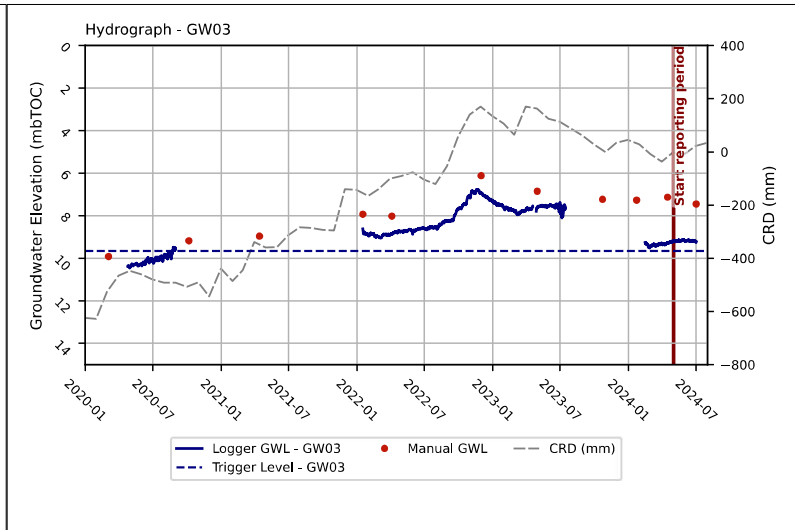
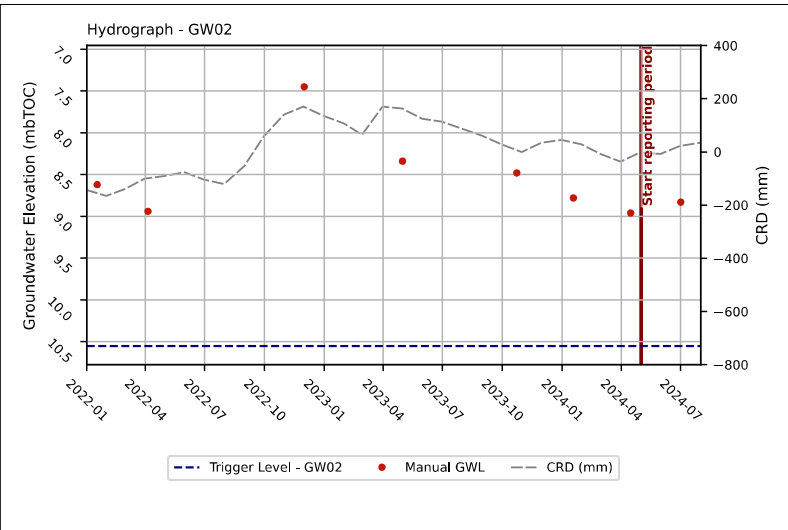
Ground Water Monitoring Locations

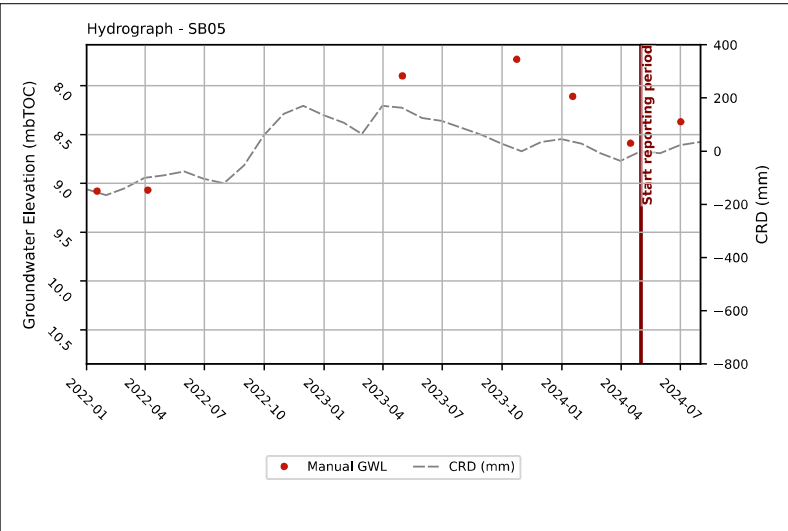
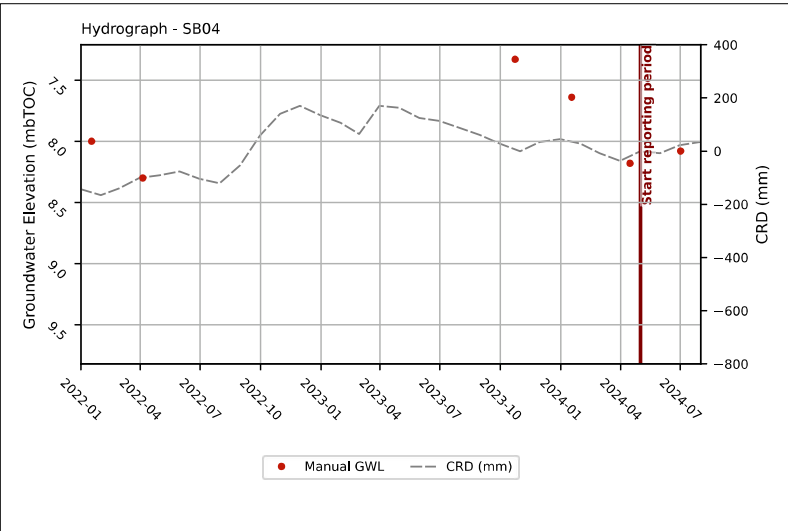
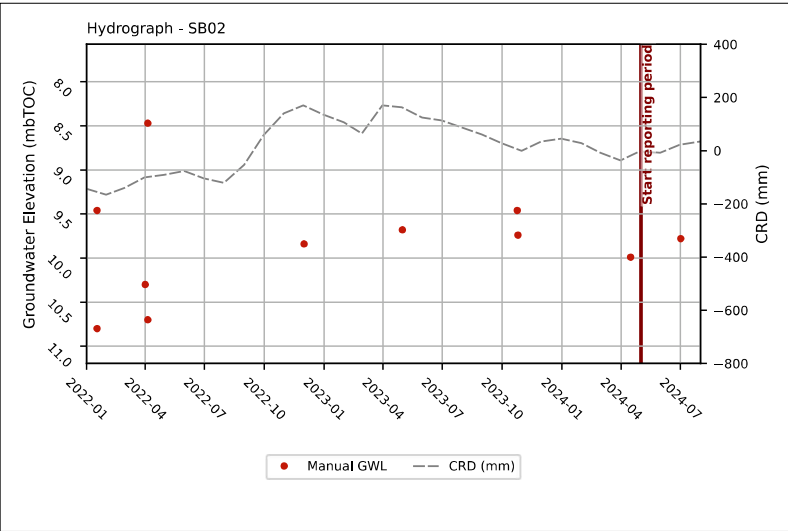
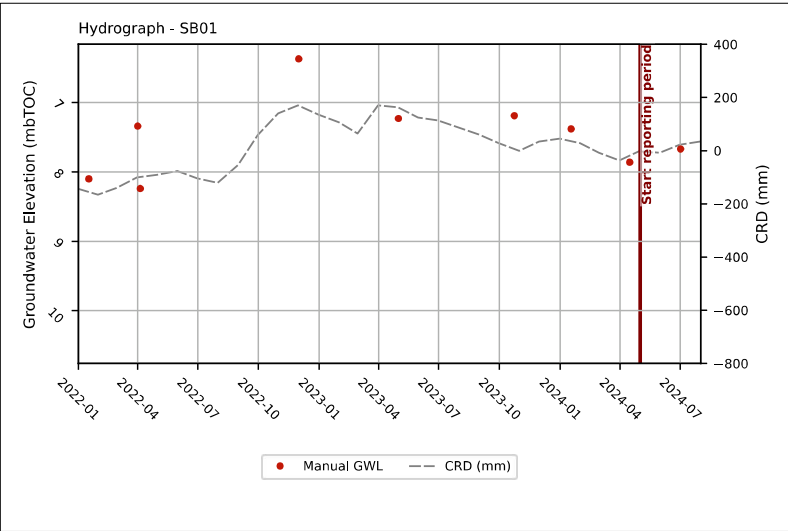
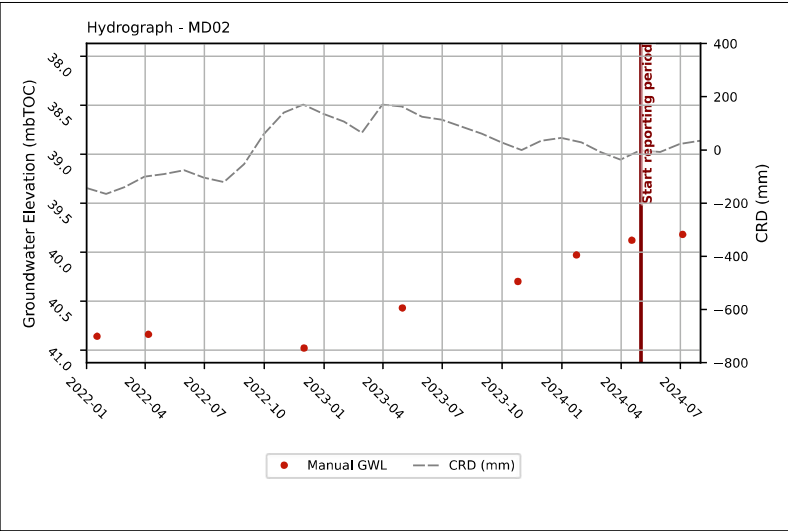
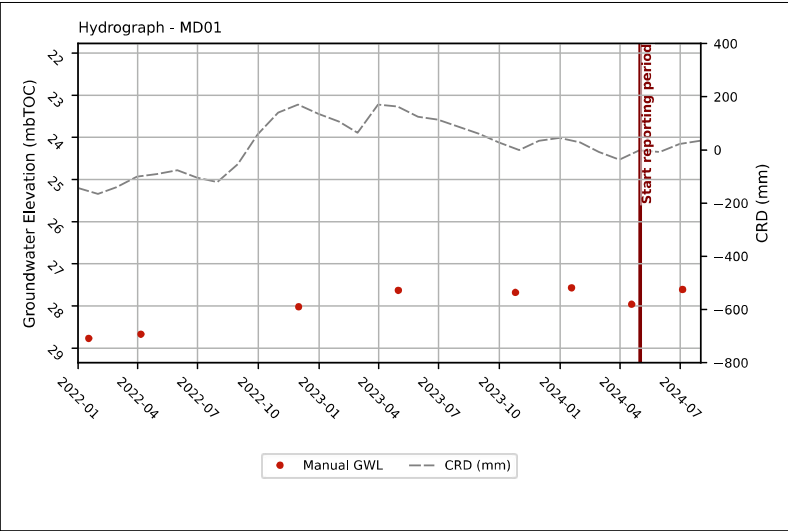
Legend		
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	Mining Lease	
	Approved Disturbance Area	

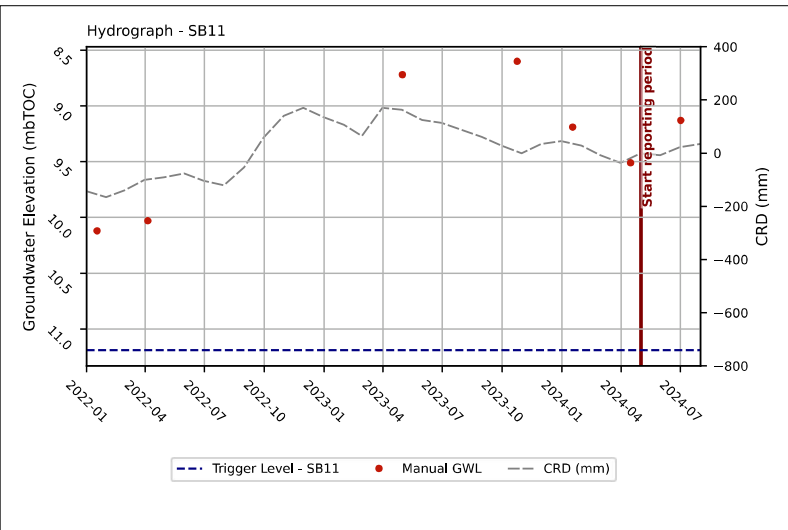
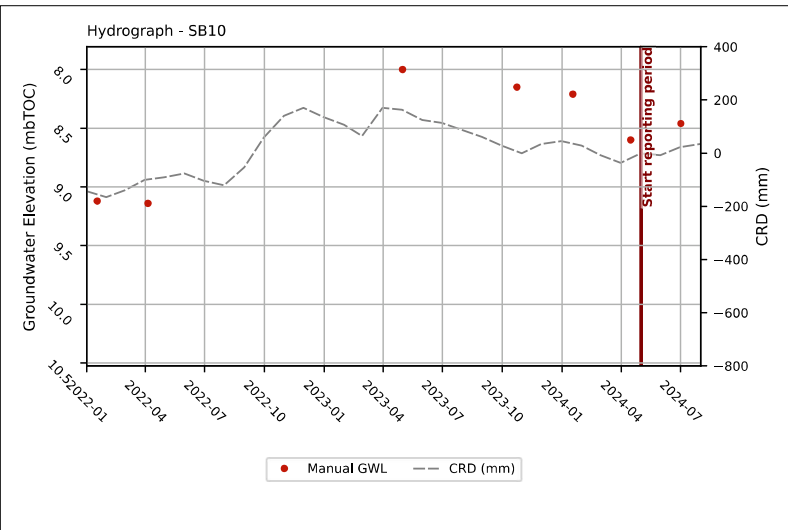
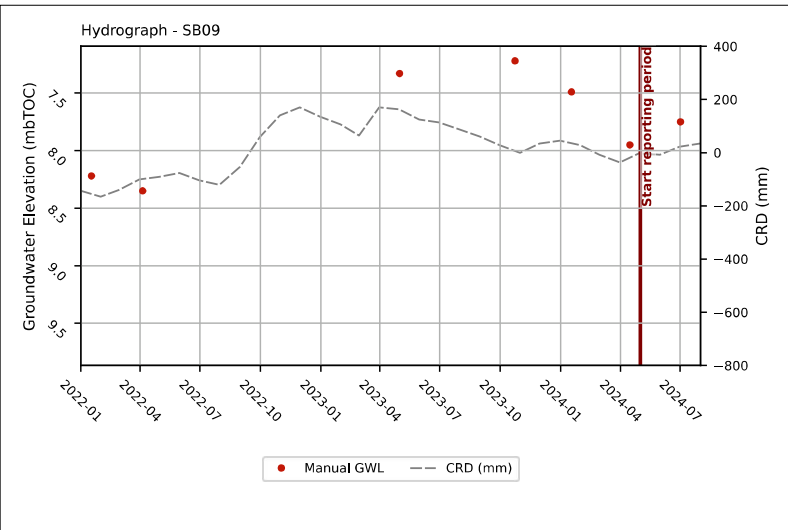
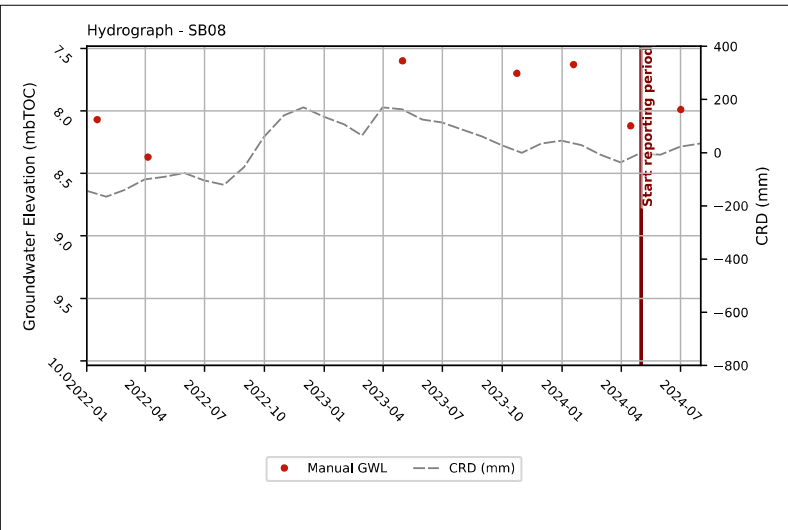
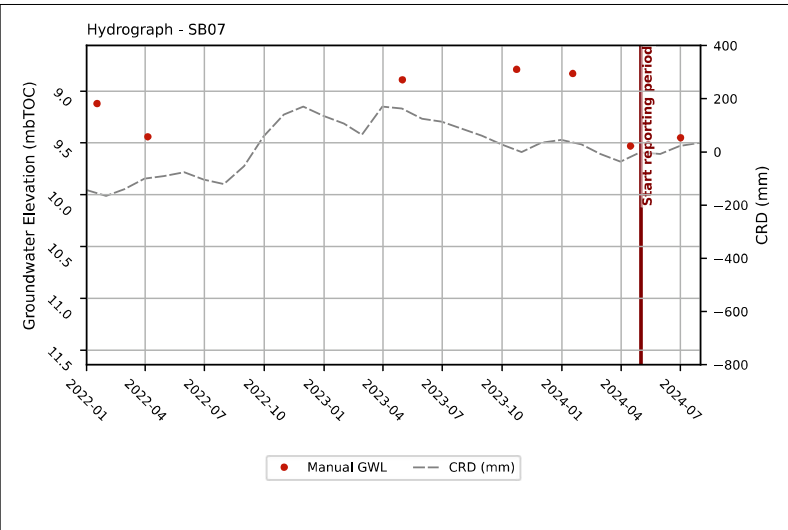
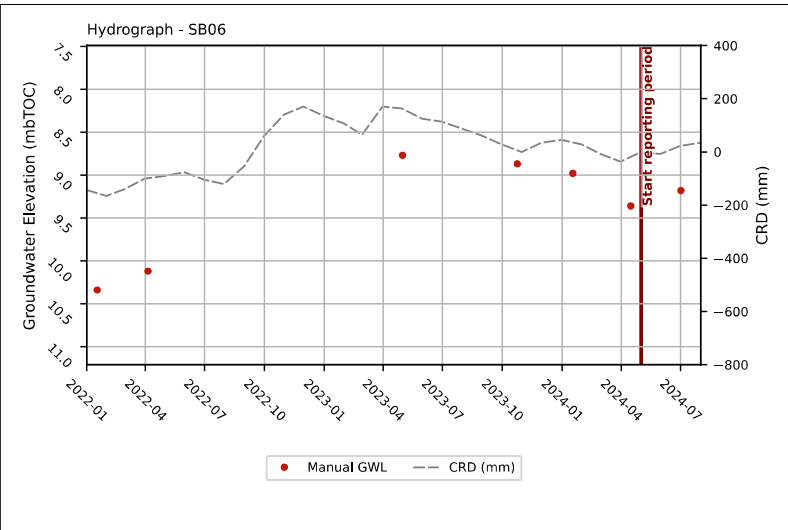


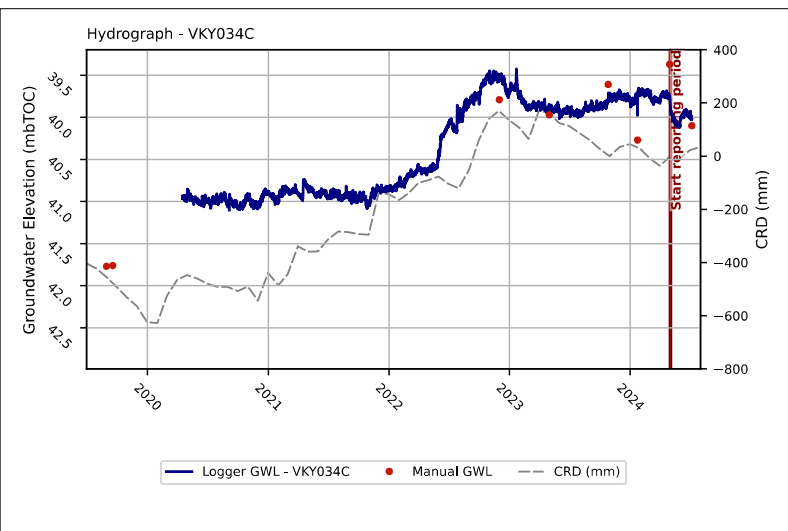
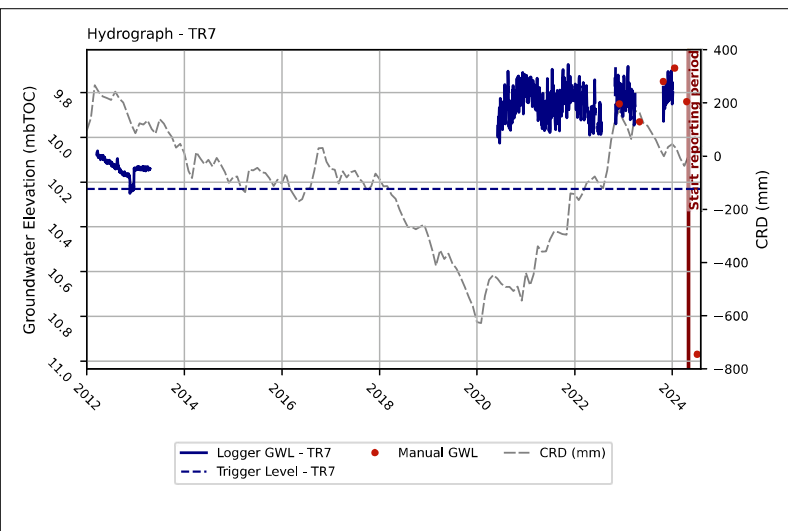
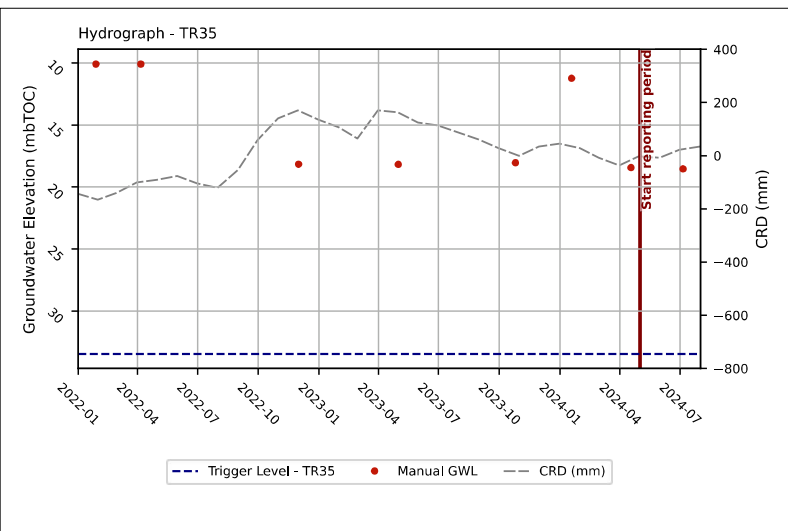
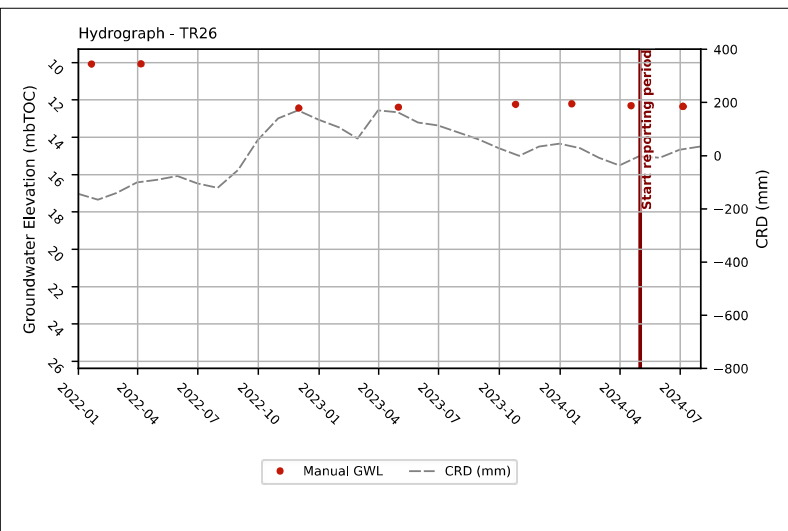
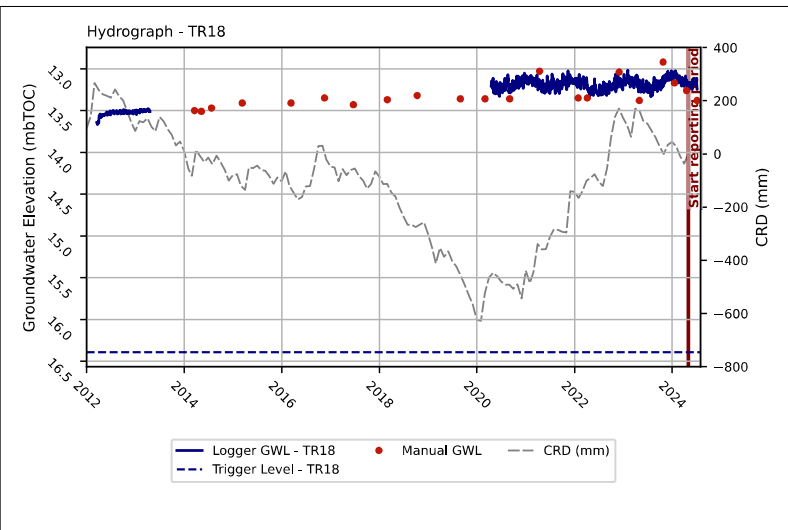
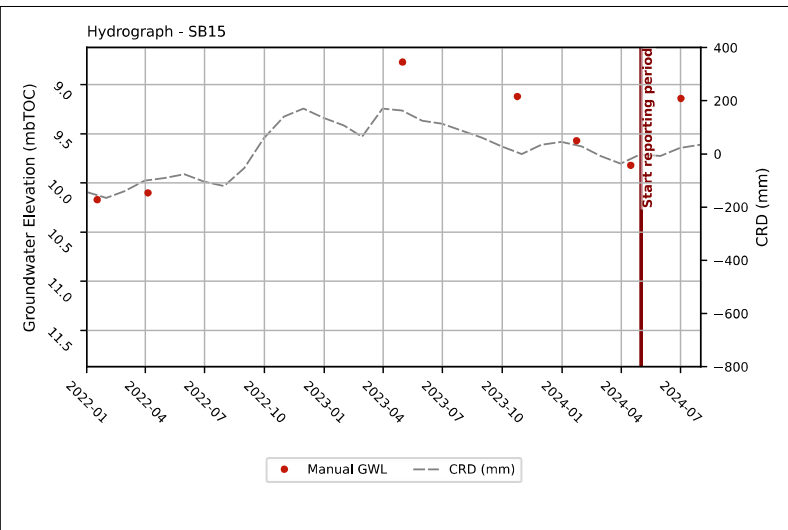
Appendix C

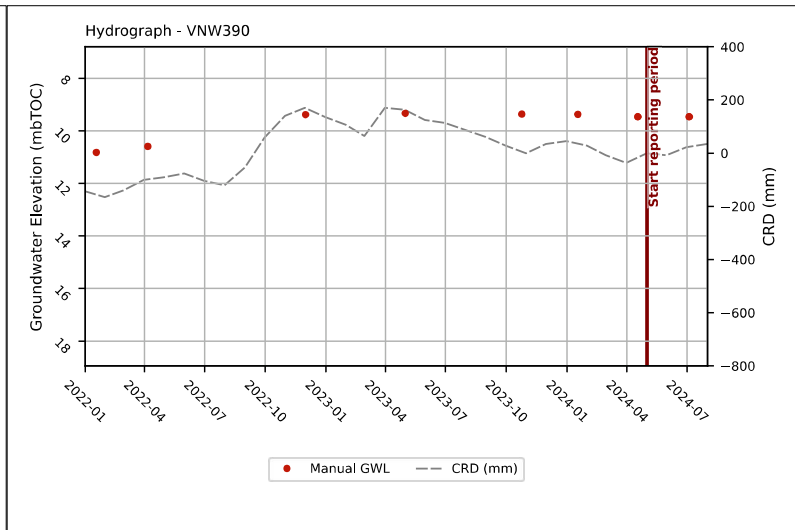
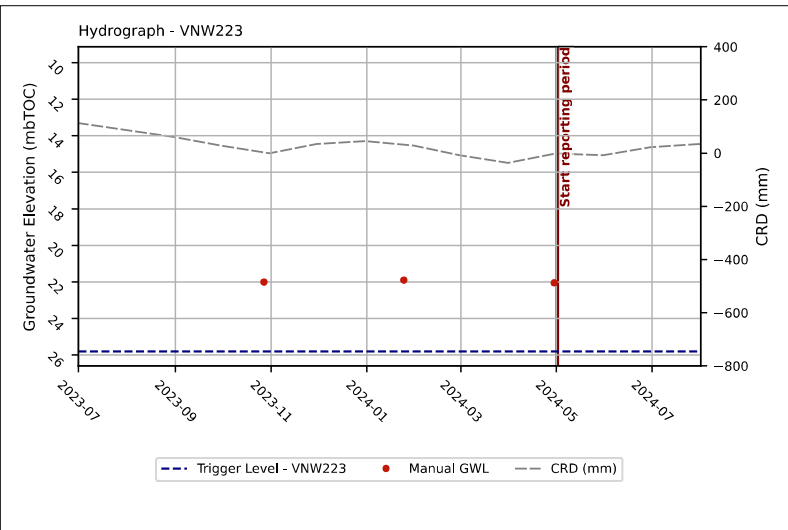
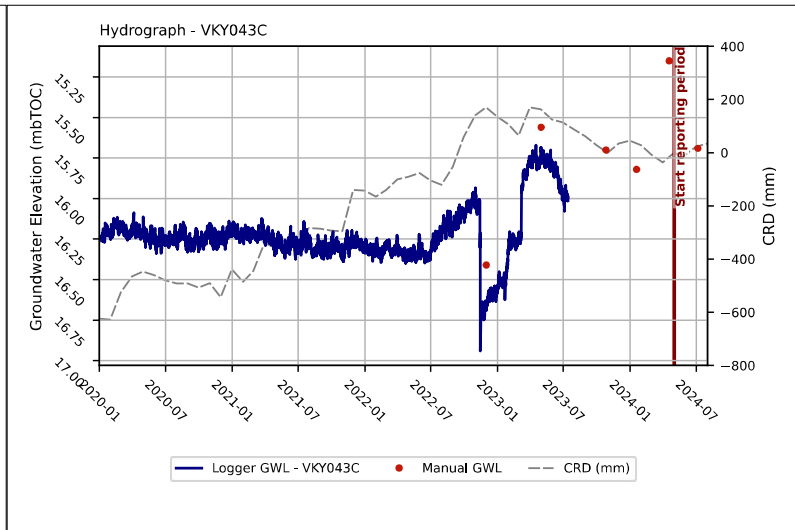
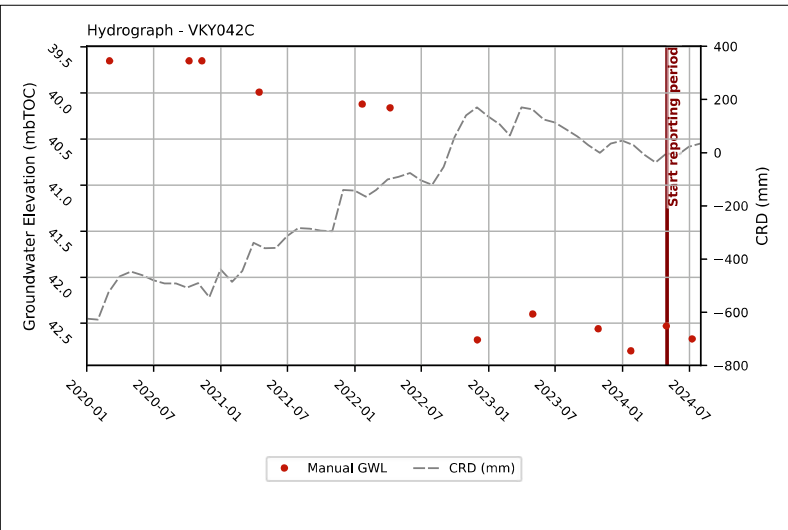
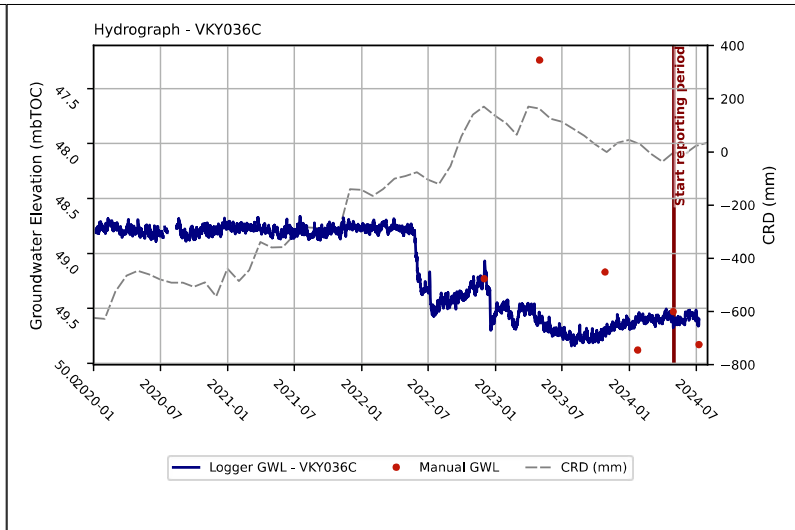
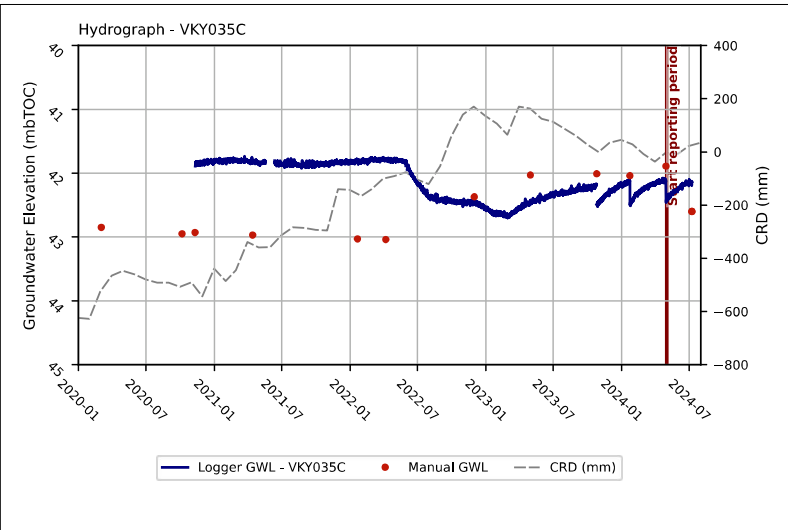


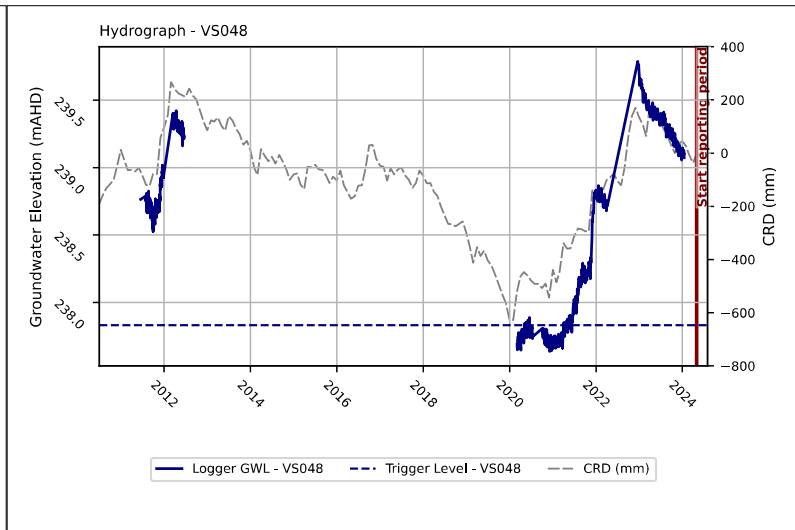
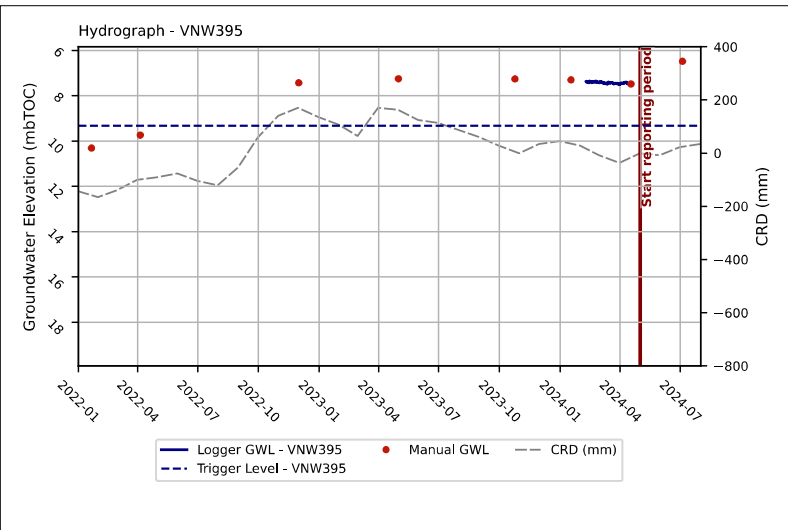
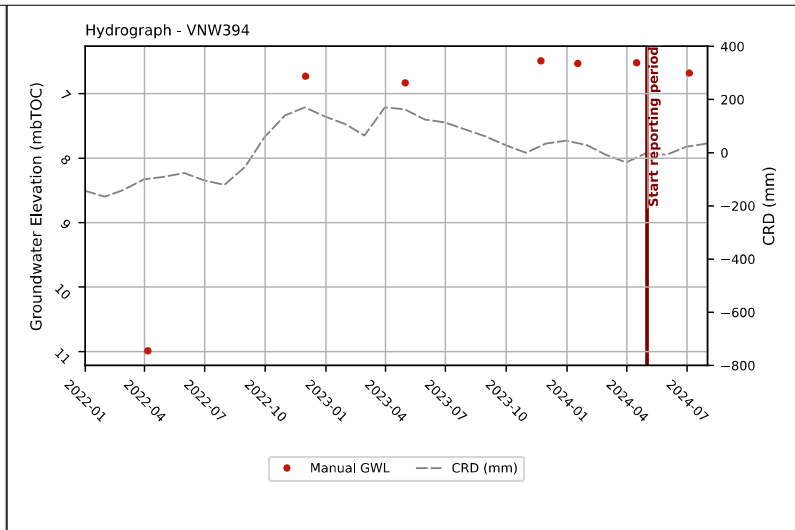
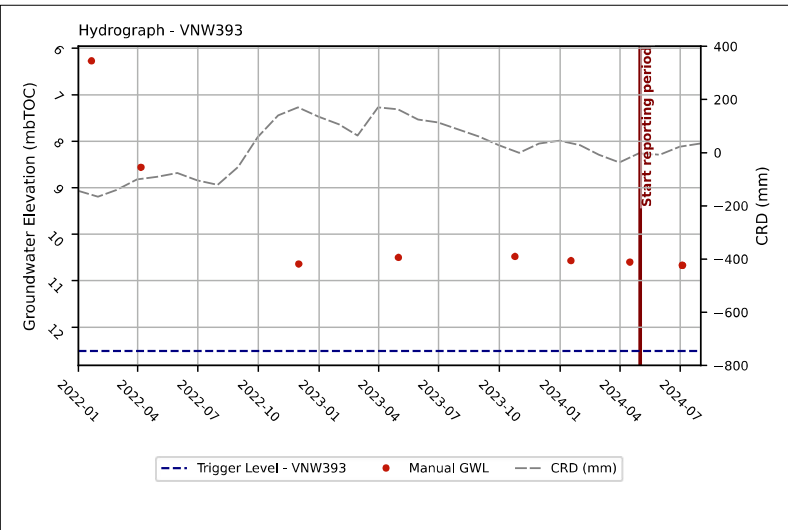
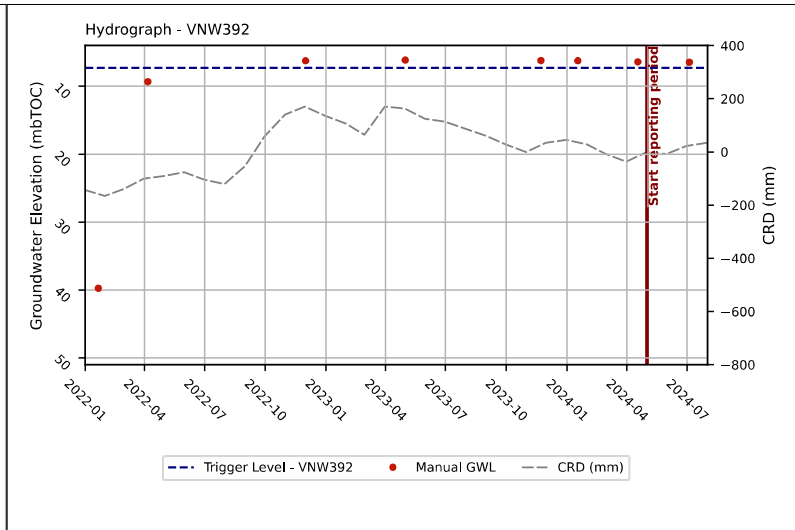
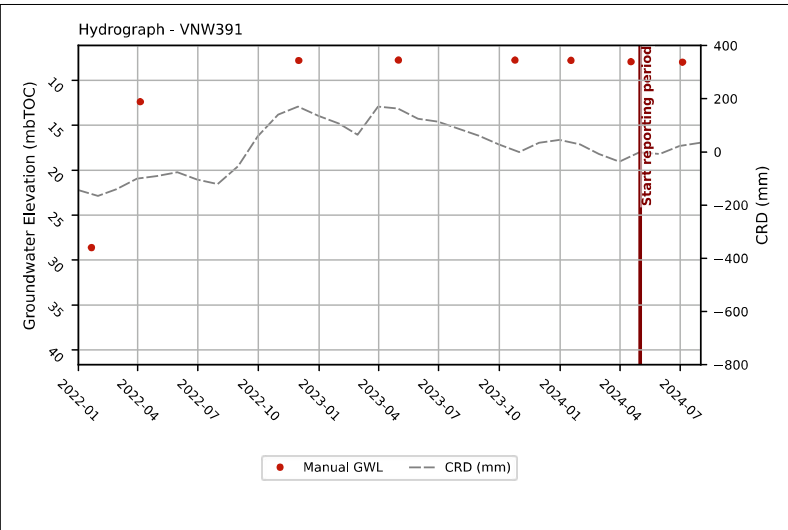


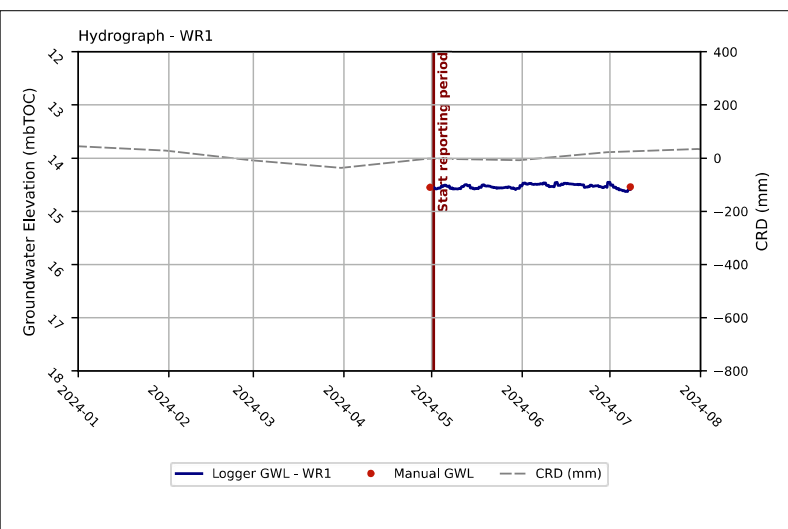
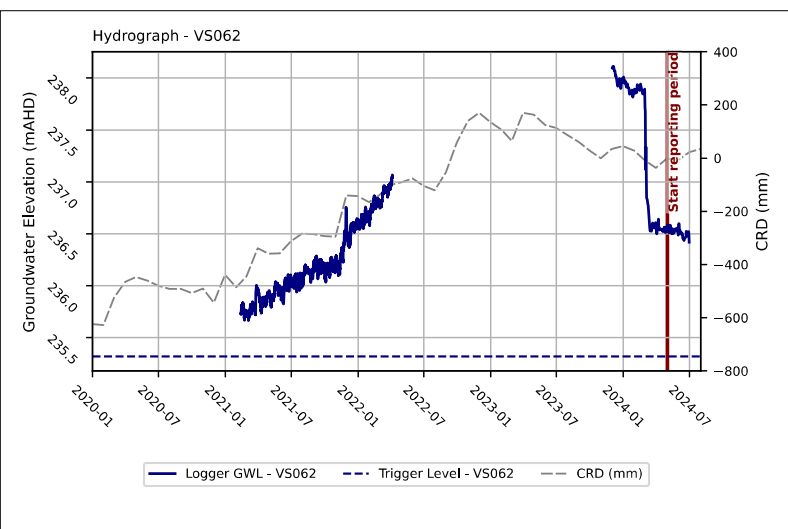
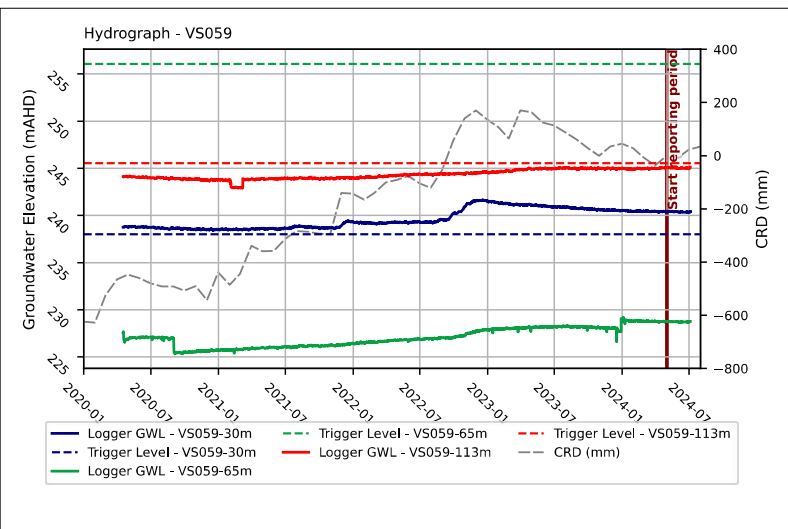
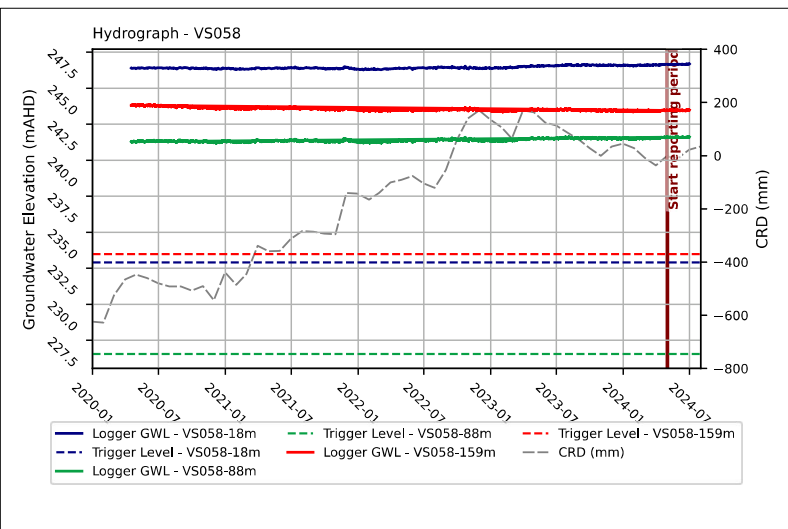
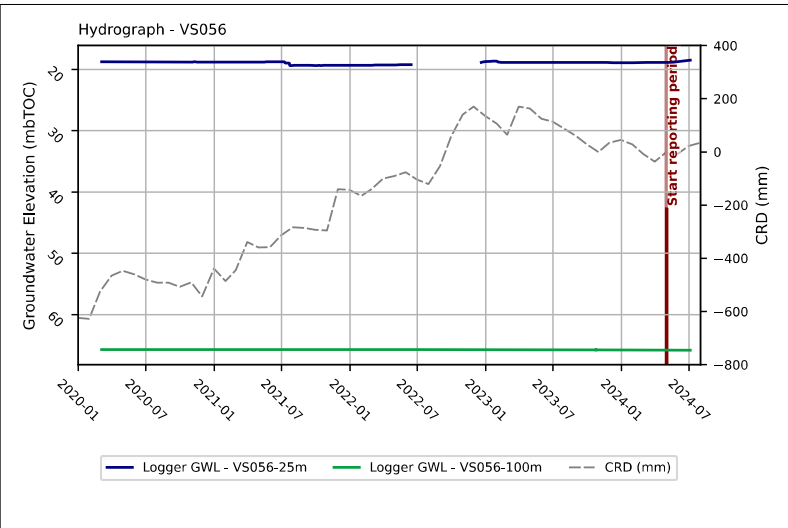
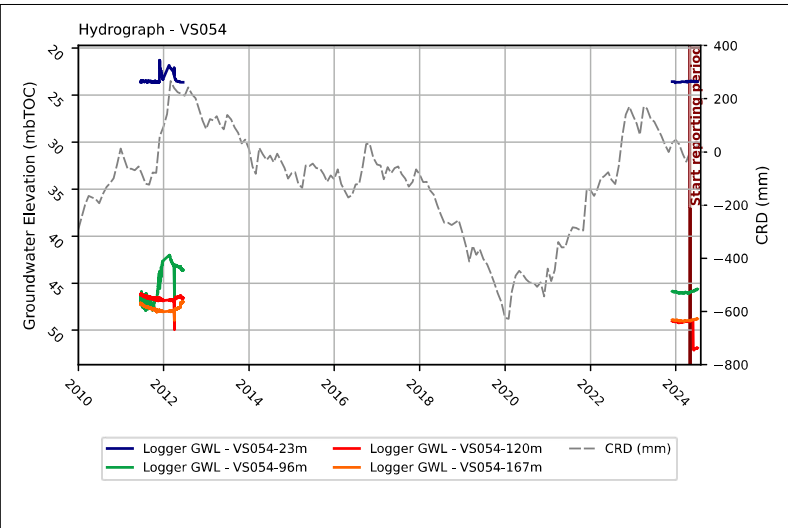












Hydrograph - WR2

