

From: [Zanotto, Linda](#)
To: [Camilla Edmunds](#); [Maria Dubikova](#); [Girja Sharma](#); [Glen Capararo](#); [Ravi Sundaram](#)
Cc: [Brassington, Gary](#); gabrielle.allan@dpie.nsw.gov.au
Subject: Dendrobium Mine - Review of distance to swamp impacts
Date: Friday, 8 September 2023 12:17:00 PM
Attachments: [Ltr WaterNSW - DA3 Distance to Swamp Impacts_08092023.pdf](#)
[Att 1 - Dendrobium Area 3A Update Report 230314_V2.pdf](#)
[Att 2 - WaterNSW letter - Dendrobium Impact Report 231314.pdf](#)
[Att 3 - 20230706c_ImpactReport-Hydrology-Swamp35b01_and 15a_19.pdf](#)
[Att 4 - R053c_Dendrobium-Distance to Swamp Impacts to June2023.pdf](#)

Dear Camilla,

Please find attached letter and supporting reports in relation to WaterNSW request regarding a review of distance to swamp impacts in Subsidence Impact Report dated 14 March 2023.

If you have any questions, please don't hesitate to reach out.

Kind Regards,

Linda Zanotto
Principal Mining Approvals
Illawarra Metallurgical Coal

M: +61 409 399 560

E: Linda.Zanotto@South32.net

south32.net



ATTACHMENT 2 –Correspondence with BCD

Ms Linda Zanotto
Illawarra Metallurgical Coal

By email: Linda.Zanotto@South32.net

Re: Dendrobium Area 3C – Impact report – 31st July 2023

Dear Linda

I refer to the Dendrobium 3C Impact Report for 17th July 2023. This Report detailed the following impacts:

- DA3C_LW21_016 (Update) (E 291249, N 6194096): Level 2 trigger
- DA3C_LW21_016 (Update) (E 291249, N 6194096): Level 1 trigger
- DA3C_LW21_018 (E 291273, N 6194190): Level 1 trigger

Further data is required for BCD analysis. Please send us the following raw data, in excel format:

1. For WC20 and swamp 144, all monitoring data, including groundwater, soil moisture and pool data.

If you wish to discuss, please contact Vanessa Allen, Senior Conservation Planning Officer, on 0242244186 or at Vanessa.Allen@environment.nsw.gov.au.

Yours sincerely



Vanessa Allen date: 10/8/2023

**Senior Conservation Planning Officer (Planning Illawarra)
Biodiversity and Conservation Division**

From: [Zanotto, Linda](#)
To: [Vanessa Allen](#)
Cc: [Chris Page](#)
Subject: RE: Dendrobium Area 3C Impact reports 8092023 14082023
Date: Tuesday, 3 October 2023 3:05:00 PM
Attachments: [image001.png](#)

Hi Vanessa,

Requested data packs are currently being uploaded to the MoveItCloud folder - refer to table below. You should receive confirmation emails when these are available. Please let me know if you do not receive these today.

Impact Report Date	Request Doc	Data	Data Files/Comments	Collated Data Pack
19/05/2023	BCD Response Dendrobium Area 3A - 9th May 2023.pdf	Raw data in excel format - All data for Swamp 148	See folders: Swamp GW; Soil Moisture	September_2023.zip
n/a	n/a	Longwall 19 End of Panel Data Pack	LW19 EoP Data Pack.zip	LW19 EoP Data Pack.zip
28/06/2023	BCD Response - Dendrobium Area 3C - 28th June 2023.pdf	Groundwater for Swamps 7, 9, 144, 145	See folder: Swamp GW.	September_2023.zip
		Bores 51845 and 51892	See 51892_dend 99 (1).xlsx <i>51845 no longer monitored as previously advised.</i>	September_2023.zip
17/07/2023	BCD Response - Dendrobium Area 3A and 3C - 17th July 2023.pdf	For WC20 and Swamp 144 all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water	September_2023.zip
		For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		All vegetation data from all swamps at Dendrobium Area 3, especially Swamp 15A, S144, S148, S34, S35a, S7, S150, S151	See Ecology folder in September 2023 data pack and Terrestrial Ecology folder in LW19 EoP data pack	September_2023.zip
31/07/2023	BCD Response Dendrobium Area 3C - 31st July 2023	Raw Data in excel format: For WC20 and Swamp 144 all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
2/08/2023		Raw Data in excel format: For Swamps 144, WC20, WC24, WC24A: all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
9/08/2023		Raw Data in excel format: For Swamps 144,145 and 9, all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
18/08/2023	BCD Response - Dendrobium Area 3A and 3C - 18th August 2023.pdf	For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		For Swamps 144, WC20, WC24, WC24A: all monitoring data, including groundwater, soil moisture, flow data and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
		All vegetation data from all swamps at Dendrobium Area 3, especially Swamp 15A, S144, S148, S34, S35a, S7, S150, S151	See Ecology folder in September 2023 data pack and Terrestrial Ecology folder in LW19 EoP data pack	September_2023.zip
4/09/2023	BCD Response Dendrobium Area 3 - 4th September 2023.pdf	For Swamps 12, 150, 9: all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby.	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		GIS shapefiles for all swamps in Area 3	See Swamp Shapefile folder	September_2023.zip

Kind Regards,
Linda

Linda Zanotto
 Principal Mining Approvals
 Illawarra Metallurgical Coal

M: +61 409 399 560
 E: Linda.Zanotto@South32.net

south32.net



-----Original Message-----

From: Vanessa Allen <Vanessa.Allen@environment.nsw.gov.au>
 Sent: Tuesday, 19 September 2023 3:30 PM
 To: Zanotto, Linda <Linda.Zanotto@south32.net>
 Cc: Chris Page <Chris.Page@environment.nsw.gov.au>
 Subject: Dendrobium Area 3C Impact reports 8092023 14082023

Hi Linda

Please see attached BCD responses to Impact Reports

Regards, Vanessa

Vanessa Allen
Senior Conservation Planning Officer

Biodiversity and Conservation Division | Department of Planning and Environment T 02 42244186 |
E Vanessa.Allen@environment.nsw.gov.au
Level 1, 84 Crown street, Wollongong NSW 2500 PO Box 514, Wollongong NSW 2520
<https://aus01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.dpie.nsw.gov.au%2F&data=05%7C01%7CLinda.Zanotto%40south32.net%7C28dc21e2b249461ce0f308dbb8d18708%7Cd05d5e5b385d4774b496d0cf85bfa5f4%7C1%7C0%7C638306982430079924%7CUnknown%7CTWFpbGZsb3d8eyJWljoimC4wLjAwMDAiLCJQjoiV2luMzliLCJBTiI6IkhWwiLCJXVCi6Mn0%3D%7C3000%7C%7C&sdata=qwv3%2BUPIS9LbDuplhjkjKBMk5HyjaW%2Fjg7%2BDVaNZb9Y%3D&reserved=0>

Office is located on Dharawal Country
The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

From: [Carlton, Josh via South32 Notification Service](#)
To: [Zanotto, Linda](#)
Subject: New File in Folder "BCD"
Date: Tuesday, 3 October 2023 2:43:43 PM
Attachments: [ATT00001.png](#)

New File Notification

A new file has arrived into the "/ Illawarra Coal - Energy and Engineering / BCD" folder.

Name: September_2023.zip
Tracking ID: 995948500
Original Size: 162,511,234 bytes



For non-repudiation purposes, it has been confirmed that the file received by MOVEit Transfer is IDENTICAL to the file uploaded by Carlton, Josh.

Please use the following URL and your username/password to DOWNLOAD or view the current status of this file, including its full upload and download history.

([https://south32.moveitcloud.com/human.aspx?
OrgID=9904&Arg12=fileview&Arg07=995948500&Arg06=957756355](https://south32.moveitcloud.com/human.aspx?OrgID=9904&Arg12=fileview&Arg07=995948500&Arg06=957756355))

Regards,
South32 Notification Service

Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and monthly during the post-mining period. Monitoring is conducted in accordance with the approved Longwall 21 Subsidence Management Plan (SMP). Extraction of Longwall 21 started on 25 April 2023 and as of 1 August 2023 had progressed approximately 854m. During a recent inspection, three new subsidence impacts were identified.

DA3C_LW21_019 (E 291634, N 6194239)

DA3C_LW21_019 is located approximately 210m west of Fire Road 6F (Figure 1). The impact consists of a single rock fracture to a rock step. The fracture has a continuous length of 2m, a maximum width of 0.03m and a maximum measurable horizontal depth of 0.3m (Photo 1 to Photo 3). Flagging tape is in place at the site as a safety precaution.

DA3C_LW21_019 is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 1), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length.



Photo 1: *DA3C_LW21_019*, looking at the rock fracture.
Taken on 1/08/2023.



Photo 2: *DA3C_LW21_019*, looking at the rock fracture.
Taken on 1/08/2023.



Photo 3: *DA3C_LW21_019*, looking at the width of the rock fracture.
Taken on 1/08/2023.

DA3C_LW21_020 (E 291318, N 6194429)

WC24 is a tributary of Wongawilli Creek that flows westward from DA3C mining operations (Figure 1). The upper reaches of the WC24 sub catchment were mined beneath by Longwall 21. Localised iron staining was observed along a 45m stretch of dry streambed on WC24 during the latest inspection (Photo 4 to Photo 7). The iron staining originates at *WC24_Pool 35* and extends downstream to *WC24_Rockbar 15*. During the baseline mapping of WC24, no surface water was observed in this part of the tributary, like latest observations. However, the recently recorded iron staining was not present in the baseline mapping. No other surface impacts have been observed in WC24.

DA3C_LW21_020 is a Level 1 trigger as per the Dendrobium Watercourse TARP (Table 2), specifically:

- Observable increase in iron staining within the mining area.



Photo 4: *DA3C_LW21_020*, section of iron staining in *WC24_Pool 35*. Taken on 1/08/2023.



Photo 5: *DA3C_LW21_020*, section of iron staining in *WC24_Channel 18*. Taken on 1/08/2023.



Photo 6: *DA3C_LW21_020*, section of iron staining in *WC24_Channel 18*. Taken on 1/08/2023.



Photo 7: *DA3C_LW21_020*, section of iron staining in *WC24_Rockbar 15*. Taken on 1/08/2023.

DA3C_LW21_021 (E 291547, N 6193965)

DA3C_LW21_021 consists of localised iron staining on the downstream basal step of Swamp 144 and the headwaters of tributary *WC20* (Figure 1). The iron staining originates from beneath a large boulder mid-way down the basal step (Photo 8). The iron staining is approximately 2m in length, 1m in width and disappears downslope into bushland. No other surface impacts were observed on or above the basal step.

DA3C_LW21_021 is a Level 1 trigger as per the *Dendrobium Watercourse TARP* (Table 2), specifically:

- Observable increase in iron staining within the mining area.



Photo 8: *DA3C_LW21_021*, overview of the iron staining. Taken on 1/08/2023.

Corrective Management Actions (CMAs)

The following management actions have been initiated:

- Continue monitoring program
- Submit an Impact Report to key stakeholders
- Report in the End of Panel Report
- Summarise actions and monitoring in AEMR

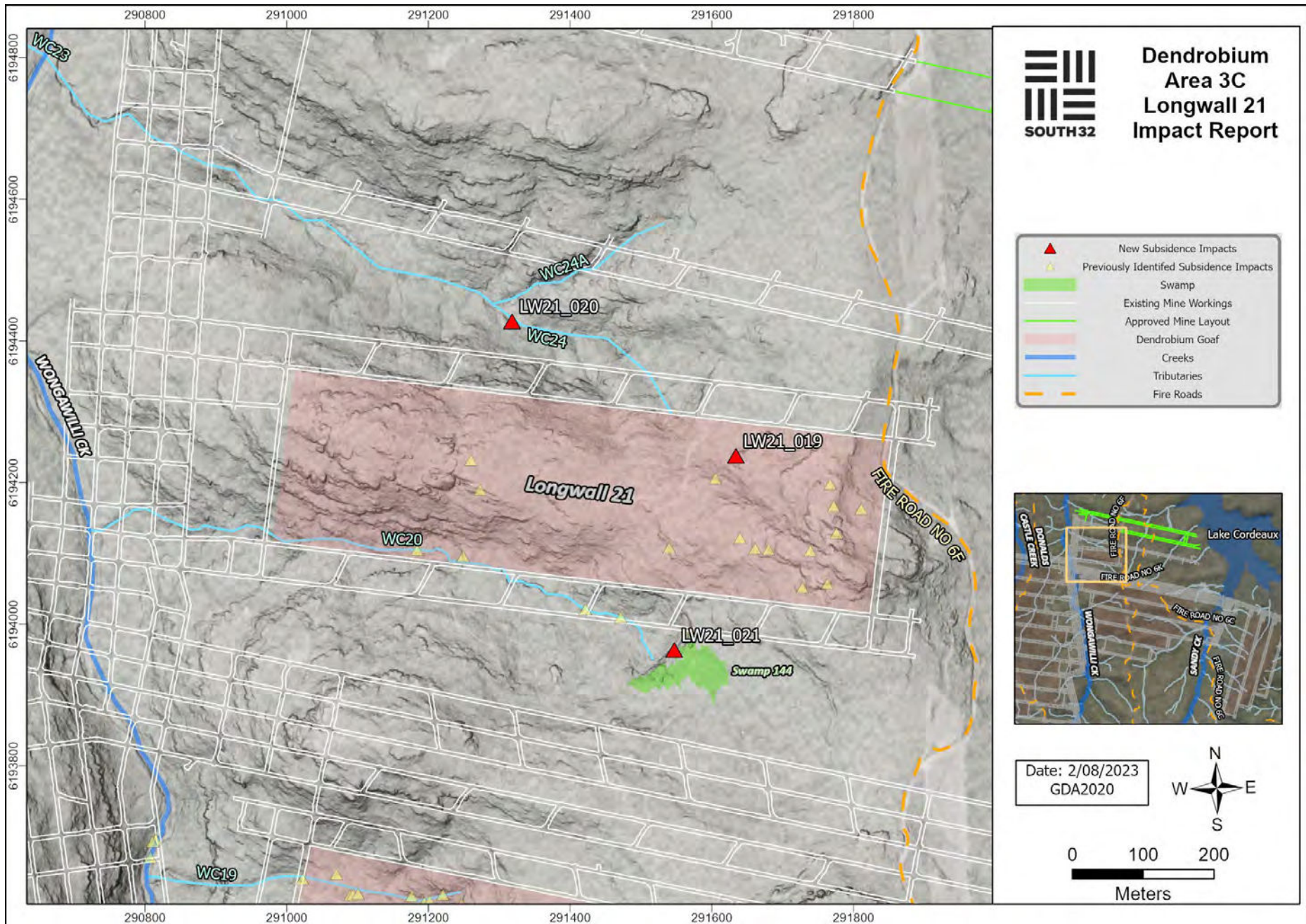


Figure 1: Latest subsidence impacts over Longwall 21 mining area in DA3C. Inset shows frame in relation to Dendrobium mining operations.

Table 1: Extract from Dendrobium Landscape TARP.

Monitoring	Trigger	Action
LANDSCAPE FEATURES		
<p>AREA 2</p> <p>Cliffs A2-CL1 (above LW4)</p> <p>Steep Slopes A2-SL1 and A2-SL2 (above LWs 4 & 5)</p> <p>Watercourses A2-WC10 and A2-WC11 (above LW3) A2-WC13 & A2-WC16 (above LWs 4 & 5)</p> <p>Swamp A2-SW1 (above LWs 4 & 5)</p> <p>4WD Track A2-FT1 (above LWs 4 & 5)</p> <p>Crininite Surface Extent A2-CN1 & A2-CN2 (above LWs 3 & 4)</p>	<p>Level 1 *</p> <ul style="list-style-type: none"> Rock fall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance Surface movement or rock displacement with negligible soil surface exposed Crack at the surface, which should not result in any significant erosion or further ground movement Crack in a fire trail which should not result in erosion or impede access Crack or fracture up to 100mm width Crack or fracture up to 10m length Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring 	<ul style="list-style-type: none"> Continue monitoring program Report impacts to key stakeholders Summarise impacts and Report in the End of Panel Report and AEMR
<p>AREA 3A</p> <p>Cliffs All mapped cliff sites in subsidence area (Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites)</p> <p>Steep Slopes All mapped steep slopes in subsidence area Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites</p> <p>Watercourses/ Swamps All mapped watercourse and swamps in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>Fire Trails All mapped fire trails in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>AREA 3B</p> <p>Cliffs All mapped cliff sites in subsidence area Refer to Dendrobium Area 3B SMP Figures 18.1 for location of sites</p>	<p>Level 2 *</p> <ul style="list-style-type: none"> Rock fall or overhang collapse at a cliff site, where characteristics of the cliff have changed, and there has been significant ground disturbance Surface movement or rock displacement that has exposed significant areas of soil A crack at the surface, which could result in significant erosion or movement at the surface A crack at the surface with potential risk to safety and/or fauna entrapment A crack in the fire trail, which could result in significant erosion or impede vehicle access Crack or fracture between 100 and 300mm width Crack or fracture between 10 and 50m length Significant erosion at any location, which is not likely to naturally stabilise within the period of monitoring, or is located in a sensitive area e.g. swamps, creek, lake shore, and may result in increased sediment transport to Cordeaux Dam, or has been previously identified as Level 1, but is not likely to naturally stabilise within the monitoring period 	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring frequency Notify relevant technical specialists and seek advice on any CMA required Provide safety signage and barricades as appropriate Implement approved repairs to ensure safety and serviceability on fire trails Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Level 3 *</p> <ul style="list-style-type: none"> Major cliff collapse where the characteristics of the cliff change significantly and there is significant ground disturbance that is unlikely to naturally stabilise within the monitoring period 	<ul style="list-style-type: none"> Actions as stated for Level 2 Immediately notify DoPI, DPIM, SCA, resource managers and relevant technical specialists and seek advice on any CMA required Site visits with stakeholders if required

Table 2: Extract from Dendrobium Watercourse TARP.

<p>DC13, LC5, WC20, WC21, WC22, WC23, WC24, WC25, WC26, WC27 and WC29</p> <p>General observation of streams in active mining areas when longwall is within 400m</p>	<p>Level 1</p> <ul style="list-style-type: none"> • Crack or fracture up to 100mm width at its widest point with no observable loss of surface water or erosion • Crack or fracture up to 10m length with no observable loss of surface water or erosion • Erosion in a localised area (not associated with cracking or fracturing) which would be expected to naturally stabilise without CMA and within the period of monitoring • Observable release of strata gas at the surface • Observable increase in iron staining within the mining area 	<ul style="list-style-type: none"> • Continue monitoring program • Submit an Impact Report to BCD, DPE, Resources Regulator, WaterNSW • Report in the End of Panel Report • Summarise actions and monitoring in AEMR
	<p>Level 2</p> <ul style="list-style-type: none"> • Crack or fracture between 100 and 300mm width at its widest point or any fracture which results in observable loss of surface water or erosion • Crack or fracture between 10 and 50m length • Soil surface crack that causes erosion that is likely to stabilise within the monitoring period without intervention • Observable increase in iron staining within the mining area continues to outside the mining area i.e. 400m from the longwall 	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring frequency • Submit letter report to DPE, BCD, Resource Regulator and WaterNSW and seek advice on any CMA required • Implement agreed CMAs as approved (subject to agency feedback)
	<p>Level 3</p> <ul style="list-style-type: none"> • Crack or fracture over 300mm width at its widest point • Crack or fracture over 50m length • Fracturing observed in the bedrock base of any significant permanent pool which results in observable loss of surface water • Soil surface crack that causes erosion that is unlikely to stabilise within the monitoring period without intervention • Gas release results in vegetation dieback, mortality or loss of aquatic habitat <p>Observable increase in iron staining within the mining area continues more than 600m from the longwall</p>	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Offer site visit with BCD, DPE, Resource Regulator, WaterNSW • Implement additional monitoring or increase frequency if required • Develop site CMA (subject to agency feedback). This may include: grouting of rockbar and bedrock base of any significant pool where it is appropriate to do so in consultation with BCD, DPE, Resource Regulator, WaterNSW • Completion of works following approvals and at a time agreed between S32, DPE, Resource Regulator and WaterNSW (i.e. may be after mining induced movements and impacts are complete), including monitoring and reporting on success • Review relevant TARP and Management Plan in consultation with key agencies

Table 3: Summary of recently reported impacts and triggers. Highlighted rows indicate observations featured in this report.

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3C_LW21_001	Rock Fracturing	Outcrop	06/06/2023	1	Rock fracturing to a small rock outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_002	Rock Fracturing and Rock Movement	LW21_RO1	06/06/2023	2	Rock fracturing and rock movement to a small rock outcrop at Landscape Monitoring Site LW21_RO1.	9/06/2023
DA3C_LW21_003	Rock Fracturing and Rockfall	Outcrop and Step	06/06/2023	2	Rock fracturing and rockfall to an outcrop and a step west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_004	Rock Fracturing	Outcrop	06/06/2023	2	Rock fracturing on an outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_005	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracture on a rock outcrop northeast of WC20.	19/06/2023
DA3C_LW21_006	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracturing on a rock outcrop northeast of WC20.	19/06/2023
DA3C_LW21_007	Rock Fracturing and Rockfall	Outcrop	15/06/2023	2	Rock fracturing and rock fall on an outcrop northeast of WC20.	19/06/2023
DA3C_LW21_008	Rock Fracturing and Soil Cracking	Rock Step	19/06/2023	1	Rock fracturing/soil cracking to a rock step and bushland northeast of WC20.	20/06/2023
DA3C_LW21_009	Rock Fracturing	Rock Step	19/06/2023	1	Rock fracturing to a rock step west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_010	Rock Fracturing and Rock Movement/ Displacement	Outcrop	19/06/2023	2	Rock fracturing and associated rock movement/displacement at an outcrop west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_011	Rock Fracturing, Rock Displacement and Soil Cracking	Outcrop and Bushland	19/06/2023	1	Soil cracking, rock fracturing and associated rock displacement to an outcrop and bushland west of <i>Fire Road 6F</i> .	20/06/2023
144_01	Groundwater	Swamp 144	22/06/2023	3	Groundwater recession rate greater than baseline	28/06/2023
S144_01	Soil Moisture	Swamp 144	27/06/2023	3	Average soil moisture level below the baseline level	28/06/2023
DA3C_LW21_012	Rock Fracturing	Rock Step	27/06/2023	1	Rock fracturing to rock step west of <i>Fire Road 6F</i> .	28/06/2023
DA3C_LW21_013	Rock Fracturing	Outcrop	03/07/2023	1	Rock fracturing to rock outcrop west of <i>Fire Road 6F</i> .	04/07/2023
DA3C_LW21_014	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to rockbar on tributary WC20.	17/07/2023

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3C_LW21_015	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to channel on tributary WC20.	17/07/2023
DA3C_LW21_016	Rockfall	Rock Step	11/07/2023	1	Small rockfall to step north of tributary WC20.	17/07/2023
Swamp 15a	Groundwater	Swamp	12/07/2023	1	Groundwater trigger at one site in Swamp 15a. (Longwall 19 mining area)	17/07/2023
Swamp 15a	Soil Moisture	Swamp	12/07/2023	2	Soil moisture triggers at three sites within Swamp 15a. (Longwall 19 mining area)	17/07/2023
DA3C_LW21_016 (Update)	Rockfall	Rock Step	26/07/2023	2	Rockfall to step north of tributary WC20.	31/07/2023
DA3C_LW21_017	Rock Fracturing	Watercourse	26/07/2023	1	Rock fracturing and uplift to WC20_Rockbar 15.	31/07/2023
DA3C_LW21_018	Rock Fracturing	Rock Outcrop/Ledge	26/07/2023	1	Rock fracturing to rock outcrop/ledge.	31/07/2023
DA3C_LW21_019	Rock Fracturing	Rock Step	1/08/2023	1	Rock fracturing to rock step west of Fire Road 6F.	2/08/2023
DA3C_LW21_020	Iron Staining	Watercourse	1/08/2023	1	Iron staining in tributary WC24.	2/08/2023
DA3C_LW21_021	Iron Staining	Rock Step	1/08/2023	1	Iron staining on the Swamp 144 basal step. Reported under the Watercourse TARP as iron occurs in the general drainage line and headwaters of WC20.	2/08/2023

Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and monthly during post-mining period. Monitoring is conducted in accordance with the approved Longwall 21 Subsidence Management Plan. Extraction of Longwall 21 started on 25 April 2023 and by 4 August 2023 had retreated 859 m. During the latest inspection over Longwall 21, one new subsidence impact was identified. Recent analysis of groundwater data in Swamps 9 and 145 identified shallow groundwater trigger at site *09_02* and soil moisture trigger at site *S145_01*.

DA3C_LW21_022 (E 291477, N 6193846)

Impact *DA3C_LW21_022* consists of a rockfall from a rock outcrop/step approximately 420m west of Fire Road 6F (Figure 1). Weathered sections of rock face are observed along with fresh rock face. The impact is likely from a natural fracture which has opened further and fallen away due to mining. Approximate volume of the rock is less than 0.5m³ (Photo 1 to Photo 3).

DA3C_LW21_022 is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 1), specifically:

- Rockfall from a cliff (step) which is mostly left intact, resulting in insignificant ground disturbance



Photo 1: Overview of boulder fallen away from step. Taken 7/08/2023.



Photo 2: Rockfall showing unweathered rock, looking down from step above. Taken 7/08/2023.



Photo 3: Close-up of boulder showing fresh edge of fracture. Taken 7/08/2023

Swamp 9

A near-surface groundwater trigger was recorded in Swamp 9 (Piezometer *09_02*) during recent analysis of groundwater data from the swamp. Site *09_02* is located 350 m east of the starting (eastern) end of Longwall 21 (Figure 1), i.e. within the longwall's 400 m buffer zone since the start of mining. The site exited the buffer on 4 May 2023. On 27 July 2023 the water level in the borehole receded below the lowest level recorded before mining (graph 1). There are two piezometers installed in Swamp 9 (one triggered and one not triggered).

These results contribute to a Level 2 trigger according to the SIMMCP (Table 1), specifically:

Level 2: Groundwater level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).

Note – additional assessment, including comparison to reference swamps is undertaken as part of End of Panel specialist assessment.

Swamp 145

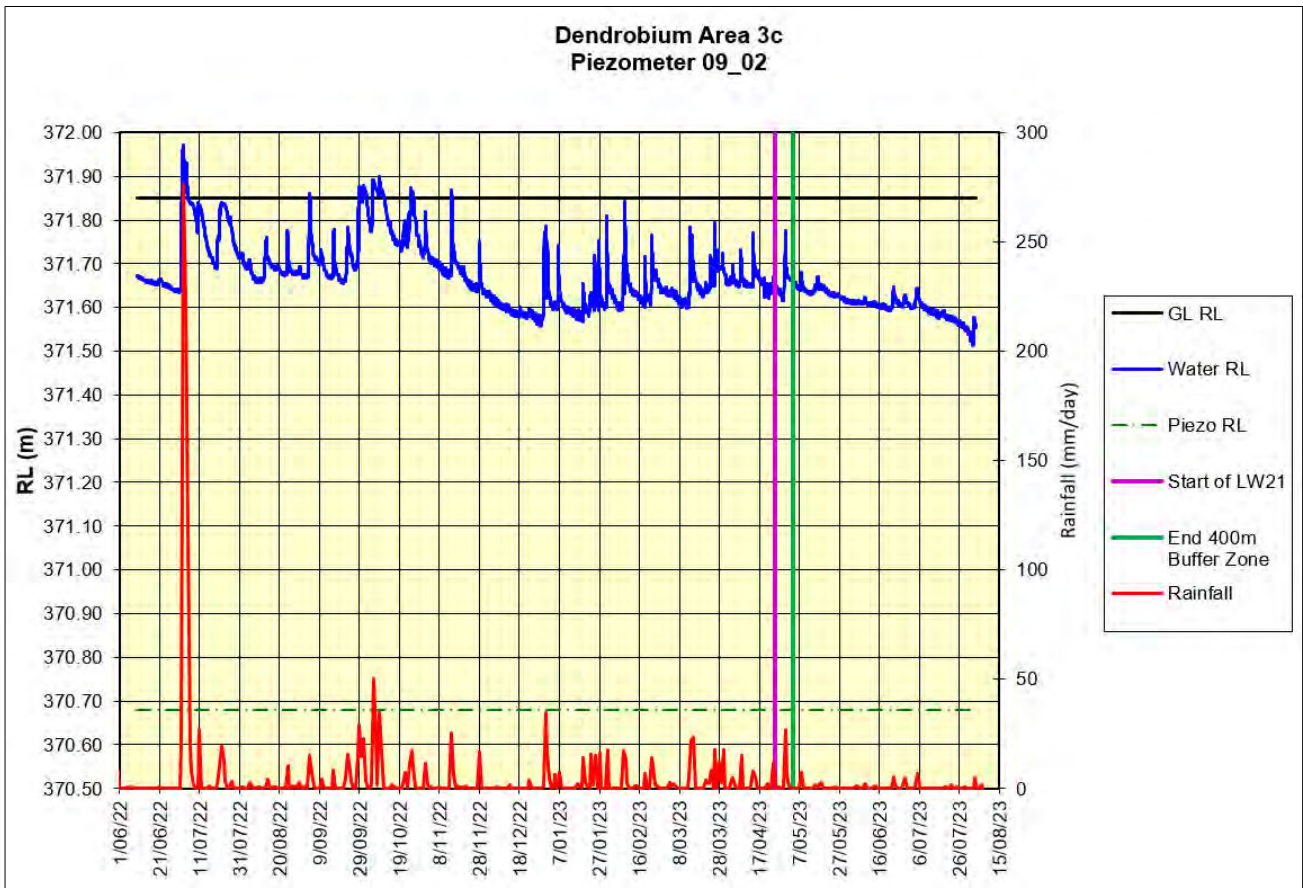
A soil moisture trigger was recorded in Swamp 145 (moisture probe *S145_01*). Site *S145_01* is located 359 m to the south-east of the starting (eastern) end of Longwall 21 (Figure 1), i.e. within the longwall's 400 m buffer zone since the start of mining. The site exited the buffer on 4 May 2023. On 3 June 2023 the average soil moisture value receded below the lowest level recorded before mining (Graph 2).

These results contribute to a Level 3 trigger according to the SIMMCP (Table 1), specifically:

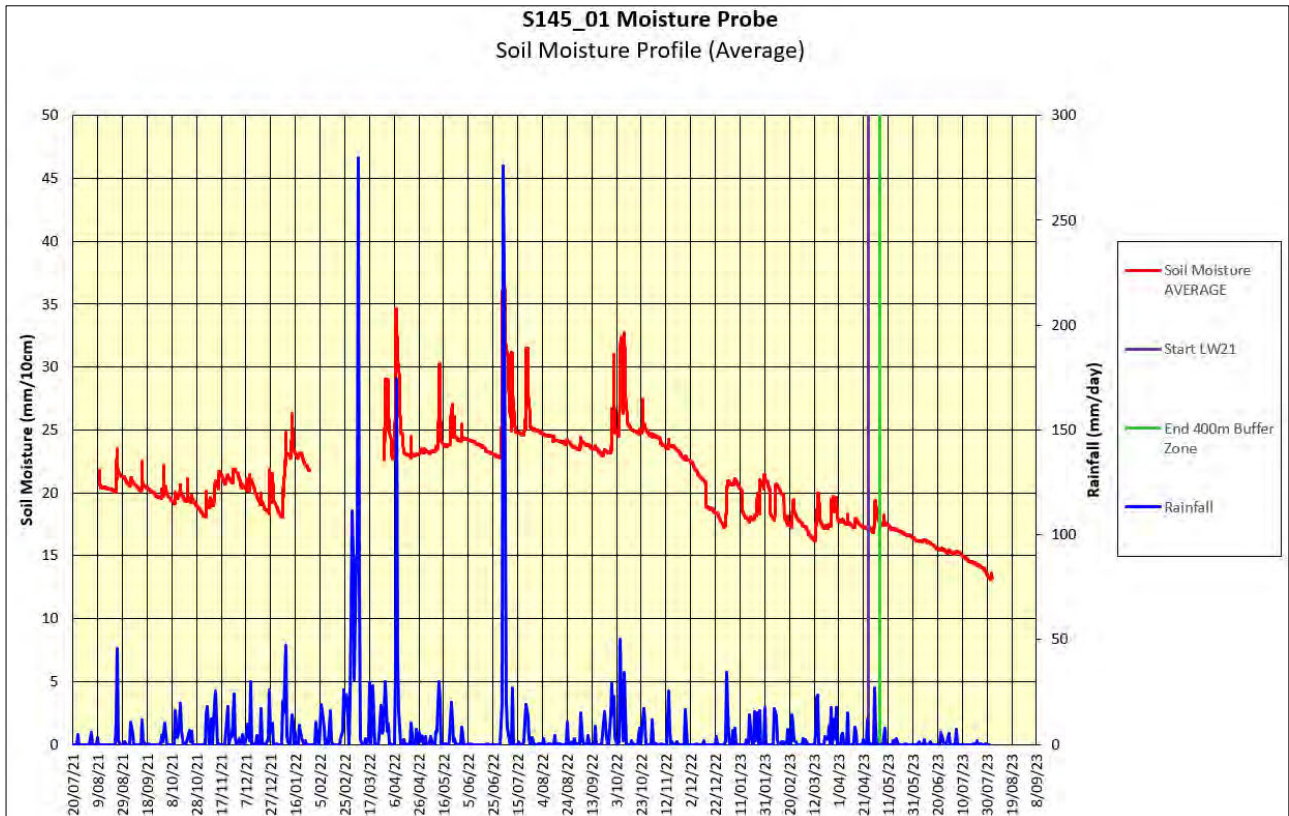
Level 3: Soil moisture level lower than baseline level at >80% of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).

Regarding the Level 3 trigger for this swamp, there is only one soil moisture probe in Swamp 145, therefore only a Level 3 trigger can apply.

The comparison to reference swamps, stated in the TARP definition, will be included in specialist analysis as part of the Longwall 21 End of Panel Report.



Graph 1: Shallow groundwater levels at 09_02, logged hourly, date range: 08/06/2022 to 03/08/2023



Graph 2: Average soil moisture levels at S145_01, logged hourly, date range: 10/08/2021 to 03/08/2023

Corrective Management Actions (CMAs)

The following management actions have been initiated:

- Continue monitoring program
- Submit an Impact Report to key stakeholders
- Seek advice on any other CMAs
- Report in the End of Panel Report
- Summarise actions and monitoring in AEMR

Figure 1: Map showing the reported subsidence impact and triggers. Inset shows frame in relation to Dendrobium mining operations.

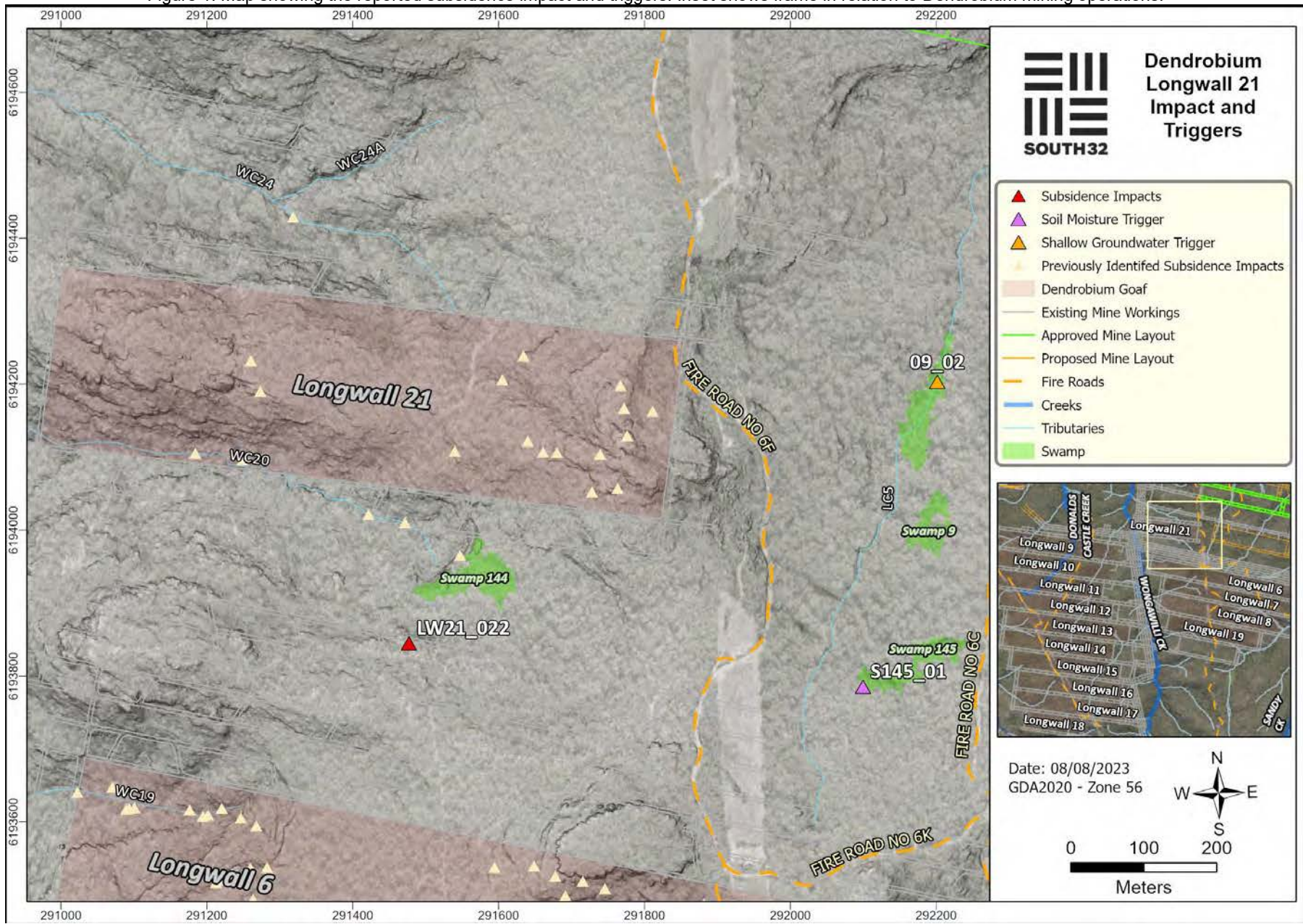


Table 1: Extract from Dendrobium Landscape TARP.

Monitoring	Trigger	Action
LANDSCAPE FEATURES		
<p>AREA 2</p> <p>Cliffs A2-CL1 (above LW4)</p> <p>Steep Slopes A2-SL1 and A2-SL2 (above LWs 4 & 5)</p> <p>Watercourses A2-WC10 and A2-WC11 (above LW3) A2-WC13 & A2-WC16 (above LWs 4 & 5)</p> <p>Swamp A2-SW1 (above LWs 4 & 5)</p> <p>4WD Track A2-FT1 (above LWs 4 & 5)</p> <p>Crinanite Surface Extent A2-CN1 & A2-CN2 (above LWs 3 & 4)</p>	<p>Level 1 *</p> <ul style="list-style-type: none"> Rock fall from a cliff which is left mostly intact (<10% length), resulting in insignificant ground disturbance Surface movement or rock displacement with negligible soil surface exposed Crack at the surface, which should not result in any significant erosion or further ground movement Crack in a fire trail which should not result in erosion or impede access Crack or fracture up to 100mm width Crack or fracture up to 10m length Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring 	<ul style="list-style-type: none"> Continue monitoring program Report impacts to key stakeholders Summarise impacts and Report in the End of Panel Report and AEMR
<p>AREA 3A</p> <p>Cliffs All mapped cliff sites in subsidence area (Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites)</p> <p>Steep Slopes All mapped steep slopes in subsidence area Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites</p> <p>Watercourses/ Swamps All mapped watercourse and swamps in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>Fire Trails All mapped fire trails in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p>AREA 3B</p> <p>Cliffs All mapped cliff sites in subsidence area Refer to Dendrobium Area 3B SMP Figures 18.1 for location of sites</p>	<p>Level 2 *</p> <ul style="list-style-type: none"> Rock fall or overhang collapse at a cliff site, where characteristics of the cliff have changed, and there has been significant ground disturbance Surface movement or rock displacement that has exposed significant areas of soil A crack at the surface, which could result in significant erosion or movement at the surface A crack at the surface with potential risk to safety and/or fauna entrapment A crack in the fire trail, which could result in significant erosion or impede vehicle access Crack or fracture between 100 and 300mm width Crack or fracture between 10 and 50m length Significant erosion at any location, which is not likely to naturally stabilise within the period of monitoring, or is located in a sensitive area e.g. swamps, creek, lake shore, and may result in increased sediment transport to Cordeaux Dam, or has been previously identified as Level 1, but is not likely to naturally stabilise within the monitoring period 	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring frequency Notify relevant technical specialists and seek advice on any CMA required Provide safety signage and barricades as appropriate Implement approved repairs to ensure safety and serviceability on fire trails Implement agreed CMAs as approved <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p>Level 3 *</p> <ul style="list-style-type: none"> Major cliff collapse where the characteristics of the cliff change significantly and there is significant ground disturbance that is unlikely to naturally stabilise within the monitoring period 	<ul style="list-style-type: none"> Actions as stated for Level 2 Immediately notify DoPI, DPIM, SCA, resource managers and relevant technical specialists and seek advice on any CMA required Site visits with stakeholders if required

Table 2: Extract from Swamp Impact, Monitoring, Management and Contingency Plan.

Performance Measures	Potential Impacts	Performance Triggers	Management Strategies	Offsets	Other Actions
Minor changes in the ecosystem functionality of the swamps	Falls in surface or near-surface groundwater levels in swamps <i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i>	<u>Level 1:</u> Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve). <u>Level 2:</u> Groundwater level lower than baseline level at 50% of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a 50% of monitoring sites (within 400m of mining) within the swamp. <u>Level 3:</u> Groundwater level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp.	a) upfront mine planning b) groundwater monitoring c) implementation of swamp research program d) weeding e) fire management f) reporting g) update future predictions		Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars
Minor changes in the ecosystem functionality of the swamps	Falls in soil moisture levels in swamps <i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i>	<u>Level 1:</u> Soil moisture level lower than baseline level at any monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps). <u>Level 2:</u> Soil moisture level lower than baseline level at 50% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps). <u>Level 3:</u> Soil moisture level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).	a) upfront mine planning b) soil moisture monitoring c) water spreading d) weeding e) fire management f) reporting g) update future predictions		Triggers of soil moisture decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars

Table 2: Summary of recently reported impacts and triggers. Highlighted rows indicate observations featured in this report.

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3C_LW21_001	Rock Fracturing	Outcrop	06/06/2023	1	Rock fracturing to a small rock outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_002	Rock Fracturing and Rock Movement	LW21_RO1	06/06/2023	2	Rock fracturing and rock movement to a small rock outcrop at Landscape Monitoring Site LW21_RO1.	9/06/2023
DA3C_LW21_003	Rock Fracturing and Rockfall	Outcrop and Step	06/06/2023	2	Rock fracturing and rockfall to an outcrop and a step west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_004	Rock Fracturing	Outcrop	06/06/2023	2	Rock fracturing on an outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_005	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracture on a rock outcrop northeast of WC20.	19/06/2023
DA3C_LW21_006	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracturing on a rock outcrop northeast of WC20.	19/06/2023
DA3C_LW21_007	Rock Fracturing and Rockfall	Outcrop	15/06/2023	2	Rock fracturing and rock fall on an outcrop northeast of WC20.	19/06/2023
DA3C_LW21_008	Rock Fracturing and Soil Cracking	Rock Step	19/06/2023	1	Rock fracturing/soil cracking to a rock step and bushland northeast of WC20.	20/06/2023
DA3C_LW21_009	Rock Fracturing	Rock Step	19/06/2023	1	Rock fracturing to a rock step west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_010	Rock Fracturing and Rock Movement/ Displacement	Outcrop	19/06/2023	2	Rock fracturing and associated rock movement/displacement at an outcrop west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_011	Rock Fracturing, Rock Displacement and Soil Cracking	Outcrop and Bushland	19/06/2023	1	Soil cracking, rock fracturing and associated rock displacement to an outcrop and bushland west of <i>Fire Road 6F</i> .	20/06/2023
144_01	Groundwater	Swamp 144	22/06/2023	3	Groundwater recession rate greater than baseline	28/06/2023
S144_01	Soil Moisture	Swamp 144	27/06/2023	3	Average soil moisture level below the baseline level	28/06/2023
DA3C_LW21_012	Rock Fracturing	Rock Step	27/06/2023	1	Rock fracturing to rock step west of <i>Fire Road 6F</i> .	28/06/2023
DA3C_LW21_013	Rock Fracturing	Outcrop	03/07/2023	1	Rock fracturing to rock outcrop west of <i>Fire Road 6F</i> .	04/07/2023
DA3C_LW21_014	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to rockbar on tributary WC20.	17/07/2023

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3C_LW21_015	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to channel on tributary WC20.	17/07/2023
DA3C_LW21_016	Rockfall	Rock Step	11/07/2023	1	Small rockfall to step north of tributary WC20.	17/07/2023
Swamp 15a	Groundwater	Swamp	12/07/2023	1	Groundwater trigger at one site in Swamp 15a. (Longwall 19 mining area)	17/07/2023
Swamp 15a	Soil Moisture	Swamp	12/07/2023	2	Soil moisture triggers at three sites within Swamp 15a. (Longwall 19 mining area)	17/07/2023
DA3C_LW21_016 (Update)	Rockfall	Rock Step	26/07/2023	2	Rockfall to step north of tributary WC20.	31/07/2023
DA3C_LW21_017	Rock Fracturing	Watercourse	26/07/2023	1	Rock fracturing and uplift to WC20_Rockbar 15.	31/07/2023
DA3C_LW21_018	Rock Fracturing	Rock Outcrop/Ledge	26/07/2023	1	Rock fracturing to rock outcrop/ledge.	31/07/2023
DA3C_LW21_019	Rock Fracturing	Rock Step	1/08/2023	1	Rock fracturing to rock step west of Fire Road 6F.	2/08/2023
DA3C_LW21_020	Iron Staining	Watercourse	1/08/2023	1	Iron staining in tributary WC24.	2/08/2023
DA3C_LW21_021	Iron Staining	Rock Step	1/08/2023	1	Iron staining on the Swamp 144 basal step. Reported under the Watercourse TARP as iron occurs in the general drainage line and headwaters of WC20.	2/08/2023
DA3C_LW21_022	Rockfall	Rock Step	7/08/2023	1	Rockfall to rock outcrop/step west of Fire Road 6F	9/08/2023
Swamp 145	Soil Moisture	Swamp	4/08/2023	3	Soil moisture trigger at one site in Swamp 145	9/08/2023
Swamp 9	Groundwater	Swamp	4/08/2023	2	Groundwater trigger at one site in Swamp 9	9/08/2023

Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and again monthly during post-mining period. Monitoring is conducted in accordance with the approved Longwall 19 Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP). Extraction of Longwall 19 started on 19 June 2022 and was completed on 29 March 2023. Recent analysis of soil moisture data in Swamp 15a identified a trigger at sites *S15a_12* and *S15a_18*. This update report is provided following report dated 17/07/2023 where Swamp 15a soil moisture triggers were previously reported.

This Version 2 of the report includes a summary of consultation with stakeholders undertaken since the initial report.

Swamp 15a

A soil moisture trigger was recorded in Swamp 15a (soil moisture probes *S15a_12* and *S15a_18*) during recent analysis of moisture data for the swamp. Site *15a_12* is located 172 m south-east from Longwall 19 (Figure 1), i.e. within the longwall's 400 m mining area since the start of mining. The site exited the mining area on 25 July 2022. On 25 July 2023 the average soil moisture value recessed below the lowest level recorded during the monitored period before mining. Site *15a_18* is located 275 m east of Longwall 19, within the longwall's 400 m mining area since the start of mining. The site exited the mining area on 9 July 2022. On 18 July 2023 the average soil moisture value recessed below the lowest level recorded during the monitored period before mining.

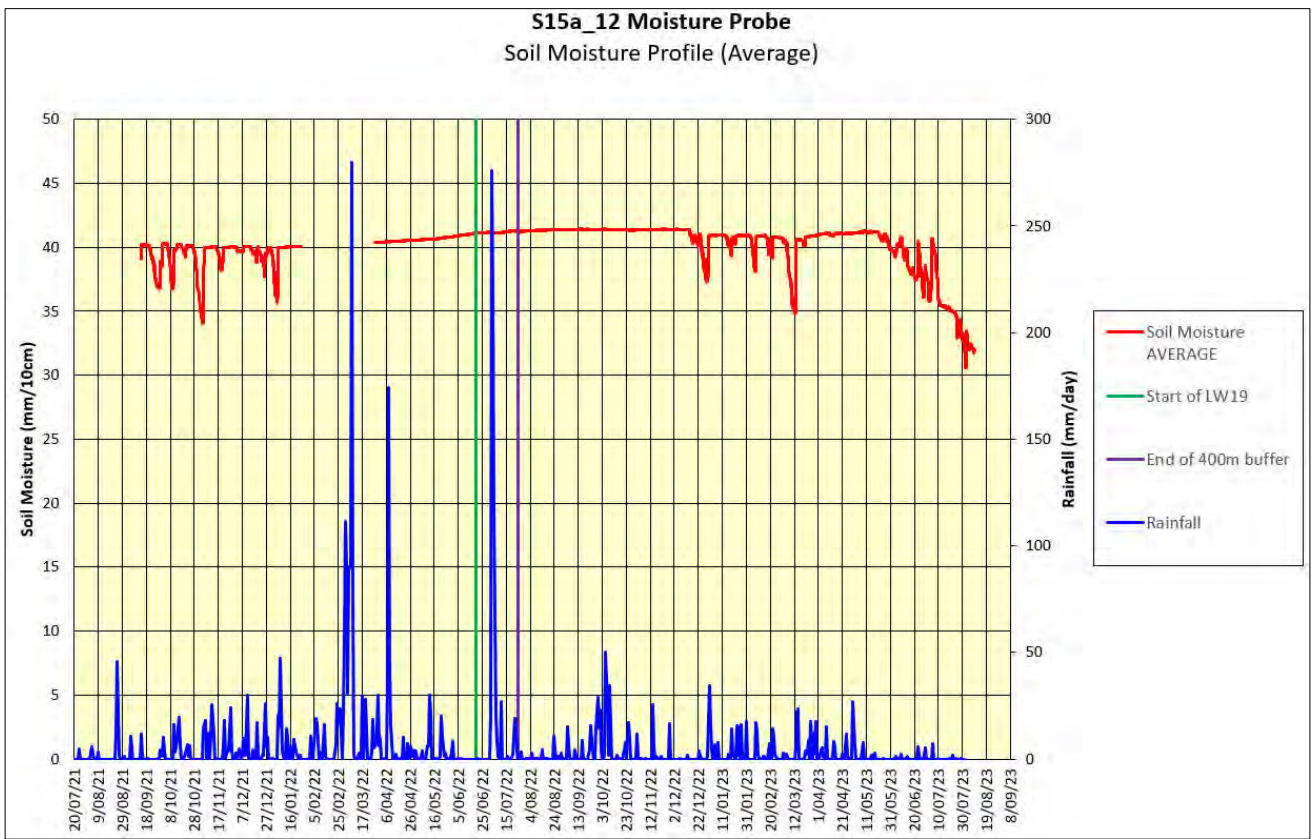
As soil moisture triggers in the other three sites within 400 m of mining in Swamp 15a were reported previously, these results contribute to a Level 3 trigger according to the Dendrobium SIMMCP TARP (Table 1), specifically:

Level 3: Soil moisture level lower than baseline level at 80% of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).

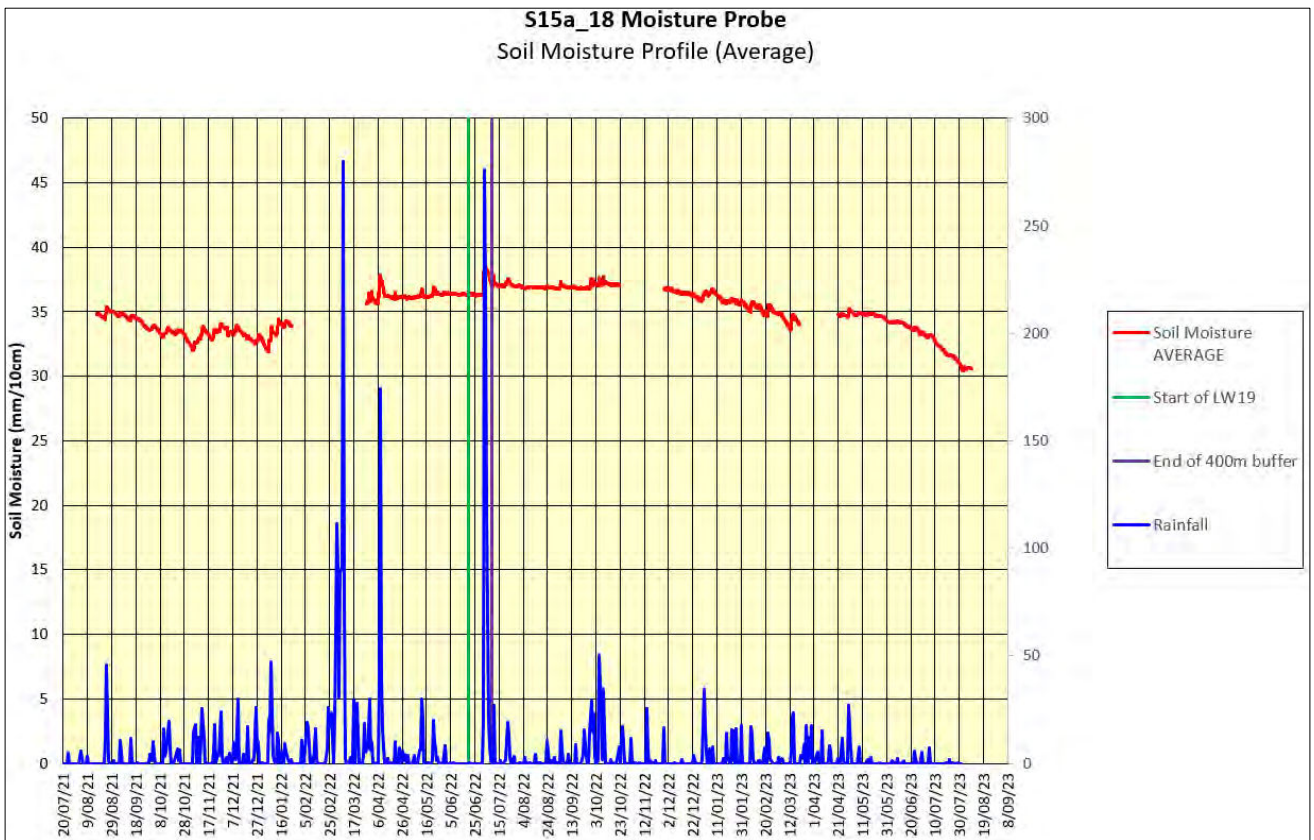
It is important to note the relatively short baseline monitoring period and that the monitoring commenced during a period of high rainfall and that there were no impacts recorded when the soil moisture probes were within the respective Longwall 19 400m mining area, over one year ago. Rainfall in the period of 2023 to date is the driest year during the sites' monitored period and the third driest year-to-date in the 22 years of rainfall records from Cordeaux Colliery.

The comparison to reference swamps, stated in the TARP definition, is undertaken as part of specialist analysis and reported as part of the four-monthly monitoring reporting and End of Panel reporting.

A full list of recent triggers and surface impacts is presented in Table 2.



Graph 1: Average soil moisture levels at site S15a_12, logged hourly, date range: 13/09/2021 to 9/08/2023



Graph 2: Average soil moisture levels at site S15a_18, logged hourly, date range: 16/08/2021 to 9/08/2023

Corrective Management Actions (CMAs)

The following management actions have been initiated:

- Continue monitoring program
- Submit an Impact Report to key stakeholders
- Seek advice on any other CMAs
- Report in the End of Panel Report
- Summarise actions and monitoring in AEMR