

Aboriginal Cultural Heritage Management Plan

Dendrobium Colliery Area 3C

Longwalls 22 and 23

Lake Cordeaux Catchment LGA: Wollongong City Council

Prepared for South32 – Illawarra Metallurgical Coal

Prepared by Niche Environment and Heritage | 13 June 2024

Important information about this report

Information relating to Aboriginal cultural heritage sites, including some details, images and maps showing the locations of sites, has been redacted from this report at the request of Registered Aboriginal Parties.

Document control

Project number	Client	Project Manager	LGA
6261	South 32 Illawarra Metallurgical Coal Ltd	Renée Regal	Wollongong City Council

Version	Author	Review	Status	Comments	Date
D1	Stella Quast and Renée Regal	Renée Regal	Draft REV01	-	22 March 2021
D2	Stella Quast and Renée Regal	Cody Brady	Draft REV02	-	19 August 2021
D3	Stella Quast and Renée Regal	Cody Brady	Draft REV03	-	23 September 2021
F1	Stella Quast and Renée Regal	Cody Brady	Final REV01	-	7 October 2021
F2	Stella Quast and Renée Regal	Registered Aboriginal Parties	Final REV02	-	29 October 2021
F4	Stella Quast and Renée Regal	Gary Brassington	Final REV04	-	17 May 2022
F5-F8	Chelsea Freeman, Isabel Parnell and Jamie Reeves	Heritage NSW	Final REV08	-	13 June 2024

© Niche Environment and Heritage Pty Ltd (ACN 137 111 721) 2019

Copyright protects this publication. All rights reserved. Except for purposes permitted by the Australian *Copyright Act 1968*, reproduction, adaptation, electronic storage, transmission and communication to the public by any means is prohibited without our prior written permission. Any third party material, including images, contained in this publication remains the property of the specified copyright owner unless otherwise indicated, and is used subject to their licensing conditions.

Important information about your Report

Your Report has been written for a specific purpose: The Report has been developed for a specific purpose as agreed by us with you and applies only for that purpose. Unless otherwise stated in the Report, this Report cannot be applied or used when the nature of the specific purpose changes from that agreed. **Report for the sole benefit of Niche's client:** This Report has been prepared by Niche for you, as Niche's client, in accordance with our agreed purpose, scope, schedule and budget. This Report should not be applied for any purpose other than that stated in the Report. Unless otherwise agreed in writing between us, the Report has been prepared for your benefit and no other party. Other parties should not and cannot rely upon the Report or the accuracy or completeness of any recommendation. **Limitations of the Report:** The work was conducted, and the Report has been prepared, in response to an agreed purpose and scope, within respective time and budget constraints, and possibly in reliance on certain data and information made available to Niche. The analyses, assessments, opinions, recommendations, and conclusions presented in this Report are based on that purpose and scope, requirements, data, or information, and they could change if such requirements or data are inaccurate or incomplete. **No responsibility to others:** Niche assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with, or conclusions expressed in the Report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with, or conclusions expressed in the Report.

Niche Environment and Heritage Pty Ltd (ACN 137 111 721)
Enquiries should be addressed to Niche Environment and Heritage
PO Box 2443, Parramatta NSW 1750, Australia
Email: info@niche-eh.com

Aboriginal and Torres Strait Islander readers are advised that the following report contains the names of people who have passed away.

Table of Contents

1. Introduction	1
1.1 Purpose and scope	1
1.2 Structure of the Aboriginal Cultural Heritage Management Plan	3
2. Aboriginal Cultural Heritage Management Plan Review and Update	7
2.1 Overview.....	7
2.2 Access to Information.....	7
3. Statutory Requirements.....	8
3.1 Environmental Planning and Assessment Act Approval.....	8
3.2 Licences, permit and leases.....	11
3.3 Other legislation	11
4. Revised assessment of potential environmental consequences.....	13
4.1 Longwalls 22 and 23 extraction layout.....	13
4.2 Relevant Information Since Development Consent	13
4.3 Environmental risk assessment	18
4.4 Aboriginal Cultural Heritage Sites.....	19
5. Consultation Protocol	26
5.1 Identification of Aboriginal Stakeholders.....	26
5.2 Aboriginal Stakeholder Participation.....	26
5.3 Aboriginal Stakeholder Access Protocol.....	28
6. Performance measures and indicators.....	29
7. Baseline Data	30
8. Supplementary fieldwork and pre-clearance surveys	31
8.1 Supplementary fieldwork/investigation.....	31
8.2 Recording and registering new Aboriginal Cultural Heritage Sites	31
9. Monitoring	32
9.1 Aboriginal Cultural Heritage Site Monitoring (Trigger Action Response Plan).....	43
10. Management, Remediation and Mitigation Measures	45
10.1 Management and remediation measures.....	45
10.2 Mitigation Measures	47
10.3 Surface Disturbance Protocol.....	50
10.4 Human Skeletal Material Protocol	50
10.5 Cultural Awareness Program	51

11. Contingency Plan	52
12. Future Subsidence Management Plans for Dendrobium.....	53
13. Annual Review and Improvement of Environmental Performance.....	54
14. Incidents	55
15. Complaints	56
16. Non-Compliances with Statutory Requirements	58
References.....	60
Annex 1: Glossary and List of Abbreviations.....	64
Annex 2: Consultation records.....	67
Annex 3: Geotechnical Risk Assessment Report	77

List of Figures

Figure 1: Map of Dendrobium Area 3C, with Longwalls 22 and 23 highlighted (Source: IMC 2021 and Niche 2021).....	5
Figure 2: Dendrobium 3C Longwall 22 and 23, 35° angle of draw (Source: IMC 2021 and Niche 2021).	6
Figure 3: Map of Aboriginal cultural heritage sites in and around the Subject Area (Source: IMC 2021, AHIMS 2020 and Niche 2021).....	17

List of Tables

Table 1. Overall void length of the approved longwalls (Source MSEC 2021)	1
Table 2: Management Plan Requirements.....	8
Table 3: Provisional Extraction Schedule.....	13
Table 4: Aboriginal cultural heritage sites within the Southern Coalfields observed to have subsidence related changes during monitoring programs.....	14
Table 5: Subsidence Risk Categories and Criteria.....	18
Table 6: Aboriginal Cultural Heritage Sites located within 600 m of Longwalls 22 and 23.....	20
Table 7: Subsidence Predictions for Longwalls 22 and 23 Aboriginal Cultural Heritage Sites	24
Table 8: Longwall 22 and 23 Aboriginal Cultural Heritage Sites Monitoring Schedule	33
Table 9: Trigger Action Response Plan – Aboriginal Cultural Heritage Sites Monitoring for Longwalls 22 and 23.....	44
Table 10: Potential Management and Remediation Measures.....	45
Table 11: Example of potential mitigation measures currently available for Aboriginal cultural heritage sites within the Southern Coalfield.....	47

1. Introduction

Illawarra Metallurgical Coal (IMC), a wholly owned subsidiary of South32 Limited (South32), operates Dendrobium Mine, located in the Southern Coalfield of New South Wales west of Wollongong and the Illawarra Escarpment and to the east of Bargo. IMC has proposed to extract Longwalls 22 and 23 in Area 3C of the Dendrobium Mine (here on referred to as ‘The Project’) within Consolidated Coal Lease (CCL) 768, under the Development Consent (DA) 60-03-2001. The Project comprises the continuation of underground coal mining operations at Dendrobium Mine Area 3C. The proposed Longwalls 22 and 23 (Figures 1 and 2) are located immediately north of Longwalls 6 to 8, 19 and 19A (Area 3A), Longwall 21 (Area 3C) and north-east of Longwalls 9 to 18 (Area 3B), and are located to the southwest of Lake Cordeaux, approximately 13 kilometres (km) north-west of Wollongong, NSW.

1.1 Purpose and scope

In accordance with Condition 12, Schedule 3 of the Development Consent, this Aboriginal Cultural Heritage Management Plan (ACHMP) has been prepared as a component of the Longwall 22 and 23 Subsidence Management Plans (SMP) to manage the potential environmental consequences of extracting Longwalls 22 and 23 on Aboriginal cultural heritage sites and values.

This report presents an ACHMP to accompany the Longwalls 22 and 23 SMPs. This report has been developed to manage Aboriginal cultural heritage sites and objects in accordance with:

- *National Parks and Wildlife Act 1974* (NPW Act);
- *Environmental Planning and Assessment Act 1979* (EP&A Act); and
- Future Aboriginal Heritage Impact Permits (AHIPs) where required following consultation with Heritage NSW.

IMC has engaged Niche Environment and Heritage (Niche) to assist with the development of this ACHMP. The Subject Area is defined by the 600 m boundary around the extent of Longwalls 22 and 23, encompassing the area that may be affected by mining related impacts including the:

- Longwall 22 and 23 voids;
- 600 m boundary around Longwalls 22 and 23; and
- 35-degree angles of draw for Longwall 22 and 23.

The Longwall 22 and Longwall 23 Subject Area encompasses approximately 650 hectares (ha) to the southwest of Lake Cordeaux, including a 600 m buffer for both longwalls and a 325 m buffer for the 35 degree angle of draw. The Subject Area is located to the north of the previously extracted Longwall 21. Longwalls 22 and 23 are proposed to be extracted from the Wongawilli Coal Seam, at depths of 290 metres (m) to 390 m subsurface.

Table 1. Overall void length of the approved longwalls (Source MSEC 2021)

Longwall	Overall void length including installation heading (m)	Overall void width including first workings (m)	Overall tailgate chain pillar width (m)
Longwall 22	2561	305	-
Longwall 23	2283	305	42

There are eleven (11) Aboriginal cultural heritage sites that have been identified within the Subject Area based on the 600 m boundary (see Figure 3 and Annex 3). These sites comprise the following:

- Shelter with Art:
 - Browns Road Site 17 (AHIMS ID#52-2-1632);
 - Browns Road Site 18 (AHIMS ID#52-2-1633);
 - Browns Road Site 19 (AHIMS ID#52-2-1634);
 - Dendrobium 3 (AHIMS ID#52-2-2219);
 - Sandy Creek Road 23 (AHIMS ID#52-5-0275);
- Shelter with Art and Deposit:
 - Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID# 52-2-0019);
 - Sandy Creek Road 24 (AHIMS ID#52-5-0276);
 - DM 1 (AHIMS ID#52-2-4656);
- Shelter with Deposit;
 - DM 10 (AHIMS ID#52-2-4657);
- Stone Arrangement;
 - Sandy Creek Road 1 Stone Arrangement (AHIMS ID#52-2-0535);
- Isolated Artefact; and
 - Dendrobium 3C Isolated Find 1 (AHIMS ID# 52-2-4499).

Two (2) Aboriginal cultural heritage sites are predicted to be directly impacted by the proposed works. These are Dendrobium 3 (AHIMS ID#52-2-2219) which is above Longwall 22, and Browns Road Site 19 (AHIMS ID#52-2-1634) which is not located above a longwall, but is predicted to experience valley-related subsidence effects (MSEC 2021:68). An additional site, Dendrobium 3C Isolated Find 1 (AHIMS ID#52-2-4499) is located within the 35° angle of draw of Longwall 23, however it is not predicted to experience any subsidence related effects as it is an isolated stone artefact.

The RAPs have advised during previous assessments completed by Biosis Research (2007) and Niche Environment and Heritage (2021 and 2022) that all sites have a high cultural significance. The status of sites within the Subject Area can be described as below:

- All have high cultural value, and associated landscape attributes of the area also have value,
- One (1) site has high scientific (archaeological) significance,
- Four (4) sites have moderate scientific (archaeological) significance, and
- Six (6) sites have a low scientific (archaeological) significance.

One (1) of the sites within 600 m of Longwall 23 is of high scientific (archaeological) significance, comprising a stone arrangement (Sandy Creek Road 1 Stone Arrangement, AHIMS ID#52-2-0535) (Figure 3 and Table 6). This site is not located within the 35° angle of draw and/or predicted 20 mm subsidence contour of Longwalls 21, 22 or 23, and is not predicted to experience subsidence related effects (MSEC 2021:67-8).

Four (4) Aboriginal cultural heritage sites have been assessed as having a moderate scientific (archaeological) value: Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID#52-2-0019), Browns Road Site 17 (AHIMS ID#52-2-1632), DM 1 (AHIMS ID#52-2-4656) and DM 10 (AHIMS ID#52-2-4657). These significance ratings are outlined by Niche (2019 and 2021) and Biosis Research (2007, 2009a). The remaining six (6) Aboriginal cultural heritage sites have a low scientific (archaeological) significance attributed to them.

The potential for adverse impacts on the nine (9) shelters located in the Subject Area from the extraction of Longwalls 22 and 23 has been assessed as *unlikely* (MSEC, 2021: 68). However, it remains a possibility that these sites could experience fracturing resulting in spalling or rock falls.

This ACHMP includes post-mining monitoring and management of Aboriginal cultural heritage sites for Longwalls 22 and 23, subject to the previously approved Dendrobium Mine Area 3 Aboriginal Heritage Plan (HMP) (Biosis Research 2010) and in accordance with future AHIP conditions for Longwalls 22 and 23 as required (following consultation with Heritage NSW). Consistent with the recommended approach in the NSW Department of Planning and Environment (2022) *Extraction Plan Guideline*, the IMC Area 3 AHP will be superseded by this ACHMP.

It is noted that an application to vary Longwall 23 has been recently submitted to the Department of Planning, Housing and Infrastructure. This ACHMP will be updated following the determination of this application and any changes to the project boundary, proposed impacts to Aboriginal Cultural Heritage and relevant project details will be included.

1.2 Structure of the Aboriginal Cultural Heritage Management Plan

The remainder of this ACHMP is structured as follows:

Section 2: Describes the review and update of this ACHMP.

Section 3: Outlines the statutory requirements applicable to this ACHMP.

Section 4: Provides a revised assessment of the potential subsidence impacts and environmental consequences for Longwalls 22 and 23.

Section 5: Describes the consultation protocol.

Section 6: Details the performance measures and indicators that will be used to assess the Project.

Section 7: Outlines the baseline data for Aboriginal cultural heritage sites.

Section 8: Describes supplementary fieldwork and pre-clearance surveys to be undertaken.

Section 9: Describes the monitoring program and provides the detailed Trigger Action Response Plan (TARP).

Section 10: Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts on Aboriginal cultural heritage.

Section 11: Provides a Contingency Plan to manage any unpredicted impacts and their consequences.

Section 12: Describes the program to collect baseline data for future SMPs.

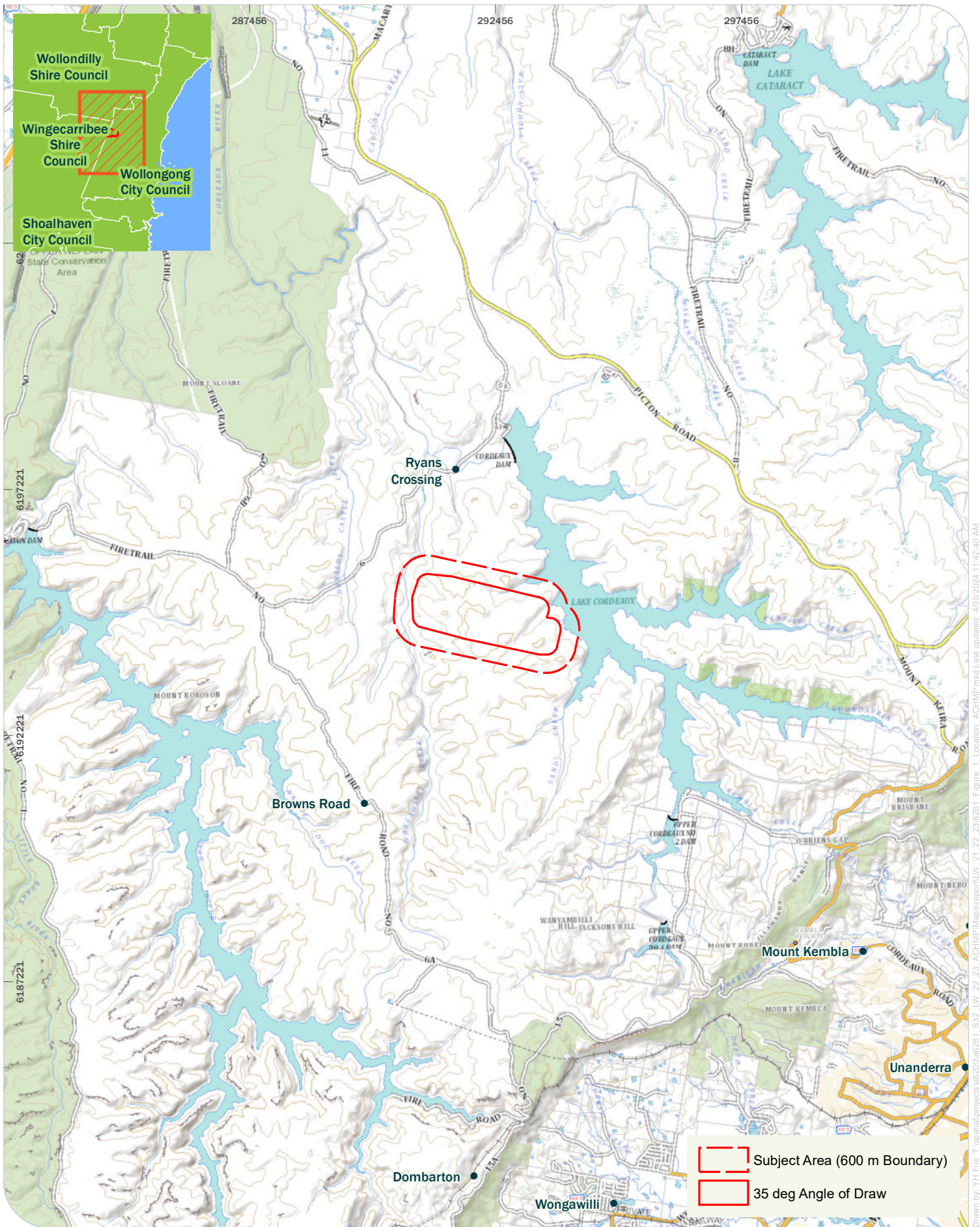
Section 13: Describes the annual review and improvement of environmental performance.

Section 14: Outlines the management and reporting of incidents.

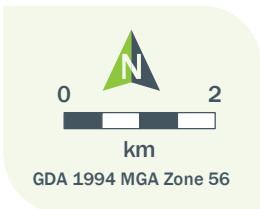
Section 15: Outlines the management and reporting of complaints.

Section 16: Outlines the management and reporting of non-compliances with statutory requirements.

Section 17: Lists the references cited in this ACHMP.



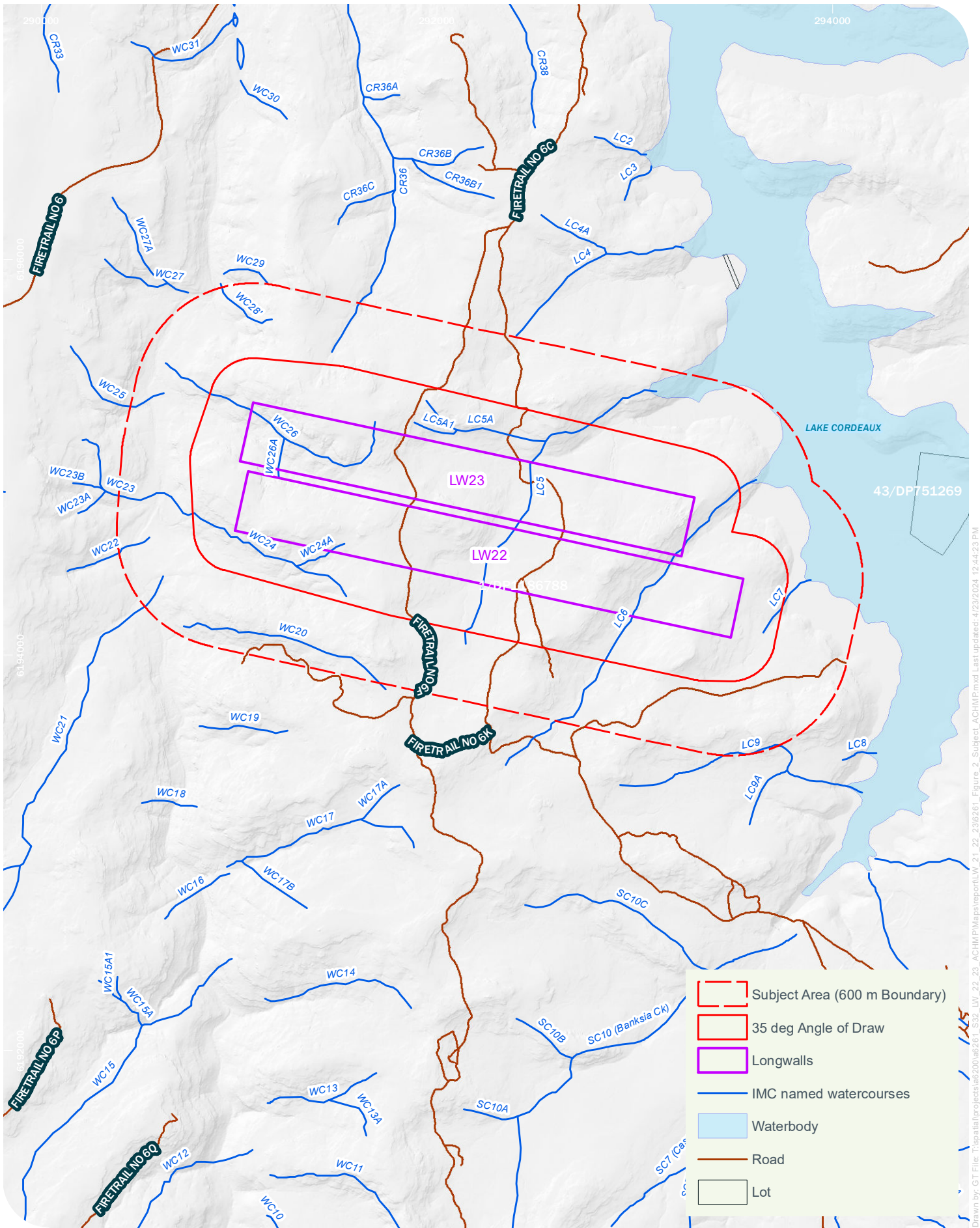
Drawn by: YH File: T:\spatial\projects\ae200\ae261_S32_LW_22_23_ACHIMP\Mapreport\LW_21_22_23\ae261_Figure_1_Location_ACHIMP.mxd Last updated: 4/30/2024 11:42:40 AM



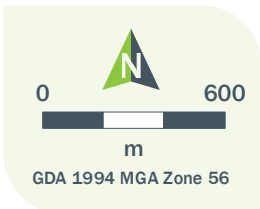
Niche PM: Renée Regal
 Niche Proj. #: 6261
 Client: South32 Illawarra Metallurgical Coal

Location Map
 Dendrobium Longwalls 21, 22 and 23
 Aboriginal Cultural Heritage Management Plan

Figure 1



Drawn by: GT File: T:\spatial\projects\iag200\ab26\1_S32_LW_22_23_ACHMP\Map\report\LW_21_22_23_236261_Figure_2_Subject_ACHMP.mxd Last updated: 4/23/2024 12:44:23 PM



Niche PM: Renée Regal
 Niche Proj. #: 6261
 Client: South32 Illawarra Metallurgical Coal

Location of the Subject Area
 Dendrobium Longwalls 22 and 23 Aboriginal Cultural Heritage Management Plan

Figure 2

2. Aboriginal Cultural Heritage Management Plan Review and Update

2.1 Overview

In accordance with Condition 2A, Schedule 8 of the Development Consent, this ACHMP will be reviewed within three months of the:

- a) submission of an incident report under Condition 4 of Schedule 8;
- b) submission of an Annual Review under Condition 5 of Schedule 8;
- c) submission of an Independent Environmental Audit under Condition 6 of Schedule 8; or
- d) approval of any modification of the conditions of this consent, the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant.

If necessary, to either improve the environmental performance of the development or cater for a modification, this ACHMP will be revised and submitted to the Secretary for approval within six weeks of the review. The revision status of this ACHMP is indicated on the title page of each copy. The distribution register for controlled copies of this ACHMP is described in Section 2.2.

2.2 Access to Information

In accordance with Condition 11, Schedule 8 of the Development Consent, 'Access to Information', IMC will make this ACHMP publicly available on the South32—IMC website. IMC recognises that various regulators have different distribution requirements, both in relation to whom documents should be sent and in what format.

3. Statutory Requirements

IMC's statutory obligations are contained in:

- (i) the conditions of the Development Consent and secondary approvals;
- (ii) relevant licences and permits, including conditions attached to mining leases; and
- (iii) other relevant legislation.

These are described below.

3.1 Environmental Planning and Assessment Act Approval

Condition 2, Schedule 8 of the Development Consent requires the preparation of a Management Plan as a component of all SMPs. Management plan requirements that are applicable to the preparation of this ACHMP. Table 2 indicates where each component of the conditions is addressed within this ACHMP.

Table 2: Management Plan Requirements

Development Consent Condition	ACHMP Section
Condition 2, Schedule 8	
Management Plan Requirements	
2. Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:	
(a) a summary of relevant background or baseline data;	Sections 4, 7 and 8
(b) details of:	
(i) the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Sections 2 and 3
(ii) any relevant limits or performance measures and criteria; and	Section 6
(iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 6
(c) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	Sections 3, 4, 5, 6, 7, 8, 9, 10, 11 and 13
(d) a program to monitor and report on the:	
(i) impacts and environmental performance of the development; and	Sections 9, 11 and 13
(ii) effectiveness of the management measures set out pursuant to condition 2(c);	Sections 9, 10 and 13
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 11
(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 13
(g) a protocol for managing and reporting any:	
(i) incident and any non-compliance (specifically including any exceedance of the impact assessment criteria and performance criteria);	Sections 14 and 16
(ii) complaint;	
(iii) failure to comply with statutory requirements; and	Section 15
(h) a protocol for periodic review of the plan.	Section 16
Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.	Section 13
REVISION OF STRATEGIES, PLANS AND PROGRAMS	
2A. Within three months of the:	
(a) submission of an incident report under condition 4 of Schedule 8;	
(b) submission of an Annual Review under condition 5 of Schedule 8;	Section 14
(c) submission of an Independent Environmental Audit under condition 6 of Schedule 8; or	Section 13

Development Consent Condition	ACHMP Section
<p>(d) approval of any modification of the conditions of this consent, the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant.</p> <p>If necessary, to either improve the environmental performance of the development or cater for a modification, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Secretary and submitted to the Secretary for approval within six weeks of the review.</p> <p>Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.</p>	Section 2
<p>Condition 12, Schedule 3</p> <p>ABORIGINAL HERITAGE</p> <p>12. The SMPs under Condition 7 must include an Aboriginal Heritage Management Plan, which must include a:</p> <ul style="list-style-type: none"> (a) description of known Aboriginal heritage sites (b) protocol for the ongoing consultation and involvement of the Aboriginal community in the conservation and management of Aboriginal heritage (c) description of the measures that would be implemented to protect Aboriginal sites generally, including measures that would be implemented to secure, analyse and record sites at risk of subsidence and; (d) description of the measures that would be implemented to protect Aboriginal site 52-2-1646, including: <ul style="list-style-type: none"> • a full recording and assessment of the site’s rock art; • a more detailed subsidence assessment for the site; • measures which seek to avoid any significant impact on the site and any necessary contingency plans to protect the site against collapse or substantial impact on its rock art; and (e) description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the development 	<p>Section 4.4</p> <p>Section 5</p> <p>Sections 6, 7, 9, 10, 12</p> <p>Not applicable to Area 3C</p> <p>Section 10</p>

In addition, Condition 2(f) of Schedule 2 of the Development Consent states that:

2. The Applicant must carry out the development generally in accordance with the:

(f) Modification application – Modification of Area 3 Footprint and Review of Conditions of Consent dated 27 November 2027, EA and associated Statement of Commitments (see Appendix 4)

Commitments 2 and 3 of Appendix 4 relate to Aboriginal Cultural Heritage. Commitments are listed in the table below.

Development Consent – Appendix 4 Statement of Commitments	
<p>Commitment 2, Appendix 4</p> <p>2. Subsidence Impact – Monitoring</p> <p>Pre, during and post mining subsidence impact monitoring will be undertaken in accordance with the approved Subsidence Management Plan. The monitoring component of the Subsidence Management Plan includes but is not necessarily limited to:</p> <p>...</p> <ul style="list-style-type: none"> • Subsidence movement of natural and man made features • Aboriginal cultural heritage sites 	<p>Sections 4, 7, 8, 9, 10</p> <p>Sections 4 and 9</p> <p>Sections 4.4, 7, 8, 9 and 10</p>

Commitment 3, Appendix 4

3. Subsidence Impact – Avoidance, Mitigation and Rehabilitation

If the monitoring program identifies impacts to natural features that exceed those predicted, the following contingent measures will be implemented.

...

Aboriginal Places of Cultural Significance - Archaeological sites

Predicted Impacts: Unlikely that the sites will sustain structural impacts. Empirical data suggests the probability of impacts to a site is less than 10%.

Avoidance & Mitigation: Baseline, active subsidence and post mining monitoring. Appropriate consultation.

Impacts Exceeding Those Predicted: Change in shelter conditions not attributable to natural weathering or preservation – cracking or exfoliation of art panel, movement of existing planes and joints at panel, block fall within shelter or overhang, shelter or overhang collapse.

Contingent Measure: Site and event specific mitigation and rehabilitation will be developed with appropriate Aboriginal representatives, Heritage NSW (formerly DECC) and WaterNSW. Techniques may involve installing artificial drip lines, detailed recording of art, stabilising and cleaning rock faces.

Sections 4, 5, 6, 7, 8, 9, 10 and 11

Sections 10 and 11

It is noted that Commitment 3 of Appendix 4 provides a prediction that it is unlikely the sites will sustain structural impacts. The probability of impacts to a site is less than 10% based on empirical data. The contingent measure required to be implemented to avoid or mitigate this prediction is to undertake baseline, active subsidence and post mining monitoring, conduct appropriate consultation and acquire approvals. Implementation of this ACHMP satisfies this commitment.

For clarification, Commitment 3 of Appendix 4 of Development Consent is **not** a requirement for IMC not to impact more than 10% of ACH sites within its approval boundary. The 10% relates to a prediction for probability of impacts to a site being less than 10% based on empirical data.

3.2 Licences, permit and leases

In addition to the Development Consent, all activities at or in association with the Dendrobium Mine will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending issue:

- The conditions of mining leases issued by the Resources Regulator (previously known as the NSW Division of Resources and Geoscience) under the *NSW Mining Act, 1992* Dendrobium Mining Lease (ML) 1510 and ML 1566 and Consolidated Coal Lease (CCL) 768.
- Development Consent (DA) 60-03-2001, issued by the Department of Planning, Industry and Environment (DPIE) on 20 November 2002 with an expiry date of 21 December 2023.
- The Dendrobium Mine and Cordeaux Colliery Rehabilitation Management Plan, DENMP0107, Version 2.0 dated 20 October 2023.
- The conditions of Environment Protection Licence (EPL) No. 3241 issued by the NSW Environment Protection Authority under the *NSW Protection of the Environment Operations Act, 1997*. Revision of the EPL will be required prior to the commencement of IMC activities that differ from those currently licensed.
- The prescribed conditions of specific surface access leases within CCL 768 for the installation of surface facilities as required.
- Water Approval 10WA118772, issued on 1 July 2013 by the Natural Resource Access Regulator.
- WaterNSW Access Consent F2020/1545, most recently issued 18 April 2023.
- Water Access Licences (WALs) issued by the then Department of Industry – Water (now DPIE-Water) under the *NSW Water Management Act, 2000*, including WAL 36473, WAL 37465, WAL 42385 and WAL 42386 under the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011.
- Mining and workplace health and safety related approvals granted by the NSW Resources Regulator and WorkCover NSW.
- Supplementary approvals obtained from WaterNSW for surface activities within the Metropolitan Special Area (e.g. fire road maintenance activities).
- Future AHIPs for Longwalls 22 and 23, as required following consultation with Heritage NSW.

3.3 Other legislation

IMC will conduct the Project consistent with the Development Consent and any other legislation that is applicable to an approved DA under the EP&A Act. The following Acts may be applicable to the conduct of the Project:

- *Biodiversity Conservation Act, 2016*
- *Biosecurity Act, 2015*
- *Contaminated Land Management Act, 1997*
- *Crown Land Management Act, 2016*
- *Dams Safety Act, 2015*

- *Dangerous Goods (Road and Rail Transport) Act, 2008*
- *Energy and Utilities Administration Act, 1987*
- *Fisheries Management Act, 1994*
- *Mining Act, 1992*
- *Protection of the Environment Operations Act, 1997*
- *Rail Safety (Adoption of National Law) Act, 2012*
- *Roads Act, 1993*
- *Water Act, 1912*
- *Water Management Act, 2000*
- *Water NSW Act, 2014*
- *Work Health and Safety Act, 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

4. Revised assessment of potential environmental consequences

4.1 Longwalls 22 and 23 extraction layout

Longwalls 22 and 23 and the area of land within 600 m of these longwalls is shown on Figures 1, 2 and 3. Longwall extraction will occur from east to west towards the main headings (i.e. retreat mining) within the Wongawilli Coal Seam, at depths of approximately 290 m to 390 m. Extraction of Longwall 22 is planned to occur after the completion of Longwall 19A in Area 3A and prior to the proposed Longwall 21A. Extraction of Longwall 23 is planned to occur after Longwall 21A. The provisional extraction schedule is provided in Table 3.

Table 3: Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date
Longwall 21*	24 April 2023	3.5 Months	6 August 2023
Longwall 19A (Area 3A)	2 November 2023	7 Months	May 2024
Longwall 22	August 2024	24 Months	August 2026
Longwall 21A	August 2026	12 Months	August 2027
Longwall 23	September 2027	15 Months	December 2028

* Extraction of Longwall 21 is complete.

The total cumulative predicted subsidence effects, subsidence impacts and/or environmental consequences at the completion of the Project are considered in the Dendrobium Area 3 Project Environmental Assessment (Project EA) (IMC, 2007). Cumulative subsidence effects, subsidence impacts and/or environmental consequences on Aboriginal cultural heritage have been assessed in the Longwalls 22 and 23 SMP (South32, 2021). Future SMP applications in Area 3C will assess further cumulative impacts.

4.2 Relevant Information Since Development Consent

Dendrobium Mine was approved in 2001 and longwall mining has been in operation since 2005. The previous operator of this mine was BHP Billiton—Illawarra Coal. A number of changes to planning, development and mining legislation has occurred during this period. As a result, the consents and approvals in place for IMC to operate the Dendrobium Mine are numerous.

All subsidence related impacts are managed in accordance with the approved SMP and the *Dendrobium Coal Mine – Area 3 Aboriginal Heritage Plan* (Biosis Research, 2009c).

The initial Development Application (DA 60-03-2001) for Dendrobium was assessed and determined under the EP&A Act in 2001 (Appendix F).

The previous ACHA for Dendrobium Area 3 (Biosis Research, 2007) was produced to modify the Dendrobium Mine DA-60-03-2001 to incorporate a revised Area 3 footprint and longwall layout pursuant to section 75W of the EP&A Act, as well as inform the broader environmental assessment documents required to support the SMP application process for Aboriginal cultural heritage sites that were to be impacted by longwall mining.

IMC acknowledges that all Aboriginal cultural heritage sites are culturally significant to the Aboriginal people who have a traditional connection to Country. All Aboriginal cultural heritage sites will be monitored

for subsidence impacts by the observation and recording of any and all changes at the sites over the monitoring period.

Archaeological monitoring programs undertaken by Sefton between 1990 and 2000 have continued in the Southern Coalfield at the majority of underground mine sites. Monitoring programs have been undertaken at the Dendrobium Mine and at Tower, Appin, West Cliff, Elouera, Cordeaux, Tahmoor and Metropolitan Collieries. During the past 21 years monitoring programs have been developed and implemented using a similar methodology to Sefton (2000) by (Biosis research 2008, 2009a, 2009b, 2009c, 2012, 2013a, 2013 and 2015; Gun, and Kayandel Archaeological Services 2007; Kayandel Archaeological Services 2012; Niche 2011, 2012, 2013a, 2013b, 2013c, 2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2017, 2019, 2020a, 2020b, 2020c, 2021; and Sefton 2000, 2002a, 2002b, 2002c and 2002d).

Baseline recording has been completed on those Aboriginal cultural heritage sites identified by MSEC (2021) as having potential to be affected by subsidence. Site types that are subject to baseline recording in the Southern Coalfield include sandstone shelter sites with art and or potential archaeological deposit, stone artefacts deposits, engravings and sandstone platforms that include engravings (often of animals, humans, anthropomorphic figures and ancestral beings) and or axe grinding grooves.

At the completion of baseline recording, Aboriginal cultural heritage sites are often monitored a second time in line with the individual projects monitoring requirements, generally within 3 months of the completion of a longwall extraction. Monitoring programs are generally continued in this fashion until the Aboriginal cultural heritage site is no longer subject to subsidence movements.

Within the Southern Coalfield a total of 244 Aboriginal cultural heritage sites have been monitored since 1990 (Regal and Reeves 2017). Of the 244 Aboriginal cultural heritage sites monitored (Table 4), 26 Aboriginal cultural heritage sites were identified as having impacts or changes that may be attributable to subsidence, environmental factors or a combination of both (Table 4). The most recently observed impacts to Aboriginal cultural heritage sites were as a result of the extraction of Longwall 19 and Longwall 19A. Subsidence related changes were identified on 28 March 2023 at two sites above Longwall 19, DM 15 AHIMS ID#52-2-3639 and Sandy Creek Road 21 AHIMS ID#52-5-0273 and additional changes to Sandy Creek Road 21 were identified on 26 March 2024 due to the extraction of Longwall 19A.

The observed impacts at each Aboriginal cultural heritage site are summarised in Table 4:

Table 4: Aboriginal cultural heritage sites within the Southern Coalfields observed to have subsidence related changes during monitoring programs.

AHIMS No.	Site Code	Site Type	Subsidence Related Changes
52-2-0094	Flat Rock Creek 4	Shelter with Art	Opening of existing bedding planes, along the roof/rear wall and minor roof fall.
52-2-0106	Flat Rock Creek 10	Shelter with Art	Cracks in rear wall, potential for altered seepage to impact art – mitigation with an artificial drip line.
52-2-0089	Flat Rock Creek 11	Shelter with Art	Exfoliation and block fall at rear wall.
52-2-0154	Flat Rock Creek 49	Shelter with Art	Minor block fall from rear wall and ceiling.
52-2-0258	Flat Rock Creek 27	Sandstone platform with engraving and axe grinding grooves	Crack in sandstone platform.
52-2-0176	Flat Rock Creek 152	Shelter with Art	Cracking and minor block fall at rear wall.
52-2-1638	Browns Road Site 24	Shelter with Art	Minor block fall at rear wall.

AHIMS No.	Site Code	Site Type	Subsidence Related Changes
52-2-1625	Browns Road Site 10	Shelter with Art	Cracking and minor blockfall at rear wall.
Number could not be confirmed	Wedderburn Road 1	Shelter with Art	Cracking in floor and rear wall.
52-2-1300	Wedderburn Road 2	Shelter with Art	Opening of crack in back wall.
52-2-1162	Stokes Creek Site 67	Shelter with Art	Opening of the bedding plane above the art and increased water seepage as a result.
52-2-2252	Dendrobium 4	Shelter with Art	Opening of crack along the back wall.
52-2-0195	Flat Rock Creek 34	Shelter with Art	Horizontal cracking visible on the ceiling of the shelter. Cracking occurred over the most southern hand stencil on the back panel.
52-2-3083	Flat Rock Creek 281	Shelter with Art	Thin cracking adjacent to the hand stencil at the northern end of the shelter.
52-2-3086	Flat Rock Creek 284	Shelter with Art	Fractured a corner of a buttress-like formation on the rear wall.
52-2-2243	Georges River No. 2	Shelter with Art	Thin vertical cracking in the shelter ceiling, adjacent to the art panel.
52-2-0396	Flat Rock Creek 15	Shelter with Art	The large vertical fissure in the central back wall had increased in width (opened) and shifted laterally.
52-2-2244	Georges River No. 3	Shelter with Art and Axe Grinding Grooves	Opening of the horizontal bedding plane, cracking and exfoliation along the back wall.
Number could not be confirmed	Met 1	Shelter with Art	Vertical cracking within the shelter.
52-2-0826	Flat Rock Creek 176	Shelter with Art	Vertical cracking at the northern and southern ends of the shelter.
52-2-3077	Flat Rock Creek 275	Shelter with Art	The horizontal bedding plane joints at the back of the shelter have been noted as opening, three hairline cracks have formed, running vertical from the bedding plane.
52-2-3486	Flat Rock Creek 301	Shelter with Art	A large crack was observed running east to west along the entire rock platform. Crack is approximately 3.08 m to the north of the grinding groove and is approximately 25m long and continues past the rock platform.
52-2-1626	Browns Site 11	Shelter with Art	Vertical and diagonal cracking within the rockshelter, exfoliation of surfaces and opening of some joints. Small crack in sediments on floor of shelter.
52-2-3645	DM21	Shelter with Art	The landscape and rock formation surrounding the shelter site shows fracturing, the interior cavern of the shelter did not have any impacts from subsidence.
52-5-0273	Sandy Creek Road 21	Shelter with Art	Horizontal cracking, opening of joints, exfoliation of surfaces and minor rockfall. Art panels not affected by cracking or exfoliation.
52-2-3639	DM15	Shelter with Art	Horizontal and diagonal cracking of surfaces, including the art panel and single motif that is present at this site.

The results of the monitoring programs have been used to assess the likelihood of Aboriginal cultural heritage sites being impacted from subsidence movements.

Aboriginal cultural heritage sites are considered to be “affected by subsidence impacts” if they exhibit one or more of the following consequences that cannot be attributed to natural weathering or deterioration (Sefton 2000, Regal and Reeves 2017):

- overhang collapse;
- cracking of sandstone or soil;
- impacts to Aboriginal art or grinding grooves; and/or
- rock fall that damages a site, including Aboriginal art.

Of the 26 Aboriginal cultural heritage sites impacted, three (3) Sandstone Shelter with Art sites have been identified as having direct impact to archaeological features resulting in adverse consequences and loss of Aboriginal cultural heritage values attributable to subsidence:

- Flat Rock Creek 34, AHIMS ID# 52-2-0195,
- Flat Rock Creek 281, AHIMS ID# 52-2-3083, and
- DM15 AHIMS ID#52-2-3639)

In these three cases the adverse consequences were cracking that occurred directly across motifs or adjacent to the art panels. The cracks adjacent to art panels have caused changes to water seepage above the panel, causing water flow to redirect over the art. Aboriginal cultural heritage sites with impacts to art panels in this instance includes 3 of the 144 sites with art assessed across the Southern Coalfield. In summary the most frequently observed impacts from over 30 years of monitoring the effects of mine subsidence on Aboriginal archaeological sites in the Southern Coalfield has shown that impacts have involved cracking of rock and rock surfaces, separation of strata, movement along existing structural elements such as planes and joints, and associated exfoliation and block fall. Often naturally occurring processes such as granular loss, mass movement, vegetation growth, exfoliation of shelter surfaces, water ingress and vandalism were observed in the absence of subsidence during monitoring programs. This is indicative of the rapid landscape retreat that is present in the Hawkesbury sandstone environments (Reeves and Regal 2017; 277-278, Turkington and Paradise 2005). In very rare cases subsidence induced cracking has occurred coincident with art or art panels, and no shelters have collapsed except Whale Cave (Reeves and Regal 2017).

The results of the monitoring to date are consistent with the potential subsidence impacts and environmental consequences predicted in the Project EA, where it was expected that the majority of identified Aboriginal cultural heritage sites would experience no significant change, particularly when compared to natural weathering processes unrelated to mining and given the conservative nature of the subsidence predictions.

The potential for vehicle-generated dust in the WaterNSW Metropolitan Special Area or rare minor blasting events underground (which is undertaken at significant depths) to impact on Aboriginal cultural heritage sites in the underground mining area is very low. Vehicle access in the WaterNSW Metropolitan Special Area is via formed tracks and existing fire trails. IMC personnel and contractors are required to observe speed limits when using the fire trails, which limits the amount of dust generated. In most cases Aboriginal cultural heritage sites are distant from the tracks and fire trails, and therefore are not subject to direct exposure to any dust generated by vehicles using the tracks and fire trails.

This information has been redacted
For more information please contact GM3.

4.3 Environmental risk assessment

The impact prediction methodology provides reasonably accurate subsidence impact predictions for shelter sites, which, in combination with a cultural heritage significance assessment, is then used to provide appropriate avoidance, mitigation and management recommendations (generally subsidence monitoring and response plans). The risk of impact criteria adopted for the purposes of this assessment are shelter size (volume), the presence of water seepage, maximum predicted subsidence movement and the presence/absence of art. Risk categories are from moderate to negligible and reflect subsidence effect occurrence and actual impacts to heritage values from subsidence effects monitored to date. A description of risk categories and criteria is provided in Table 5.

The subsidence risk assessment for Aboriginal cultural heritage sites in the Project Area is presented in Table 7. This assessment includes all parameters considered in Sefton’s 2000 principal components analysis and subsidence predictions provided by MSEC (2012: 75). The assessment of risk was made using a cumulative scoring of the criteria outlined in Table 5. A summary of potential impacts is also provided in Table 5. To date no impacts from subsidence effects have resulted in a total loss of heritage values.

Table 5: Subsidence Risk Categories and Criteria.

Category	Description	Criteria	LW22 and 23 Site Assessment
Moderate	Moderate chance of subsidence effects occurring. Impacts to heritage values are possible.	<ul style="list-style-type: none"> The shelter has an art panel present. The shelter has a volume greater than 50 cubic metres. The shelter has joints or bedding plans subject to water seepage. Maximum predicted subsidence is greater than 300mm. 	<ul style="list-style-type: none"> Browns Road Site 17 (AHIMS IC#52-2-1632); Browns Road Site 18 (AHIMS ID#52-2-1633); Browns Road Site 19 (AHIMS ID#52-2-1634); Dendrobium 3 (AHIMS ID#52-2-2219); DM 1 (AHIMS ID#52-2-4656); Sandy Creek Road 23 (AHIMS ID#52-5-0275); Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID#52-2-0019); Sandy Creek Road 24 (AHIMS ID#52-5-0276);
Low	Low chance of subsidence effects occurring. Impacts to heritage values unlikely	<ul style="list-style-type: none"> The shelter has a volume greater than 50 cubic metres. Maximum predicted subsidence is greater than 300mm. 	<ul style="list-style-type: none"> DM 10 (AHIMS ID#52-2-4657);
Very Low	Very low chance of subsidence effects occurring. Impacts to heritage values are highly unlikely.	<ul style="list-style-type: none"> The shelter has a volume less than 50 cubic metres and maximum predicted subsidence is greater than 300mm. The shelter has a volume more than 50 cubic metres and maximum predicted subsidence is less than 300mm. 	NA
Negligible	Impacts to heritage values are unlikely and if they did occur would normally be	<ul style="list-style-type: none"> The shelter has a volume less than 50 cubic metres. Maximum predicted subsidence is less than 	<ul style="list-style-type: none"> Sandy Creek Road 1 Stone Arrangement (AHIMS ID#52-2-0535);*

Category	Description	Criteria	LW22 and 23 Site Assessment
	indistinguishable from natural environmental effects.	300mm, tensile strain predictions are <0.5mm/m and compressive strain estimates are <0.01mm/m.	<ul style="list-style-type: none"> <li data-bbox="1077 212 1426 271">Dendrobium 3C Isolated Find 1 (AHIMS ID#52-2-4499);

4.4 Aboriginal Cultural Heritage Sites

The eleven (11) Aboriginal cultural heritage sites identified within 600 m of Longwalls 22 and 23 are shown on Figure 3 and a summary is provided in Table 6 below.

Table 6: Aboriginal Cultural Heritage Sites located within 600 m of Longwalls 22 and 23.

AHIMS No.	Site Name	Site Type	Scientific (Archaeological) Significance Rating
52-2-0019	Cordeaux Reservoir; Sandy Creek Road 2 (duplicate recording of same site as 52-3-0753 and 52-2-0544)	Shelter with Art and Deposit	Moderate – this shelter provides a diversity of art motifs with varying pigment types, including the locally uncommon white ochre hand stencil motif. Additional comment from Niche notes that the diversity of art motifs within this shelter includes red ochre hand stencils of adults and a white hand stencil of a young child. However, the art surfaces in this shelter vary in condition, with the hand stencil panels being much better preserved than the charcoal panels.
52-2-0535	Sandy Creek Road 1 Stone Arrangement	Stone Arrangement	High – this is the only site of its type in the area. Additional comment from Niche notes that this is the only Stone Arrangement site found in the area. The site is relatively well preserved and contributes to a strong sense of place.
52-2-1632	Browns Road Site 17	Shelter with Art	Moderate – this shelter provides a diversity of art motifs, including an unusual example of a bird head motif. Additional comment from Niche notes that all art panels in this shelter are representative of the local charcoal with infill style, and are in moderately well-preserved condition.
52-2-1633	Browns Road Site 18	Shelter with Art	Low – the five charcoal motifs in this shelter are poorly preserved, and are a common motif type found in Shelter with Art sites the region.
52-2-1634	Browns Road Site 19	Shelter with Art	Low – the two charcoal motifs within this Shelter with Art site are poorly preserved and a common site type within the regional area.
52-2-2219	Dendrobium 3	Shelter with Art	Low - this shelter contains a single indeterminate charcoal motif, with no outstanding characteristics and in poor condition. This is a common site type within the region.
52-2-4499	Dendrobium 3C Isolated Find 1	Isolated Artefact	Low – as an isolated artefact found in the landscape, this is of low scientific significance.
52-2-4656	DM 1	Shelter with Art and Deposit	Moderate – twelve artefacts made of silicified clay were found in the shelter, including debitage and a very large core. The art in this shelter consists of four charcoal outline-and-infill macropods (likely kangaroos) in moderate condition. This site is representative of the common Shelter with Art site type in this region.
52-2-4657	DM 10	Shelter with Deposit	Moderate – four artefacts from the deep deposit surface of the outer shelter were recorded, including a quartz core and a flake made of black volcanic stone. The moderately sized cave joining the back of the shelter contained no visible artefacts or art, and had a very restrictive entrance.
52-5-0275	Sandy Creek Road 23	Shelter with Art	Low – the art in this shelter consists of two indeterminate charcoal lines in poor condition. The art here has no outstanding characteristics and is a common site type in the region.
52-5-0276	Sandy Creek Road 24	Shelter with Art and Deposit	Low – the art in this shelter consists of two indeterminate red ochre motifs, but the art is in poor condition. The are is is not relatively common for the area, however, the condition of the art means it has very low rarity, representative and general value. Archaeological deposit is common, and the deposit and artefacts display no outstanding attributes.

The Subsidence Impact Assessment prepared by MSEC for Longwalls 22 and 23 (2021) identify three (3) Aboriginal cultural heritage sites within the 35° angle of draw and predicted 20 mm subsidence contour of Longwalls 22 and 23 (Browns Road Site 17 AHIMS ID#52-2-1632, Dendrobium 3 AHIMS ID#52-2-2219 and Dendrobium 3C Isolated Find 1 AHIMS ID#52-2-4499, although the latter is not predicted to be impacted as it is an isolated artefact). Due to its location on a ridgeline and low levels of predicted subsidence movements, Browns Road Site 17 (AHIMS ID#52-2-1632) is not predicted to experience subsidence related impacts (MSEC 2021:67-8). There are eight (8) additional sites that are located within the Subject Area based on the 600 m boundary (Cordeaux Reservoir; Sandy Creek Road 2 AHIMS ID# 52-2-0019, Sandy Creek Road 1 Stone Arrangement AHIMS ID#52-2-0535, Browns Road Site 18 AHIMS ID#52-2-1633, Browns Road Site 19 AHIMS ID#52-2-1634, DM 1 AHIMS ID#52-2-4656, DM 10 (AHIMS ID#52-2-4657) and Sandy Creek Road 23 AHIMS ID #52-5-0275) and Sandy Creek Road 24 AHIMS ID#52-5-0276. As some of these sites could experience far-field or valley related effects and could be sensitive to these movements, they have been included in the assessments. In particular, Browns Road Site 19 (AHIMS ID#52-2-1634) may experience valley-related subsidence impacts due to its position along a tributary (MSEC 2021:68).

The sites within the Subject Area comprise six (6) Shelters with Art, one (1) Shelter with Art and Deposit, one (1) Shelters with Deposit, one (1) Stone Arrangement and one (1) Isolated Artefact (Figure 3, Table 5 and Annex 3). Two (2) Aboriginal cultural heritage sites are predicted to be directly impacted by the proposed works at Longwalls 22 and 23 specifically (Dendrobium 3 AHIMS ID#52-2-2219 and Browns Road Site 19 AHIMS ID#52-2-1634) (MSEC 2021:68). Although Aboriginal cultural heritage site Dendrobium 3C Isolated Find 1 AHIMS ID#52-2-4499 is also located within 35° angle of draw and predicted 20 mm subsidence contour of Longwalls 22 and 23, it would not experience subsidence related impacts as it is an Isolated Artefact.

The extraction of the proposed longwalls are likely to result in fracturing of the exposed bedrock along the ridgelines and, where the rock is marginally stable, could then result in rockfalls or instabilities. Should this fracturing or rock fall occur at the Aboriginal heritage sites these changes will adversely impact the heritage values of the sites.

Cultural Significance

IMC acknowledges that the entire Subject Area holds cultural significance to the local Aboriginal community, and that all Aboriginal cultural heritage sites within the Subject Area are of high cultural significance. There is the contemporary view held by Aboriginal people that all Aboriginal cultural objects and sites are important within the region due to their interconnectivity with the natural landscape and past occupation of the region.

An extract regarding the cultural significance of the Subject Area from the Dendrobium Longwall 19 SMP Appendix A: Archaeological Report is provided below (Niche, 2020b), and applies to the entirety of Dendrobium Area 3:

The entire Subject Area holds cultural significance to the local Aboriginal community. This is the contemporary view held by Aboriginal people that all Aboriginal objects and sites are important within the region, due to their interconnectivity with the natural landscape and past occupation of the region.

The Subject Area is located on the traditional country of the Dharawal nation. Tindale (1940, 1974) considered Dharawal/Tharawal boundaries to extend from Botany Bay in the north, west to Appin, and as far south as Nowra and Goulburn. The coastal plains and escarpment around Wollongong were inhabited by the Wadi Wadi, a tribe or subgroup of Dharawal-speakers (Tindale 1940:194-5, DEC 2005:3). Other named groups of the Dharawal language group are thought to include the Gweagal, Norongerraga, Illawarra, Tagary, Wandeandega, Wodi Wodi and Ory-ang-ora (Tindale 1974). Attenbrow (Attenbrow 2010:35) points out that such boundary mapping, undertaken as it was in the nineteenth century, is indicative at best, however, there appears to be reasonably strong agreement between those who have mapped language boundaries that the area is Dharawal country. Dharawal people distinguished themselves as Fresh Water, Bitter Water or Salt Water depending on where in the wider language boundary their traditional lands were – the inland hills and valleys, the plateaus and swamps or the coastal plain respectively (DEC, NSW, 2005:6)

Past Aboriginal land use of the Subject Area can be re-traced using contemporary comments from Aboriginal people, previously recorded archaeological resources, and historical observations of early settlers and surveyors (though the inherent bias present in historical European observations must be recognised).

Aboriginal cultural heritage sites within the Woronora Plateau remain in relatively undisturbed environment with a relatively high density of sites, many being a highly visual cultural resource which creates a strong sense of place and cultural identity. It has been identified in the previous Dendrobium Area 3 Archaeological and Cultural Heritage Assessment (Biosis Research, 2007) that all Aboriginal cultural heritage sites located within Dendrobium Area 3 are of cultural significance to the ILALC, Korewal Elouera Jerrunga and Cubbitch Barta Native Title Claimants Aboriginal Corporation. It is important that comment on the area is provided directly by members of the Aboriginal community.

4.4.1 Revised Subsidence Predictions

The subsidence predictions for Longwalls 22 and 23 in relation to Aboriginal cultural heritage sites located within the 35° angle of draw and 600 m boundary have been prepared by MSEC (2021) (Table 7).

Eleven (11) AHIMS registered Aboriginal cultural heritage sites are located within the Longwalls 22 and 23 Subject Area (Figure 3, Table 6 and Annex 3). These sites comprise:

- Five (5) Shelters with Art (Browns Road Site 17 AHIMS ID#52-2-1632, Browns Road Site 18 AHIMS ID#52-2-1633, Browns Road Site 19 AHIMS ID#52-2-1634, Dendrobium 3 AHIMS ID#52-2-2219, and Sandy Creek Road 23 AHIMS ID #52-5-0275);
- Three (3) Shelter with Art and Deposit (Cordeaux Reservoir; Sandy Creek Road 2 AHIMS ID# 52-2-0019, Sandy Creek Road 24 AHIMS ID#52-5-0276 and DM 1 AHIMS ID#52-2-4656);
- One (1) Shelters with Deposit (DM 10 AHIMS ID#52-2-4657);
- One (1) Stone Arrangement (Sandy Creek Road 1 Stone Arrangement AHIMS ID#52-2-0535); and
- One (1) Isolated Artefact (Dendrobium 3C Isolated Find 1 AHIMS ID# 52-2-4499).

Two (2) of the eleven (11) AHIMS registered sites within the Subject Area are predicted to have the potential to be directly impacted by the proposed works at Longwalls 22 and 23 (Dendrobium 3 AHIMS ID#52-2-2219 and Browns Road Site 19 AHIMS ID#52-2-1634). One (1) of these sites is located directly above the proposed Longwall 22 (Dendrobium 3 AHIMS ID#52-2-2219). The maximum predicted total subsidence effects for this site is 1400 mm vertical subsidence and 10 mm/m tilt (MSEC 2021:68). Table 7 provides further details on subsidence predictions by MSEC (2021:67-8) for each of the Aboriginal cultural heritage sites located within the Subject Area.

The proposed extraction of Longwalls 22 and 23 is likely to result in fracturing of the exposed bedrock along the ridgelines and, where the rock is marginally stable, could then result in rockfalls or instabilities. The fracturing and rock falls could adversely impact the sandstone shelters located within the proposed Longwalls 22 and 23 Subject Area.

The potential for adverse impacts on Aboriginal cultural heritage sites Dendrobium 3 (AHIMS ID#52-2-2219) and Browns Road Site 19 (AHIMS ID#52-2-1634) has been assessed as *unlikely* (i.e. less than 10 % probability) (MSEC 2021:68). It is possible that these sites could experience fracturing resulting in spalling or rock falls.

Table 7: Subsidence Predictions for Longwalls 22 and 23 Aboriginal Cultural Heritage Sites

Aboriginal Cultural Heritage Sites ¹		Maximum Predicted Total Vertical Subsidence ² (mm)	Maximum Predicted Total Tilt ³ (mm/m)	Maximum Predicted Total Hogging Curvature ⁴ (km ⁻¹)	Maximum Predicted Sagging Curvature ⁴ (km ⁻¹)
AHIMS No.	Site Name				
52-2-0019	Cordeaux Reservoir; Sandy Creek Road 2	< 20	< 0.5	< 0.01	< 0.01
52-2-0535	Sandy Creek Road 1 Stone Arrangement*	< 20	< 0.5	< 0.01	< 0.01
52-2-1632	Browns Road Site 17	< 20	< 0.5	< 0.01	< 0.01
52-2-1633	Browns Road Site 18	< 20	< 0.5	< 0.01	< 0.01
52-2-1634	Browns Road Site 19	< 20	< 0.5	< 0.01	< 0.01
52-2-2219	Dendrobium 3	1400	10	0.30	0.08
52-2-4499	Dendrobium 3C Isolated Find 1	< 20	< 0.5	< 0.01	< 0.01
52-2-4656	DM 1	< 20	< 0.5	< 0.01	< 0.01
52-2-4657	DM 10	< 20	< 0.5	< 0.01	< 0.01
52-5-0275	Sandy Creek Road 23	< 20	< 0.5	< 0.01	< 0.01
52-5-0276	Sandy Creek Road 24	< 20	< 0.5	< 0.01	< 0.01

Source: after MSEC (2021:67-8).

***Site of High Scientific (Archaeological) Significance.**

Sites predicted to be directly impacted by the proposed extraction of Longwalls 22 and 23 (after MSEC 2021:68).

¹ Aboriginal heritage sites within the 35° angle of draw of Longwalls 22 and 23 and/or within the 600 m boundary of Longwalls 22 and 23.

² Subsidence refers to vertical displacements of the ground.

³ Tilt is 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 distance between those points.

⁴ Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by average length of those sections.

4.4.2 Assessment of Potential Subsidence Impacts and Environmental Consequences

The Longwalls 22 and 23 SMP Subsidence Assessment (MSEC 2021) provided a description of the potential impacts on Aboriginal cultural heritage sites (including open sites and sandstone overhang sites) in the Southern Coalfield as a consequence of longwall mining. The following provides a summary of potential impact mechanisms and any changes to the predicted subsidence impacts and environmental consequences due to the subsidence predictions for Longwalls 22 and 23.

Open Sites

Open sites have the potential to be impacted by the cracking of sandstone resulting from mine subsidence. Two (2) open sites are located within the 600 m boundary of Longwalls 22 and 23 (Sandy Creek Road 1 Stone Arrangement [AHIMS ID#52-2-0535] and Dendrobium 3C Isolated Find 1 [AHIMS ID# 52-2-4499]).

Sandstone Overhang Sites

There are 9 sandstone overhang sites located within the 600 m boundary of Longwalls 22 and 23. Of the eleven sites with overhangs, there are:

- 5 Shelters with Art (Browns Road Site 17 AHIMS ID#52-2-1632, Browns Road Site 18 AHIMS ID#52-2-1633, Browns Road Site 19 AHIMS ID#52-2-1634, Dendrobium 3 AHIMS ID#52-2-2219, and Sandy Creek Road 23 AHIMS ID #52-5-0275);
- 3 Shelter with Art and Deposit (Cordeaux Reservoir; Sandy Creek Road 2 AHIMS ID# 52-2-0019 Sandy Creek Road 24 AHIMS ID#52-5-0276 and DM 1 AHIMS ID#52-2-4656); and
- 1 Shelter with Deposit (DM 10 AHIMS ID#52-2-4657).

Overhang sites can potentially be impacted by subsidence, including the cracking of sandstone. Where cracking is coincident with an overhang, it is possible there could be cracking of art panels, isolated rock fall, or in rare cases, overhang collapse.

The majority of the Aboriginal cultural heritage sites are located above solid coal and based on the low magnitudes of the predicted subsidence parameters, impacts to these sites resulting from the extraction of Longwalls 22 and 23 are considered unlikely (MSEC 2019:64, 2021:68). Surface fracturing of the bedrock can occur outside the longwall layouts, however such fracturing is minor and isolated, and the likelihood of such fracturing impacting the Aboriginal cultural heritage sites outside the longwall layouts is considered to be low (MSEC 2019:64, 2021:68).

Table 5 presented a risk analysis based on some of the rock shelter features and components developed by Sefton (2000) and subsequent studies. This risk assessment showed that adverse impacts that result in the loss of heritage values at the sites within the southern coalfield have a low likelihood of occurring. Impacts that would result in the total loss of heritage values at an individual site have not previously occurred in the Southern Coalfield.

In addition to the above, Section 10 provides an additional assessment (including tabulation of additional risk factors) for Aboriginal cultural heritage sites of high scientific (archaeological) significance and/or particular Aboriginal cultural significance. Notwithstanding the above and the assessments presented in Sections 4 and 10, Section 9 describes a monitoring program that will be implemented to record the impacts and consequences of Project related subsidence on Aboriginal cultural heritage sites. The monitoring includes Aboriginal cultural heritage sites of low, moderate and high (archaeological) significance.

5. Consultation Protocol

5.1 Identification of Aboriginal Stakeholders

For the purpose of this ACHMP, Aboriginal stakeholders are defined as being those Aboriginal groups/parties who have previously registered an interest in being consulted in relation to the Project (e.g. ACHA Longwalls 22 and 23), or who have been involved on an ongoing basis with IMC. These Aboriginal stakeholders include the following:

- Barraby Cultural Services,
- Cubbitch Barta Native Title Claimants Aboriginal Corporation,
- Freeman & Marx Pty Ltd,
- Gulgunya Ngunawal Heritage Aboriginal Consultancy,
- Gumaraa,
- Illawarra Local Aboriginal Land Council,
- Korewal Elouera Jerrungarugh Tribal Elders Council,
- Muragadi Heritage Indigenous Corporation,
- Murra Bidgee Mullangari Aboriginal Corporation,
- Mr Gary Caines,
- Mr Richard Campbell,
- Ms Leanne Tungai,
- South Coast People Native Title Claimants (via NTS Corp),
- Warra Bingi Nunda Gurri,
- Wodi Wodi Traditional Owners,
- Woronora Plateau Gundangara Elders Council,
- Yulay Cultural Services, and
- Yurrandaali Cultural Services.

5.2 Aboriginal Stakeholder Participation

IMC is committed to maintaining ongoing consultation with Aboriginal stakeholders throughout the life of the Project; however, Aboriginal stakeholders have a responsibility to ensure that up-to-date contact details (full name, postal address, telephone number, and where possible, email address) are provided to IMC.

5.2.1 Involvement of Aboriginal Stakeholders in fieldwork

The number of participants in an effective field team is governed by a number of safety, logistic and access considerations, including:

- **Safety:** a large group can be difficult to keep together when moving through dense vegetation in steep terrain as is the case across the majority of the Project underground mining area. Large groups move slowly (especially through dense vegetation and in steep terrain) and can prevent a rapid response (i.e. evacuation) to hazards that can be encountered in the Project underground mining area (e.g. bush fire warnings and electrical storms).
- **Logistics:** Participant numbers are limited by vehicle availability and safety restrictions. The isolated nature of the Project underground mining area requires the use of vehicles for efficient field work.

- **Access Restrictions:** Areas within the Project underground mining area are located within a WaterNSW Schedule One special area. Public access is controlled in this area to protect water quality and ecological integrity (WaterNSW and OEH, 2015). Excessive access into this area is not consistent with the WaterNSW's Special Areas Strategic Plan of Management (WaterNSW and OEH, 2015).

Aboriginal stakeholders will be invited to attend relevant scheduled fieldwork in consideration of the above. Scheduled fieldwork to which Aboriginal stakeholders may be invited to attend includes:

- Aboriginal cultural heritage monitoring (Section 9);
- supplementary fieldwork (Section 8); and
- the planning for and/or implementation of management and mitigation measures (Section 10).

Invitations to attend scheduled fieldwork will be provided in writing with 10 business days' notice and no less than 5 business days' notice where unscheduled inspections are required. Where there are matters that require rapid assessment and participation, with agreement from RAPs, the 5 days' notice may be less. Dates for undertaking fieldwork will be subject to consultation with Aboriginal stakeholders and archaeologists, and scheduling and conducting of fieldwork will be subject to access conditions as required by WaterNSW, which may result in delays and unplanned changes to some fieldwork

Prior to undertaking fieldwork, all participating Aboriginal stakeholders and archaeologists will be required to comply with the workplace health and safety requirements of IMC. These requirements include the provision of copies of current relevant insurances (i.e. public liability and workers compensation) and appropriate personal protection equipment.

All IMC staff and contractors (including Aboriginal stakeholders and archaeologists) may be subject to random drug and alcohol testing. All IMC staff and contractors (including Aboriginal stakeholders and archaeologists) must be able bodied and fit to undertake the work required.

5.2.2 Ongoing consultation with Aboriginal Stakeholders

IMC will continue to maintain a consultation log to record all correspondence with Aboriginal stakeholders (e.g. emails, telephone calls, letters, meeting minutes, etc.).

Aboriginal stakeholders will be invited to comment on relevant draft documentation regarding the management of Aboriginal cultural heritage, if and when required.

Where the ACHMP is amended or modified other than minor administrative changes, Aboriginal stakeholders and HeritageNSW will be provided with a reasonable opportunity to comment on the amendments before the revised version is adopted. In the context of this ACHMP, an amendment or modification would include any change that affects the management of Aboriginal cultural heritage associated with IMC. Examples of amendments or modifications in the context of this ACHMP include:

- Any change to the monitoring program methodology (e.g. monitoring frequency or parameters).
- Any change to the available remediation or mitigation measures (e.g. proposed use of a new engineering technology to reduce potential consequences).
- Any change to the surface disturbance protocol.

Copies of earlier drafts of this ACHMP were sent to the Aboriginal stakeholders identified in Section 5.1, with a comment period open for two-weeks on the following dates:

- 15 October 2021 (ACHMP for Longwalls 21, 22 and 23)

Two responses were received in relation to the October 2021 consultation including Gumaraa to confirm receipt of the report draft, the Illawarra Local Aboriginal Land Council and Gary Caines to report problems with the link sent, which were promptly resolved by Niche. These responses are included in Annex 2. No additional responses were received.

The latest revisions of this ACHMP Revisions F4 to F8 have not been issued to RAPs for consultation as the amendments do not include changes that affect the management of Aboriginal Cultural Heritage associated with IMC but rather consist of minor changes related to the removal of Longwall 21 from the ACHMP. Therefore, under this consultation protocol, additional consultation with the RAPs is not considered warranted.

5.3 Aboriginal Stakeholder Access Protocol

In addition to scheduled field activities, Aboriginal stakeholders may apply to WaterNSW or other landholders for access to Aboriginal cultural heritage sites within the larger Project Area (e.g. for personal, spiritual or cultural reasons). IMC will endeavour to facilitate the requested access, consistent with personnel workplace health and safety requirements and associated landholder requirements.

6. Performance measures and indicators

Condition 12, Schedule 3 of the Development Consent requires the following in relation to Aboriginal cultural Heritage:

The SMPs under Condition 7 must include an Aboriginal Heritage Management Plan, which must include a:

- (a) description of known Aboriginal heritage sites*
- (b) protocol for the ongoing consultation and involvement of the Aboriginal community in the conservation and management of Aboriginal heritage*
- (c) description of the measures that would be implemented to protect Aboriginal sites generally, including measures that would be implemented to secure, analyse and record sites at risk of subsidence and;*
- (d) description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the development.*

Aboriginal cultural heritage sites are subject to ongoing natural deteriorating processes unrelated to mining, including impacts from tree roots, natural weathering or deterioration, natural cracking of sandstone and inappropriate visitor behaviour (Lambert, 1989; Reeves and Regal, 2017). Limited long term studies have been undertaken on subsidence impacts to overhangs in the NSW Southern Coalfield and as the internal structures of overhangs (e.g. existing bedding planes, joints, cracking and seepage) are not always observable, not all risks to shelters from mining can be identified. This makes it sometimes problematic to clearly differentiate between subsidence impacts and natural weathering.

As indicated in Section 4.2, IMC acknowledges that all Aboriginal cultural heritage sites are culturally significant to the Aboriginal people who have a traditional connection to Country.

7. Baseline Data

Baseline recording of Aboriginal cultural heritage sites for Area 3C has been conducted by Biosis Research (2007) and Niche (2021b). The baseline records include:

- a photographic record of each Aboriginal cultural heritage site;
- detailed scaled plans of each site including physical characteristics and features; and
- detailed information regarding the dimensions, composition and features of the site.

All of the known Aboriginal cultural heritage sites within Dendrobium Area 3C have been subject to baseline recording at the level appropriate for registration on the Aboriginal Heritage Information Management System (AHIMS) at Heritage NSW. The purpose is to:

- Mitigate the risk of potential impact through more detailed archival recording of all Aboriginal cultural heritage sites (Shelter with Art, Deposit and/or Axe Grinding Groove sites, Axe Grinding Groove Sites and Engraving Sites).
- Provide a set of baseline records for the monitoring program.

Baseline recording is proposed to include:

- Imaging laser scanning or 3D photogrammetry of all shelter interiors and features;
- High resolution 3D photogrammetry of sites of high significance;
- Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium);
- Photographic records of art and features;
- “D-stretch” image enhancement on-site and during post-processing;
- Photographic records of monitoring points; and
- Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.

A monitoring regime established by Sefton (2000) and amended and continued by Biosis Research (2007), and further implemented by Niche (2009 to date) has proven effective in observing changes to Aboriginal cultural heritage shelter sites due to subsidence movements.

All eleven (11) Aboriginal cultural heritage sites within the Longwalls 22 and 23 Subject Area have previously been subject to detailed baseline recording undertaken by Biosis (2007) as part of the Dendrobium Area 3 Aboriginal Cultural Heritage Assessment (ACHA) and/or the Niche (2020c) Dendrobium Area 3C Longwalls 22 and 23 ACHA. This baseline recording undertaken by Biosis (2007) is not considered in this assessment as sufficiently updated due to the length of time since it was undertaken. It is recommended that a baseline recording is redone to accommodate for changes to the sites, and for the new technologies available in archaeological recording. All sites within the 600 m study area will be baseline recorded.

The photogrammetry data will be used to derive 3D models to a precision of approximately 4 mm / 10 m, from which plans and sections will be digitally derived.

A digital archive of the baseline recording will be produced and made available to the RAPs for their inspection.

8. Supplementary fieldwork and pre-clearance surveys

8.1 Supplementary fieldwork/investigation

Supplementary Aboriginal cultural heritage fieldwork may be undertaken over the life of the Project to inform the management and monitoring of Aboriginal cultural heritage sites.

8.2 Recording and registering new Aboriginal Cultural Heritage Sites

Any previously unrecorded Aboriginal cultural heritage sites identified during fieldwork (e.g. baseline recording, supplementary fieldwork, pre-clearance surveys, monitoring, follow-up inspections to assess the effectiveness of mitigation/management/remediation measures, etc.) would be recorded using the standard Heritage NSW site card. This information would be submitted to the Heritage NSW for registration on the AHIMS database. Any previously unrecorded sites would also be subject to subsidence risk and impact assessments, and an archaeological and Aboriginal cultural significance assessment in consultation with Aboriginal stakeholders. Any previously unrecorded Aboriginal cultural heritage sites would be managed in accordance with the requirements of this ACHMP.

9. Monitoring

A monitoring program will be implemented to monitor subsidence impacts and environmental consequences of Project related subsidence on Aboriginal cultural heritage sites.

Monitoring of the Longwalls 22 and 23 Aboriginal cultural heritage sites will be undertaken as a component of this ACHMP.

Monitoring of Dendrobium Area 3C Aboriginal cultural heritage sites, at which previous monitoring indicates continued change due to mining induced subsidence following the completion of Dendrobium Area 3C longwalls will be monitored as a component of this ACHMP.

All Aboriginal cultural heritage sites located within the 600 m boundary of Longwalls 22 and 23 will be monitored following the method and schedule used consistently at Dendrobium in accordance with approval conditions. The monitoring program involves three rounds of monitoring during and after the predicted subsidence effects associated with Longwalls 22 and 23 (Table 8).

Round 1 baseline monitoring will be undertaken prior to the extraction of Longwalls 22 and 23 respectively, and will include all Aboriginal cultural heritage sites within the 600 m boundary for each longwall (Table 8).

Round 2 monitoring will be undertaken within 6 months following the completion of Longwalls 22 and 23 respectively, and will include all Aboriginal cultural heritage sites within the 600 m boundary of each longwall (Table 8) as part of the End of Panel assessment.

Round 3 Monitoring will be undertaken as part of a final End of Panel assessment approximately 12 months after the completion of Longwall 22 and 23 respectively, and will include all Aboriginal cultural heritage sites within the 600 m boundary of each longwall (Table 8).

Table 8: Longwall 22 and 23 Aboriginal Cultural Heritage Sites Monitoring Schedule

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
Browns Road Site 17 (AHIMS ID#52-2-1632)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>
Browns Road Site 18 (AHIMS ID#52-2-1633)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	<p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>		
Browns Road Site 19 (AHIMS ID#52-2-1634)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	<p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>		
Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID# 52-2-0019)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
Dendrobium 3 (AHIMS ID#52-2-2219)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>
Dendrobium 3C Isolated Find 1 (AHIMS ID# 52-2-4499)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	<p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>		
DM 1 (AHIMS ID#52-2-4656)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	<p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>		
DM 10 (AHIMS ID#52-2-4657)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
Sandy Creek Road 23 (AHIMS ID #52-5-0275)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>
Sandy Creek Road 24 (AHIMS ID #52-5-0276)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	<p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p> <p>Photographic records of art and features.</p> <p>Photographic records of monitoring points; and</p> <p>Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.</p>		
Sandy Creek Road 1 Stone Arrangement (AHIMS ID#52-2-0535)	<p>Observational and photographic monitoring in consultation with stakeholders.</p> <p>Recording completed prior to longwall commencement.</p> <p>Imaging laser scanning or 3D photogrammetry of all shelter interiors and features.</p> <p>High resolution 3D photogrammetry of sites of high significance.</p> <p>Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium).</p> <p>“D-stretch” image enhancement on-site and during post-processing;</p>	<p>Approximately six (6) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within six (6) months.</p>	<p>Twelve (12) months after each predicted subsidence movement at the Aboriginal cultural heritage site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within six (6) months</p>

Aboriginal Cultural Heritage Site	Round 1	Round 2	Round 3
	<i>Baseline archival recording</i>	<i>Impact assessment recording</i>	<i>Final impact assessment recording</i>
	Photographic records of art and features. Photographic records of monitoring points; and Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs.		

The monitoring team will include a suitably qualified archaeologist (with experience in rock art recording and management) and representatives of the Aboriginal stakeholders (Section 5.1). Specific details that will be recorded during the monitoring program include (but are not limited to):

- the date of monitoring;
- the location of longwall extraction (i.e. the longwall chainage) at the time of monitoring;
- comparison of the physical characteristics of the site at the time of monitoring against the previous monitoring and the baseline record (detail/quantify any changes observed);
- inspections of rock surfaces for cracking and/or exfoliation and/or blockfall since the previous monitoring and against the baseline record;
- inspection of art motifs for damage or deterioration since the previous monitoring and against the baseline record;
- identification of any natural weathering processes that may result in deterioration (e.g. fire, vegetation growth and water seepage);
- detailed description and quantification of any changes noted during the completion of the above tasks;
- a photographic record of any changes noted during monitoring (taken at the same position and distance as baseline record to allow comparison over time);
- whether any follow-up actions are required (e.g. implementation of management or initiation of the Contingency Plan, etc.); and
- any other relevant information.

A summary of the information collected during monitoring will be recorded and reported in accordance with the Development Consent conditions. At the completion of monitoring, a report will be prepared and distributed to the Heritage NSW and each of the Aboriginal stakeholders. The report will include the following:

- a map of the area and the location of Aboriginal cultural heritage sites monitored;
- a table outlining the dates on which each site was monitored and which Aboriginal stakeholders were present;
- a table outlining Aboriginal cultural heritage sites at which change has been noted and the nature and degree of change;
- a summary of comments made by Aboriginal stakeholders present during monitoring regarding: - the degree and nature of change to Aboriginal cultural heritage sites; and - proposed recommendations.
- general observations made during the monitoring; and
- recommendations for future monitoring.

As described in Section 10, in the event that any subsidence impact is recorded during monitoring, the implementation of appropriate management, remediation and/or mitigation measures would be required in consultation with the landholder, Heritage NSW and the Aboriginal stakeholders. In addition, the AHIMS site card for any Aboriginal cultural heritage site affected by subsidence impacts will be updated and submitted to Heritage NSW for registration on the AHIMS database. In the event the subsidence impact performance measure is exceeded, the Contingency Plan outlined in Section 11 will be implemented.

9.1 Aboriginal Cultural Heritage Site Monitoring (Trigger Action Response Plan)

The Trigger Action Response Plan (TARP) (Table 9) contains the Performance Measures along with the proposed Corrective Management Actions (CMA) for Aboriginal cultural heritage sites, as outlined in the Dendrobium Longwalls 22 and 23 SMP. The following sites are considered by the TARP:

- Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID# 52-2-0019),
- Sandy Creek Road 23 (AHIMS ID #52-5-0275),
- Sandy Creek Road 24 (AHIMS ID #52-5-0276),
- Sandy Creek Road 1 Stone Arrangement (AHIMS ID#52-2-0535),
- Browns Road Site 17 (AHIMS ID#52-2-1632),
- Browns Road Site 18 (AHIMS ID#52-2-1633),
- Browns Road Site 19 (AHIMS ID#52-2-1634),
- Dendrobium 3 (AHIMS ID#52-2-2219),
- DM 1 (AHIMS ID#52-2-4656) and
- DM 10 (AHIMS ID#52-2-4657)

Table 9: Trigger Action Response Plan – Aboriginal Cultural Heritage Sites Monitoring for Longwalls 22 and 23

Feature	Performance Measures	Actions as a result of performance measure rating
<p><u>Within 35-degree angle of draw</u> Browns Road Site 17 (AHIMS ID#52-2-1632), Dendrobium 3 (AHIMS ID#52-2-2219),</p> <p><u>Within 600 m boundary</u> Cordeaux Reservoir; Sandy Creek Road 2 (AHIMS ID# 52-2-0019), Sandy Creek Road 23 (AHIMS ID #52-5-0275), Sandy Creek Road 24 (AHIMS ID #52-5-0276), Sandy Creek Road 1 Stone Arrangement (AHIMS ID#52-2-0535),</p> <p>Browns Road Site 18 (AHIMS ID#52-2-1633), Browns Road Site 19 (AHIMS ID#52-2-1634),</p> <p>DM 1 (AHIMS ID#52-2-4656) and DM 10 (AHIMS ID#52-2-4657)</p>	<p>Observational and photographic monitoring in consultation with stakeholders (completed by this assessment).</p>	<p>None.</p>
	<p><u>Level 1</u> Change in shelter conditions not attributable to natural weathering or preservation; mineral growth of micro-organism growth (as observed by comparing pre-mining photographs with post-subsidence/ mining photographs). Changes external to the shelter that affect the site context (e.g. ground cracking, boulder slumping, rock and/or tree falls).</p>	<p>Continue monitoring program. Condition assessment and photographic record . Notify RAPs and HeritageNSW within 24 hours of any confirmed changes to the conditions of Aboriginal cultural heritage sites. Summarise impacts and report in the End of Panel report and Annual Review.</p>
	<p><u>Level 2</u> Change in shelter conditions not attributable to natural weathering or preservation- change in drip line or seepage, cracking or exfoliation of overhang or shelter, movement or opening of existing planes and joints in panel, block fall within shelter or overhang, shelter or overhang collapse.</p>	<p>Actions as stated for Level 1. Modify monitoring program if necessary. Trigger the development of site management plan to mitigate effects in consultation with Registered Aboriginal Parties and Landowner (WaterNSW). Notify RAP’s of damages caused from mining. Notify Heritage NSW and complete Aboriginal Site Impact Recording Forms (ASIRF) for damaged sites.</p>
	<p><u>Level 3</u> Level 2 impacts at greater frequency than predicted. Level 2 impacts attributable to mining remote from the mining area.</p>	<p>Actions stated for Level 2. Notify Heritage NSW, DPHI, WaterNSW, other resource managers and relevant technical specialists and seek advice on any Corrective Management Actions (CMA) required. Site visits with stakeholders if required. Review monitoring program and notify if necessary, within 1 month. Implement increased monitoring if required within 2 weeks. Develop site CMA in consultation with key stakeholders within 1 month, (pending stakeholder availability) and seek approvals. Completion of works following approvals. Issue CMA report within 1 month of works completion. Conduct initial follow up monitoring and reporting within two months of CMA completion. Review the relevant TARP and Management Plan in consultation with key stakeholders.</p>

10. Management, Remediation and Mitigation Measures

10.1 Management and remediation measures

Following monitoring within six (6) and twelve (12) months of the completion of Longwall 22 and 23 respectively, IMC will assess the need for implementation of appropriate management and/or remediation measures.

Examples of potential management and remediation measures are provided in Table 11. Development and implementation of these measures will be assessed on a case-by-case basis and will acknowledge that whilst the measures may reduce the risk of impact and consequence, they can also have the potential to cause substantial damage to Aboriginal cultural heritage sites and their settings.

Table 10: Potential Management and Remediation Measures

Consequence	Potential Management and Remediation Measures	
	Measure	Description
Increased seepage with the potential to impact art.	Seepage control techniques.	<ul style="list-style-type: none"> Installation of an artificial dripline (e.g. silicone dripline) to direct increased moisture/water seepage away from art panels.
Reduction in the stability of a sandstone overhang due to substantial cracking or block fall.	Stabilisation techniques.	<ul style="list-style-type: none"> Installation of artificial rock support (e.g. rock bolts, cable bolts, cement sprays [e.g. shotcrete], injection of a binding agent [PUR or similar]). Installation of standing supports (e.g. timber props, timber cogs, sandbags and metal [hydraulic] props). Scaling/dislodgement/removal of remaining loose rock.
	Salvage.	<ul style="list-style-type: none"> Archaeological salvage of artefacts for safekeeping and storage and/or display at a suitable location in consultation with the Aboriginal community.
Impacts on aesthetic values due to cracking.	Restoration of aesthetic values.	<ul style="list-style-type: none"> Use of cosmetic treatments (e.g. in the form of coloured grout or similar) to restore aesthetic values.
Cracking of sandstone at open sites, threatening grinding grooves or engraved art.	Strain reduction techniques.	<ul style="list-style-type: none"> Installation of a stress relief slot or stress focus notch.

The development of management and/or remediation measures will be determined in consultation with Heritage NSW and the Aboriginal stakeholders and regarding the specific circumstances of the subsidence impact (e.g. the location, nature and extent of the impact) and the assessment of consequences.

If proposed, the implementation of any invasive techniques (e.g. stabilisation, stress relief/focus slots, use of material for aesthetic restoration, etc.) will also be developed in consultation with WaterNSW or other relevant landowners.

Follow-up inspections will be conducted to assess the effectiveness of implemented management and/or remediation measures and the requirement for any additional measures. The specific timing and nature of follow-up inspections/additional monitoring will be dependent on the nature of the management and/or remediation measures implemented. Any management and/or remediation measures implemented will be reported in the Annual Review (Section 13).

Consideration of any examples of successful remediation actions for Aboriginal heritage values and rockshelters will be undertaken in future assessments of Aboriginal cultural heritage and ACHMPs by Dendrobium. Where successful remediation examples are implemented and known, then these will be

included in future management considerations when preparing site specific management plans under the TARP.

10.2 Mitigation Measures

10.2.1 Mitigation Measure Consideration and Implementation Process

As part of the development of SMPs (and on an ongoing basis during mining), IMC will consider the requirement for development and implementation of Aboriginal cultural heritage mitigation measures. The aim of the mitigation measures is to reduce the potential for substantial impacts and consequences to Aboriginal cultural heritage sites of high archaeological significance and/or particular cultural significance.

The development of mitigation measures will be determined with regard to the specific circumstances of individual sites, including accessibility, size and spatial extent, nature of predicted subsidence impacts and consequences, and level of damage or disturbance (to the site or its setting) associated with implementing the measure(s). The consideration of mitigation measures will acknowledge that while they may reduce the risk of consequence to the site, they also have the potential to cause substantial damage to the site and its settings (including impacts to cultural setting). Other potential environmental impacts associated with implementation of mitigation works (e.g. vegetation clearing) will also be considered.

Examples of potential mitigation measures currently available are provided in Table 15 that would be discussed with the RAPs prior to implementation. It should be noted during consultation with the Aboriginal Parties for previous assessments that the cutting of stress slots and inclusion of bracing are not considered appropriate mitigation measures as they can cause more harm than subsidence may cause.

Any physical impacts would be reported to the IMC Management, DPHI, Heritage NSW and the RAPs. Consultation would then begin as to which action(s) would be appropriate as a mitigation measure.

Any proposed mitigation measures will be developed and implemented (if considered appropriate) in consultation with Heritage NSW, Aboriginal stakeholders and the relevant landowner (e.g. WaterNSW).

If mitigation measures are implemented, follow-up inspections will be conducted to assess the effectiveness of mitigation measures and to determine the requirement for any additional measures. The specific nature of follow-up inspections/additional measures will be dependent on the specific nature of the mitigation measure(s) implemented and their success.

A summary of the development process and success of implemented mitigation measures will be reported in the Annual Review (Section 13).

Table 11: Example of potential mitigation measures currently available for Aboriginal cultural heritage sites within the Southern Coalfield

Proposed Mitigation Measure	Details
Mine Planning	Design of Longwalls 22 and 23 was completed using ESD Principals and included an integrated planning process with input from experts, including mine engineers, resource geologists and natural and cultural heritage experts. IMC considered all potential impacts relating to the proposed extraction. The proposed layout was developed with consideration for sensitive surface features, including Aboriginal cultural heritage and the natural environment. The proposed mining has been set back from sensitive surface features, including Aboriginal cultural heritage, to minimise the potential for harm. These assessments are undertaken within an overall context of the approved operations and economics of the Dendrobium Mine.
Additional Monitoring during active subsidence movements	During the active subsidence of LW 22 and 23, when the longwall is within 400m of the Aboriginal cultural heritage, the sites would be monitored on a

Proposed Mitigation Measure	Details
	<p>monthly basis as part of the IMC field crews⁵ regular landscape monitoring process (where the site can be safely accessed). The purpose of the monitoring is to identify any physical changes at the sites that require notification to the RAPs and relevant Government agencies in the form of a letter memo and initiate further consultation with the RAPs and Government agencies and consideration of Corrective Management Actions. The IMC field crews are experienced in monitoring subsidence impacts and are involved in RAP consultation and site visits on an ongoing basis. IMC field teams have been provided with cultural heritage awareness training and inductions. Should any changes be identified during weekly inspections the RAPs would be invited to undertake additional site visits.</p>
Increased consultation	<p>RAPs would be informed of the extraction timing of LW 22 and 23.</p>
Bracing	<p>Should a shelter suffer cracking or destabilisation of its ceiling or back wall, mitigation measures such as the use of bracing poles or similar would be discussed with the RAPs, the landowner and a suitably qualified engineer and archaeologist for further settling processes.</p>
Stress slots	<p>Should a rock platform suffer cracking due to longwall extraction, mitigation measures such as the cutting of stress slots, grouting or similar within the platform would be discussed with the RAPs, the landowner and a suitably qualified archaeologist and subsidence specialist.</p>
Artificial Driplines	<p>Should a shelter suffer cracking and/or tilt that may cause any art panels to be impacted due to changes in water flow, mitigation measures such as the installation of an artificial dripline or similar would be discussed with RAPs, the landowner and a suitably qualified archaeologist.</p>

⁵ The IMC Field Team is led by the Coordinator Environment with over 15 years experience and expertise in the field of Environmental Science.

10.2.2 Consideration of Mitigation Measures for Longwall 22 and 23

Eleven (11) Aboriginal cultural heritage sites of low to high scientific (archaeological) significance and of particular Aboriginal cultural significance are located within the 600 m boundary of Longwall 22 and 23 (Figure 3). One (1) of these sites is of high scientific (archaeological) significance and of high cultural significance (Sandy Creek Road 1 Stone Arrangement, AHIMS ID#52-2-0535), and four (4) sites are of moderate archaeological significance and high cultural significance (Cordeaux Reservoir; Sandy Creek Road 2 AHIMS ID#52-2-0019, Browns Road Site 17 AHIMS ID#52-2-1632, DM 1 AHIMS ID#52-2-4656 and DM 10 AHIMS ID#52-2-4657). The remaining sites are of low archaeological significance and high cultural significance (Sandy Creek Road 23 AHIMS ID #52-5-0275, Browns Road Site 18 AHIMS ID#52-2-1633, Browns Road Site 19 AHIMS ID#52-2-1634, Dendrobium 3 AHIMS ID#52-2-2219 and Dendrobium 3C Isolated Find 1 AHIMS ID# 52-2-4499).

IMC acknowledges that all Aboriginal cultural heritage sites are of high cultural significance to the Aboriginal people who have a traditional connection to Country.

Previous monitoring, studies and experience from the Woronora Plateau and greater Southern Coalfield have identified several site characteristics/features as being most relevant when assessing the risk of environmental consequence to an Aboriginal cultural heritage site from subsidence impacts. These characteristics include (Sefton, 2000 and 2004; Biosis Research, 2007 and 2009a; Regal and Reeves 2017; MSEC 2007 and 2020):

- overhang volume – > 50 cubic metres increases the risk of negative consequence;
- presence of existing water seepage – damage to art from water is more likely if existing seepage is present;
- location in relation to a drainage line – sites located in valley bottoms can experience valley closure mechanisms and increased risk of cracking;
- location in relation to goaf – location of sites relative to the goaf influences the level of subsidence impacts experienced;
- overhang formation process – block-fall type overhangs are more likely to have roof or rear wall damage due to subsidence impacts;
- depth of cover – increased depth of cover reduces subsidence impacts and consequences; and
- presence of existing joints and bedding planes – subsidence movements may be dissipated through existing joints and bedding planes rather than the creation of new cracks.

MSEC was engaged by IMC to conduct a subsidence based risk assessment of the Aboriginal cultural heritage sites of high archaeological significance in order to inform the potential implementation of mitigation measures to reduce the potential for substantial impacts and consequences to the Aboriginal cultural heritage sites. The geotechnical risk assessment report by MSEC (2021) is provided in Annex 3 and considers the above characteristics and the potential for damage at each Aboriginal cultural heritage site.

Based on the information provided in the subsidence based risk assessment and in consideration of the potential damage caused by the implementation of available techniques, mitigation measures are not proposed for Aboriginal cultural heritage sites within the 600 m boundary of Longwalls 22 and 23. However, monitoring is planned to be undertaken of the Stone Arrangement site.

Future longwalls have the potential to result in additional subsidence movements at Aboriginal cultural heritage sites associated with Longwalls 22 and 23 or the previous Dendrobium mining areas. As part of the development of the future SMPs, IMC will review the potential impacts and environmental

consequences to Aboriginal cultural heritage sites and re-consider the development and implementation of mitigation measures if required.

As described above, the development and implementation of any mitigation measures will be undertaken in consultation with Heritage NSW, the Aboriginal stakeholders and relevant landowners (e.g. WaterNSW).

10.3 Surface Disturbance Protocol

The surface disturbance protocol aims to avoid accidental damage to Aboriginal cultural heritage sites located in close proximity to surface disturbance works. As described in Section 8, pre-clearance surveys will be undertaken (as needed) to identify the most appropriate location for required Project infrastructure.

This protocol will apply to surface disturbance works (e.g. exploration works, installation/operation/maintenance of surface infrastructure, construction/maintenance of access tracks, monitoring and stream restoration) proposed to be located close to any known Aboriginal cultural heritage site(s).

Surface disturbance works will be undertaken in consideration of the following:

1. Avoidance of impact to Aboriginal cultural heritage sites will be the primary management measure, where practicable.
2. To avoid accidental damage to Aboriginal cultural heritage sites located close to surface disturbance works, appropriate demarcation will be implemented (e.g. fencing, sign-posting or temporary flagging).
3. Where avoidance is not practicable, a comprehensive baseline record will be developed, and consideration of salvage will be undertaken in consultation with Aboriginal stakeholders prior to disturbance.

10.4 Human Skeletal Material Protocol

Burial sites can have high cultural significance to Aboriginal communities and culturally appropriate management of burial sites is a high priority for the Aboriginal community. “Aboriginal remains” are defined in the NPW Act as:

... the body or the remains of the body of a deceased Aboriginal person, but does not include:

- (a) body or the remains of a body buried in a cemetery in which non-Aboriginal persons are also buried, or*
- (b) a body or the remains of a body dealt with or to be dealt with in accordance with a law of the State relating to medical treatment or the examination, for forensic or other purposes, of the bodies of deceased persons.*

No burial or potential burial sites have been identified in the Project underground mining area. Nor are they considered likely to be identified in the future due to the shallow soil profiles present on the Woronora Plateau. Notwithstanding, the following steps will be carried out in the event that suspected Aboriginal human skeletal material is encountered within the Project underground mining area:

- surface works in the immediate vicinity of the skeletal material will cease;
- Environment Line will be contacted as soon as practicable by phone (131 555) or email (info@environment.nsw.gov.au);

- the DPHI, Heritage NSW, NSW Police and Aboriginal stakeholders will be informed as soon as practicable; and
- the identified skeletal remains will not be disturbed until the NSW Police and Heritage NSW have inspected the remains and authorised their disturbance.

10.5 Cultural Awareness Program

IMC will include a cultural awareness program as part of inductions aimed at minimising the potential for accidental damage to Aboriginal cultural heritage. The Aboriginal cultural awareness program will provide:

- an overview of the Aboriginal cultural heritage management program;
- an overview of the consultation protocol (Section 5);
- an overview of mitigation, management and remediation measures (Section 10);
- simple criteria and procedures for artefact and human bone recognition;
- actions to follow if human skeletal material is encountered (Section 10. 4); and
- personnel to contact for more information or assistance.

11. Contingency Plan

In the event the Aboriginal cultural heritage sites subsidence impacts detailed in Section 4 of this ACHMP are considered to have been exceeded, IMC will implement the following Contingency Plan:

- The exceedance will be reported to the Approvals Manager as soon as practicable.
- The exceedance will be recorded consistent with the monitoring program described in Section 9 of this HMP.
- IMC will report the exceedance to the DPIE, Heritage NSW and RAPs within 24 hours of IMC confirming the exceedance.
- IMC will conduct an investigation to evaluate the potential contributing factors. The investigation will:
 - compare and critically analyse measured versus predicted subsidence parameters;
 - review measured subsidence parameters against the observed impact; and
 - review the subsidence monitoring program and update the program where appropriate, in consultation with Heritage NSW and the RAPs.
- IMC will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists, relevant agencies and RAPs, as necessary. For example:
 - proposed management and/or mitigation measures (Section 10); and
 - a program to review the effectiveness of the management and/or mitigation measures.
- IMC will submit the proposed course of action to Heritage NSW and WaterNSW (or other landholder) for approval, in accordance with any future AHIP, as required following consultation with Heritage NSW.
- IMC will implement the approved course of action to the satisfaction of Heritage NSW.

12. Future Subsidence Management Plans for Dendrobium

In accordance with Condition 2, Schedule 8 of the Development Consent, IMC will collect baseline data for future SMPs. The collection of baseline data will include:

- Imaging laser scanning or photogrammetry of shelter interiors and features;
- Imaging laser scanning or photogrammetry of shelter exteriors where possible (often not possible due to vegetation at Dendrobium);
- Photographic records of art and features;
- Photographic records of monitoring points;
- Construction of 3D renders/models with point-cloud and imagery data stored by IMC and made available to RAPs;
- Photographic records;
- Detailed scaled plans including physical characteristics and features; and
- Detailed information regarding the dimensions, composition and features.

Prior to the commencement of extraction associated with the next SMP, baseline data will be obtained for Aboriginal cultural heritage sites located within the relevant 35° angle of draw and/or predicted 20 mm subsidence contour of the SMP longwall layout.

In addition to the baseline data collection, consideration of the environmental performance and management measures in accordance with the review(s) conducted as part of this ACHMP will inform the appropriate type and frequency of monitoring of the Aboriginal cultural heritage sites relevant to the next SMP.

13. Annual Review and Improvement of Environmental Performance

In accordance with Condition 5, Schedule 8 of the Development Consent, IMC will conduct an Annual Review of the environmental performance of the Project by the end of September each year, and for at least three (3) years following the cessation of mining at the development. IMC must submit an Annual Review to the Secretary, CCC and relevant agencies reviewing the environmental performance.

The Annual Review will relate to the previous financial year and specifically address the environmental performance of the ACHMP and will:

- identify the standards and performance measures that apply to the Project;
- describe the development (including any rehabilitation) that was carried out in the previous financial year;
- describe the Project (including any rehabilitation) that is proposed to be carried out in the current financial year;
- include a summary of the complaints received during the past year, and compare this to the complaints received in the previous years;
- include a summary of the monitoring results for the Project during the past year;
- include a comprehensive review of the monitoring results and complaints records of the Project over previous financial year, including a comparison of these results against the:
 - relevant statutory requirements, limits or performance measures/criteria;
 - requirements of any plan or program required under this Consent;
 - monitoring results of previous years; and
 - relevant predictions in the documents listed in condition 2 of Schedule 2.
- identify any non-compliance or incident which occurred in the previous financial year, and describe what actions were (or are being) taken to rectify the the non-compliance and avoid reoccurrence;
- evaluate and report on:
 - the effectiveness of the noise and air quality management systems; and
 - compliance with the performance measures, criteria and operating conditions in this Consent.
- identify any trends in the monitoring data over the life of the Project:
 - identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
 - describe what measures will be implemented over the next financial year to improve the environmental performance of the Project.

Copies of the Annual review must be submitted to the affected Councils and made available to the CCC and any interested person upon request.

14. Incidents

An incident is defined as a set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in the Development Consent. An incident may or may not be or cause a non-compliance.

The reporting of incidents will be conducted in accordance with Conditions 3 and 4, Schedule 8 of the Development Consent. IMC will notify the Secretary of the DPIE and any other relevant agencies of any incident associated with the Project:

- within 24 hours of the incident being confirmed by IMC;
- within seven days of notifying the DPPI and other relevant agencies, IMC will provide a detailed written report on the incident. This report will include:
 - (a) a description of the date, time, and nature of the incident;
 - (b) an identification of the cause (or likely cause) of the incident;
 - (c) a description what action has been taken to date; and
 - (d) a description of the proposed measures to address the incident.

Where the incident has caused or has the potential to cause material environmental harm, the Dendrobium Mine Pollution Incident Response Management Plan (PIRMP) will be activated, and notifications as listed in the PIRMP completed as required.

15. Complaints

A protocol for managing and reporting of complaints has been developed by IMC as a component of the Dendrobium Mine Environmental Management Strategy (EMS) (DENMP0039) and *Handling Community Complaints, Enquiries & Disputes Procedure (IMCP0112)*, and is described below.

Section 6.1 of the EMS states that:

6.6.1 Complaints

IMC has a 24 hour, free community call line (1800 102 210) and email address (illawarracommunity@south32.net) which is displayed at IMC Projects and Mine Sites, and included in newsletters, letters and other correspondence. The call line is for all complaints and general enquiries regarding environmental or community issues associated with IMC's operations.

Community complaints and enquiries may also be received in person by any employee of IMC, with details to be immediately shared with the Community Team for investigation. All complaints received in relation to Dendrobium Mine will be managed in accordance with the Handling Community Complaints, Enquiries and Disputes Procedure.

Upon receipt of a community complaint, preliminary investigations will commence as soon as practicable to determine the likely cause of the complaint. An initial response will be provided to the complainant within 24 hours of the complaint being made, with a follow up response being provided as soon as practicable once a more detailed investigation is complete.

A summary of all complaints received during the reporting year will be provided as part of the Annual Review. A log of complaints is also maintained on the South32 website at: <https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>.

6.6.2 Dispute Resolution Process

In the event that an issue cannot be resolved between the IMC representative and complainant, the issue is escalated within IMC. The escalation of the issue is aligned with the risk associated with the nature of the complaint.

In the event that the matter remains unresolved, it may be appropriate that the matter be taken to third-party mediation (e.g. Subsidence Advisory NSW, DPIE, EPA or other relevant agencies) in order to achieve an outcome.

IMC is responsible for maintaining a complaints register recording all complaints, in accordance with Section 6.1 of the EMS; Condition 11, Schedule 8 of the Development Consent; and the *Handling Community Complaints, Enquiries & Disputes Procedure (IMCP0112)*. For each complaint, the following information will be recorded in the complaints register:

- date and time of complaint;
- method by which the complaint was made;
- personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;

- nature of the complaint;
- the action(s) taken by IMC in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by IMC, the reason why no action was taken.

The IMC External Affairs Team will be responsible for the management of complaints and ensuring access to information, as stated in Section 2 of the EMS. In accordance with Condition 11, Schedule 8 of the Development Consent, the complaints register will be made publicly available on the South32 website (<https://www.south32.net/>) and updated on a monthly basis. As required by Condition 5, Schedule 8 of the Development Consent, a summary of complaints received during the past year will be submitted to the Secretary, CCC and relevant agencies as part of the Annual Review, alongside a comparison of the complaints received in previous years.

16. Non-Compliances with Statutory Requirements

A protocol for managing and reporting non-compliances has been developed as a component of IMC's Dendrobium Mine EMS. Section 6.2 of the EMS states:

6.2 Events, Cumulative Impacts, Non-Compliances, Corrective Actions and Preventative Actions

Events, non-compliances, non-conformances, corrective actions and preventative actions are managed in accordance with the Reporting and Investigation Standard and Environmental Compliance/Conformance Assessment and Reporting Procedure. These procedures, which relate to all IMC operations, detail the processes to be utilised with respect to event and hazard reporting, investigation and corrective action identification. The key elements of the process include:

- *Identification of events, non-conformances and/or non-compliances:*
- *Recording of the event, non-conformance and/or non-compliance in the event management system (G360);*
- *Investigation/evaluation of the event, non-conformance and/or non-compliance to determine specific corrective and preventative actions;*
- *Assigning of corrective and preventative actions to responsible persons in G360; and*
- *Review of corrective actions to ensure the status and effectiveness of the actions.*

Corrective and preventative actions address the cumulative impacts of the mining operations as applicable.

Subsidence modelling at Dendrobium Mine uses the Incremental Profile Method. This method uses a database of past movements/measurements to calibrate the subsidence model. The model predicts subsidence movements for each longwall (incremental) as well as all other longwalls and other influences on subsidence movements, including any adjacent, overlying or underlying workings (cumulative).

Ground and surface water modelling takes into account all other mining operations and other activities which impact water resources.

Integrated mine planning considers these cumulative impacts by adopting mine design and subsidence monitoring and management programs to ensure conditions of consent and performance measures are met.

Non-compliances with this ACHMP and conditions of any future AHIP will be reported to the Environment Line at info@environment.nsw.gov.au and 131 555.

As outlined in Section 6.3 of the Dendrobium Area 3 SMPs, compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed at or in association with Dendrobium Mine operations. Regular inspections, internal audits and initiation of any remediation/rectification work in relation to this Plan will be undertaken by the Principal Approvals.

Non-conformities, corrective actions and preventative actions are managed in accordance with the following process:

- Identification, reporting and recording of non-conformance and/or non-compliance;
- Evaluation of the non-conformance and/or non-compliance to determine specific corrective and preventative actions;
- Corrective and preventative actions to be assigned to the responsible person;
- Management review of corrective actions to ensure the status and effectiveness of the actions; and
- An Annual Review will be undertaken to assess IMC's compliance with all conditions of the Dendrobium Development Consent, Mining Leases and other approvals and licenses.

An independent environmental audit will be undertaken in accordance with Schedule 8, Condition 6 of Development Consent 60-03-2001 to review the adequacy of strategies, plans or programs under these approvals and if appropriate, recommend actions to improve environmental performance. The independent environmental audit will be undertaken by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of DPHI.

References

Attenbrow, V 2010 *Sydney's Aboriginal Past: Investigating the archaeological and historical records*. University of New South Wales Press, Sydney.

Biosis Research 2004. *Dendrobium Area 3 Lake Cordeaux foreshore seismic testing REF: Archaeological Survey*. An unpublished report for BHP Billiton- Illawarra Coal.

Biosis Research 2007a. *Dendrobium Area 3 Archaeological and Cultural Heritage Assessment*. An unpublished report for BHP Billiton-Illawarra Coal.

Biosis Research 2007b *West Cliff Colliery Stage 3 Coal Emplacement Archaeological and Cultural Heritage Assessment*. An unpublished report for BHP Billiton Illawarra Coal.

Biosis Research 2008. *Appin Area 7 Longwall 701: End of Panel Report: Cultural Heritage*. An unpublished report for BHP Billiton Illawarra Coal

Biosis Research 2009a. *Bulli Seam Operations Aboriginal Cultural Heritage Assessment*. An unpublished report for BHP Billiton Illawarra Coal.

Biosis Research 2009b. *Dendrobium Coal Mine-Area 3A: Aboriginal Heritage Management Plan*. An unpublished report for BHP Billiton Illawarra Coal.

Biosis Research, 2009c. *Dendrobium Coal Mine-Area 3 Aboriginal Heritage Plan*. Report for BHP Billiton-Illawarra Coal.

Biosis Research 2012. *Dendrobium Area 3B Longwalls 9 to 18: Aboriginal Cultural Heritage Assessment Report*. Unpublished report for BHP Billiton Illawarra Coal.

Biosis Research 2013. *Baseline recording of Aboriginal Sites in Dendrobium Area 3B Longwalls 9-18*. Unpublished report for BHP Billiton-Illawarra Coal.

Biosis Research 2015. *Dendrobium 3B, Longwall 10 End of Panel Report: Cultural Heritage*. An unpublished report for BHP Billiton Illawarra Coal

Comur Consulting Pty Ltd 2009. *Dendrobium Colliery Area 2 Longwall 4 End of Panel report*. An unpublished report for BHP Billiton Illawarra Coal.

Department of Environment and Conservation, NSW, 2005. *A History of Aboriginal People of the Illawarra 1770 to 1970*, Hurstville, NSW, Department of Environment and Conservation (NSW).

IMC 2007. *Dendrobium Area 3 Project Environmental Assessment (Project EA)*, <https://www.south32.net/our-business/australia/illawarra-metallurgical-coal/documents>

Gun and Kayandel Archaeological Services 2007. *Metropolitan Coal Longwalls 20-22 Baseline Monitoring*. An unpublished report for Metropolitan Colliery.

Kayandel Archaeological Services 2008. *Aboriginal Cultural Heritage Assessment, Metropolitan Coal Project, Metropolitan Colliery, Helensburgh, NSW*. An unpublished report for Helensburgh Coal Pty Ltd.

Kayandel Archaeological Services 2012. *Longwall subsidence impact monitoring January and March 2012 Metropolitan Colliery, Helensburgh, NSW*. An unpublished report for Helensburgh Coal Pty Ltd

Lambert, D 1989. *Conserving Australian Rock Art: A manual for Site Managers*. The Institute Report Series. Aboriginal Studies Press, Canberra.

Mining Subsidence Engineering Consultants, 2007. *Introduction to Longwall Mining and Subsidence*. http://www.minesubsidence.com/index_files/files/Intro_Longwall_Mining_and_Subs.pdf.

Mine Subsidence Engineering Consultants, 2007. *Subsidence Assessment – The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure Resulting from the Proposed Extraction of Proposed Longwalls 18 to 19A at Metropolitan Colliery in Support of an SMP Application*.

Mining Subsidence Engineering Consultants 2019. *Subsidence Predictions and Impact Assessments for the Dendrobium LW20 and 21, Revision E*. Report prepared for Illawarra Coal.

Mining Subsidence Engineering Consultants 2021. *Subsidence Predictions and Impact Assessments for the Dendrobium LW22 and 23, Revision 03*. Report prepared for Illawarra Coal.

Navin Officer Heritage Consultants 2000. *Dendrobium Coal Project: Cultural Heritage Assessment*. A report prepared for Olsen Environmental Consulting on behalf of the collieries division of BHP Steel.

Niche Environment and Heritage 2011. *Aboriginal and European Heritage Assessment for West Cliff Colliery Longwall 34 End of Panel Report*. An unpublished report prepared for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2012. *Attachment 7 Aboriginal Objects Due Diligence Assessment Dendrobium Areas 3B, C and D Exploration Program Survey 11*. An unpublished report for BHP Billiton-Illawarra Coal.

Niche Environment and Heritage 2013a. *West Cliff Longwall 35 End of Panel Heritage Assessment*. An unpublished report prepared for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2013b. *Longwalls 20-22 Subsidence Impact Monitoring of Aboriginal Cultural Heritage Sites: Metropolitan Coal July 2013*. Unpublished report prepared for Metropolitan Coal.

Niche Environment and Heritage 2013c. *West Cliff Longwall 35 End of Panel Heritage Assessment*. An unpublished report for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2014. *West Cliff Colliery Longwall 36 End of Panel Heritage Assessment*. An unpublished report prepared for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2014a. *Aboriginal and European heritage Assessment for Appin Colliery- Longwall 705 End of Panel Report*. An unpublished report for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2014b. *Aboriginal Heritage Assessment for Tahmoor Colliery- Longwall 27 End of Panel Report for Tahmoor Colliery*. An unpublished report for Tahmoor Colliery.

Niche Environment and Heritage 2014c. *Redbank Creek 1 Aboriginal Cultural Heritage Assessment Report*. An unpublished report for Tahmoor Colliery.

Niche Environment and Heritage 2015a. *Metropolitan Coal Longwall 22: Monitoring of Aboriginal Heritage Sites*. Unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2015b. *Metropolitan Coal Longwall 23: Monitoring of Aboriginal Heritage Sites*. Unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2015c. *Tahmoor Colliery Longwall 28 End of Panel Reporting: Cultural Heritage review and reporting*. An unpublished report for Tahmoor Colliery.

Niche Environment and Heritage 2016a. *Metropolitan Coal Longwall 25: Monitoring of Aboriginal Heritage Sites*. Unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2016b. *Longwalls 23-27 Metropolitan Colliery Baseline Recording*. An unpublished report for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2016c. *Longwalls 301-303 Metropolitan Colliery Baseline Recording*. An unpublished report for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2017a. *Metropolitan Coal Longwall 26: Monitoring of Aboriginal Heritage Sites*. Unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2017b. *Tahmoor South Aboriginal Cultural Heritage Assessment*. An unpublished report prepared for Tahmoor Colliery.

Niche Environment and Heritage, 2019. *Dendrobium Colliery Longwall 14 End of Panel Report - Aboriginal Heritage Assessment*. An unpublished report prepared for South32 – Illawarra Coal.

Niche Environment and Heritage, 2020a. *Dendrobium Colliery Longwall 15 End of Panel Report - Aboriginal Heritage Assessment*. An unpublished report prepared for South32 – Illawarra Coal.

Niche Environment and Heritage, 2020b. *Aboriginal Cultural Heritage Assessment Report: Longwall 19 Dendrobium Area 3A*. An unpublished report prepared for South32 – Illawarra Coal.

Niche Environment and Heritage, 2020c. *Dendrobium Mine Area 3C: Longwalls 20-21 Aboriginal Cultural Heritage Assessment Report*. An unpublished report prepared for South32 – Illawarra Coal.

Niche Environment and Heritage, 2021 *Longwall 16 End of Panel Report*. An unpublished report for South 32 Illawarra Metallurgical Coal

Niche Environment and Heritage, 2021. *Aboriginal Cultural Heritage Assessment Report: Longwalls 22 and 23, Dendrobium Area 3C*. An unpublished report prepared for South32 – Illawarra Coal.

Reeves, J. and Regal, R. (2017). *The Unexpected Outcomes of 25 Years of Subsidence Monitoring of Aboriginal Cultural Heritage Sites in the Southern Coalfield NSW*. The Proceedings of the Tenth Triennial Conference of the Mine Subsidence Technological Society.

Regal, R and Reeves, J. 2017 'Overview of the monitoring of sandstone overhangs for the effects of mining subsidence in the Southern Coalfields.' In Mine Subsidence Technological Society 10th Triennial Conference proceedings Mine Subsidence: Adaptive Innovation for Managing Challenges.

Sefton, C. 1990. *1989-1990 Archaeological survey of the Cordeaux River and Woronora River by the Illawarra Prehistory Group*. Report for the Australian Institute of Aboriginal and Torres Strait Islander Studies.

Sefton, C. 1994. *1993-1994 Archaeological Survey of the Avon River by the Illawarra Prehistory Group*. Report for the Australian Institute of Aboriginal and Torres Strait Islander Studies.

Sefton, C. 1998a. *Site and Artefact Patterns on the Woronora Plateau*. M.A Thesis, University of Wollongong, Wollongong.

Sefton, C. 1998b. *Resurvey of Brennans Creek Stage II Coal Washery Refuse Emplacement Area*. Unpublished report to Collieries Division, BHP Australia Coal.

Sefton, C. 2000. *Overview of the monitoring of sandstone overhangs for the effects of mining subsidence in the Illawarra Coal Measures*. An unpublished report for Collieries Division, BHP Coal.

Sefton, C. 2002. *Archaeological Survey of longwall 9 and 10 Application Elouera Colliery*. An unpublished report for BHP Billiton Illawarra Coal Holdings Pty Ltd

Sefton, C. 2002a. *Archaeological Survey of West Cliff Colliery Area 5*. An unpublished report for BHP Billiton, Cano Steel materials, Illawarra Coal.

Sefton, C. 2002b. *Archaeological Investigation of West Cliff Colliery Longwalls 5A5 to 5A8*. An unpublished report for BHP Billiton, Carbon Steel Materials, Illawarra Coal

Sefton, C. 2002c. *Archaeological Investigation for the Proposed Longwalls 406 to 408 Appin Colliery*. An unpublished report for BHP Carbon Steel Materials Illawarra Coal.

Sefton, C. 2004. *Archaeological Survey of the Eastern Drainage of the Hacking River from Upper Peach Trees to Leg of Mutton Bay to Grahams Point*. Unpublished report.

South32 – Illawarra Metallurgical Coal, 2018. *Dendrobium Development Consent – Modification 8*. [https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/development-consent/consolidated-dendrobium-consent-\(modification-7\)-april-2015.pdf?sfvrsn=a99db8f8_6](https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/development-consent/consolidated-dendrobium-consent-(modification-7)-april-2015.pdf?sfvrsn=a99db8f8_6).

South 32 – Illawarra Metallurgical Coal, 2019 (Modification 5.0). *Environmental Management Strategy: Dendrobium Mine*. ID: DENMP0039. https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/dendrobium-environmental-management-plans---surface-facilities/dendrobium-environmental-management-strategy.pdf?sfvrsn=21da4dbc_4.

South32 – Illawarra Metallurgical Coal, 2020. *Dendrobium Area 3B Longwall 18 Subsidence Management Plan*. An unpublished report.

Tindale, N. 1940 *Distribution of Australian Aboriginal Tribes: Results of the Harvard-Adelaide Universities Anthropological Expedition 1938-1939: A Field Survey*. Royal Society of South Australia, Adelaide.

Tindale, N. 1974. *Aboriginal Tribes of Australia*. Australian National University, Canberra.

Annex 1: Glossary and List of Abbreviations

Term or abbreviation	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present-day Aboriginal communities.
ACHA	Aboriginal Cultural Heritage Assessment.
ACHMP	Aboriginal Cultural Heritage Management Plan.
Aboriginal object(s)	The legal definition for material Aboriginal cultural heritage under the NSW <i>National Parks and Wildlife Act 1974</i> .
Aboriginal stakeholders	Members of a local Aboriginal land council, registered holders of Native Title, Aboriginal groups or other Aboriginal people who may have an interest in the Project.
Angle of draw	<p>This is a subsidence engineering term used to define the limits of the subsidence movements in a landscape caused by mine workings, that leads to vertical displacement on the surface.</p> <p>The angle of draw is determined through a series of geometric parameters in which the angle between two lines drawn from the edge of the mine workings. One being a vertical line, and the other a line to the limit of vertical displacement on the surface. Because surface movements can also be caused by natural effects such as seasonal variations or drought leading to swelling or shrinkage of near-surface soil and sediment, it can be very difficult to identify where vertical movement due to mining ceases. Therefore, it is standard practice to specify a limiting value for vertical displacement which might be attributable to mining. In New South Wales, this value is usually 20 mm of vertical subsidence. It should be noted that, in some environments, up to 50 mm or more of vertical movement may occur due to seasonal climatic changes.</p>
Archaeology	The scientific study of material traces of human history, particularly the relics and cultural remains of past human activities.
Archaeological deposit	A layer of soil material containing archaeological objects and/or human remains.
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.
Archaeological site	An area that contains surface or sub-surface material evidence of past human activity in which material evidence (artefacts) of past activity is preserved.
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	<p>A group of artefacts found in close association with one another.</p> <p>Any group of items designated for analysis that exist in spatial and/or vertical context – without any assumptions of chronological or spatial relatedness.</p>
Avoidance	A management strategy which protects Aboriginal sites within an impact area by avoiding them totally in development.
Heritage NSW	Heritage NSW, of the Department of Premier and Cabinet (DPC). Previously known as the Biodiversity Conservation Division (BCD) of the Department of Planning, Industry and Environment, which was priorly known as the Office of Environment and Heritage (OEH).

Term or abbreviation	Definition
CCC	Community Consultative Committee
CCL	Consolidated Coal Lease
Code of Practice	<i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.</i>
CMA	Corrective Management Actions.
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
DA	Development Approval (same as Development Consent).
DCP	Development Control Plan.
DECCW	The Department of Conservation, Climate Change and Water, then known as the Office of Environment and Heritage, now known as Heritage NSW.
DPIE	Department of Planning, Industry and Environment, NSW.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
DRG	NSW Resources and Geoscience, of the Department of Planning and Environment Cluster. Now known as Mining, Exploration and Geosciences (MEG).
EA / Project EA	Project Environmental Assessment.
EMS	Dendrobium Mine Environmental Management Strategy (DENMP0039, version 7.0, 2023).
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979.</i>
EPL	Environment Protection Licence.
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
FY	Financial Year.
Harm	With regard to Aboriginal objects this has the same meaning as the <i>NSW National Parks and Wildlife Act 1974.</i>
Heritage NSW	Heritage NSW, of the Department of Premier and Cabinet. Previously known as the Office of Environment and Heritage (OEH), and the Department of Conservation, Climate Change and Water (DECCW) priorly.
HMP	Heritage Management Plan.
ILALC	Illawarra Local Aboriginal Land Council
IMC	The proponent; South32–Illawarra Metallurgical Coal
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Impact area	An area that requires archaeological investigation and management assessment.
In situ	Latin words meaning ‘on the spot, undisturbed’.
Isolated artefact / find	A single artefact found in an isolated context.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Landform	Any one of the various features that make up the surface of the earth.

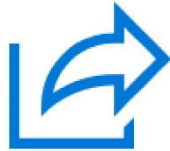
Term or abbreviation	Definition
LEP	Local Environmental Plan.
LW	Longwall.
Management plans	Conservation plans which identify short- and long-term management strategies for all known sites recorded within a (usually approved) Subject Area.
MEG	Mining, Exploration and Geosciences Department NSW.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
ML	Mining Lease.
MSEC	Mine Subsidence Engineering Consultants Pty Ltd.
NPW Act	National Parks and Wildlife Act 1974.
NPW Regulation	National Parks and Wildlife Regulation 2009.
OEH	Office of Environment and Heritage NSW, previously known as the Department of Conservation, Climate Change and Water (DECCW). Now called Heritage NSW.
Open camp site	An archaeological site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill, etc.).
PAD	Potential Archaeological Deposit. A location considered to have a potential for subsurface archaeological material.
PIRMP	Pollution Incident Response Management Plan
RAP	Registered Aboriginal Party.
SHI	State Heritage Inventory
Statutory controls	Control or regulation provided for by legislation.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	A place where past human activity is identifiable.
SMP	Subsidence Management Plan.
Spit	A unit of archaeological excavation with an arbitrary assigned measurement of depth and extent.
Survey coverage	A graphic and statistical representation of how much of an impact area was surveyed and therefore assessed.
TARP	Trigger Action Response Plan.
WA	Water Approval.
WAL	Water Access Licence.

Annex 2: Consultation records

From: [Richard Campbell](#)
To: [Stella Quast](#)
Cc: [GulgunyaNHAC@hotmail.com](#); [aantony@ntscorp.com.au](#); [asingh@ntscorp.com.au](#); [barrabyculturalservices@gmail.com](#); [clive.freeman@y7mail.com](#); [garycaines87@gmail.com](#); [georgeavillafor@gmail.com](#); [grc04@live.com.au](#); [heritage@ilalc.org.au](#); [jvdcorp@hotmail.com](#); [kayla_87@hotmail.com](#); [kgchalker@bigpond.com](#); [leannecaroltungai@gmail.com](#); [lmelrose@ntscorp.com.au](#); [muragadi@yahoo.com.au](#); [murrabidgeemullangari@yahoo.com.au](#); [oldmanwisdomgumaraa@gmail.com](#); [richardcampbell123@outlook.com](#); [schalmers@ntscorp.com.au](#); [warrabingi@gmail.com](#); [yulayculturalservices@gmail.com](#); [yurrandaali_cs@outlook.com](#)
Subject: Re: Stella Quast shared "6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview" with you.
Date: Friday, 15 October 2021 8:31:36 PM
Attachments: [AttachedImage](#)
[AttachedImage](#)
[AttachedImage](#)
[AttachedImage](#)
[AttachedImage](#)

Received, thank you.

On Fri, 15 Oct 2021 at 5:09 pm, Stella Quast <squast@niche-eh.com> wrote:



Stella Quast shared a file with you

To whom it may concern,

Niche Environment & Heritage have been commissioned by South 32-IMC to prepare a draft Aboriginal Cultural Heritage Management Plan (ACHMP) for Aboriginal cultural heritage sites that may be impacted by the proposed extraction of Longwalls 21, 22 and 23 within Dendrobium Mine.

If you have any comments, suggestions or queries regarding this draft, please contact Niche by 5pm on Friday 29 October 2021.

Kind regards,
Stella Quast



6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview



This link only works for the direct recipients of this message.

Open



[Privacy Statement](#)

--
Director
Gumaraa Aboriginal Experience Pty Ltd

M: 0432645912 M: 0487406782
E: info@gumaraa.com.au
W: www.gumaraa.com.au

I acknowledge with respect our Elders past, present and those of the future. All traditional custodians, our lore, our culture, and the land, water and air, where I live, work and travel.

Copyright statement for Gumaraa Aboriginal Experience Pty Ltd
Gumaraa Aboriginal Experience Pty Ltd ('Gumaraa' or 'we' or 'us' or 'our') hereby reserve all rights and privilege in relation to the program, material and contents of these documents and artworks in part or in whole ('our material')

No part of our material may be reproduced in part or in whole without the prior written express consent from the copyright holders Gumaraa Aboriginal Experience Pty Ltd. All and any rights, ownership and opportunity to our material is hereby reserved and for our sole benefit including but not limited to all rights it holds in relation to and she went to the copyright act 1968 (CTH).

We do not accept any responsibility what so ever for any damage, directly or indirectly, all loss of freelance materials submitted for reproduction in relation to this material or artwork.

The information contained in our material are true and correct to the best of our knowledge and beliefs, all recommendations are made without any guarantee on the part of Gumaraa.

From: [Stella Quast](#)
To: garycaines87@gmail.com; [Richard Campbell](#)
Subject: RE: Stella Quast shared "6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview" with you.
Date: Tuesday, 19 October 2021 4:53:00 PM
Attachments: [6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview_Condensed file.pdf](#)
[image003.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)
[image001.jpg](#)

Hi Gary,

Thank you for letting me know. Please find attached a condensed version of the report file (the contents are all the same as the original file).

If this does not work, please let me know and I will print the report off and drop it at the Mount Ousley address.

Kind regards,
Stella

Stella Quast *BA (Hons)*
Heritage Consultant
0458 000 903
NSW Head Office – Sydney
PO Box 2443 North Parramatta NSW 1750



From: garycaines87@gmail.com <garycaines87@gmail.com>
Sent: Tuesday, 19 October 2021 4:29 PM
To: Richard Campbell <info@gumaraa.com.au>
Cc: Stella Quast <squast@niche-eh.com>
Subject: Re: Stella Quast shared "6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview" with you.

Hello Stella,

i have had a lengthy watching brief at this mount kembla mine site's origins and intentions since my much younger years' time on Wollongong's illawarra.

Ftm i am unable to access the file linked to "Niche Environment & Heritage have been commissioned by South 32-IMC to prepare a draft Aboriginal Cultural Heritage Management Plan (ACHMP) for Aboriginal cultural heritage sites that may be

impacted by the proposed extraction of Longwalls 21, 22 and 23 within Dendrobium Mine"

Could you please provide a hardcopy of your draft ACHMP by mail service to my Household Address:

28 Gowan Brae Avenue
Mount Ousley NSW 2519

Regards garyC
0487272690

Ps: i have had well know anti extractive industries attitudes and am much aligned with sovereign territorial benefactorships, TBA

[Sent from Yahoo Mail on Android](#)

On Fri, 15 Oct 2021 at 8:31 PM, Richard Campbell
<info@gumaraa.com.au> wrote:

Received, thank you.

On Fri, 15 Oct 2021 at 5:09 pm, Stella Quast <squast@niche-eh.com> wrote:



Stella Quast shared a file with you

To whom it may concern,

Niche Environment & Heritage have been commissioned by South 32-IMC to prepare a draft Aboriginal Cultural Heritage Management Plan (ACHMP) for Aboriginal cultural heritage sites that may be impacted by the proposed extraction of Longwalls 21, 22 and 23 within Dendrobium Mine.

If you have any comments, suggestions or queries regarding this draft, please contact Niche by 5pm on Friday 29 October 2021.

Kind regards,
Stella Quast



6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview



This link only works for the direct recipients of this message.

[Open](#)



Custom logo



[Privacy Statement](#)

--

Director
Gumaraa Aboriginal Experience Pty Ltd

M: 0432645912 M: 0487406782

E: info@gumaraa.com.au

W: www.gumaraa.com.au

I acknowledge with respect our Elders past, present and those of the future. All traditional custodians, our lore, our culture, and the land, water and air, where I live, work and travel.

Copyright statement for Gumaraa Aboriginal Experience Pty Ltd

Gumaraa Aboriginal Experience Pty Ltd ('Gumaraa' or 'we' or 'us' or 'our') hereby reserve all rights and privilege in relation to the program, material and contents of the these documents and artworks in part or in whole ('our material')

No part of our material may be reproduced in part or in whole without the prior written express consent from the copyright holders Gumaraa Aboriginal Experience Pty Ltd

All and any rights, ownership and opportunity to our material is hereby reserved and for our sole benefit including but not limited to all rights it holds in relation to and she went to the copyright act 1968 (CTH).

We do not accept any responsibility what so ever for any damage, directly or indirectly, all lose of freelance materials submitted for reproduction in relation to this material or artwork. The information contained in our material are true and correct to the best of our knowledge and beliefs, all recommendations are made without any guarantee on the part of Gumaraa.

From: admin@ilalc.org.au on behalf of [Heritage Services](#)
To: [Stella Quast](#)
Cc: [Paul Knight](#)
Subject: Re: Stella Quast shared "6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview" with you.
Date: Wednesday, 20 October 2021 12:20:41 PM
Attachments: [image003.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)

Hi Stella,

Thank you, confirming receipt of the condensed report without a problem.

Kind regards,

Donna Hiscox
Illawarra Local Aboriginal Land Council
3 Ellen Street, Wollongong 2500
Telephone: 4226 3338



On Mon, 18 Oct 2021 at 16:58, Stella Quast <squast@niche-eh.com> wrote:

Hi Donna,

My apologies, thank you for letting me know – I have now marked this in our system so that we don't keep sending you links!

Please find attached a condensed version of the report file (the contents are the same as the original larger-sized file). If this does not work, I can drop off a USB with the report file on it at the ILALC office tomorrow.

Kind regards,

Stella

Stella Quast BA (Hons)
Heritage Consultant
0458 000 903
NSW Head Office – Sydney
PO Box 2443 North Parramatta NSW 1750



Excellence in your environment

NSW Head Office – Sydney
L4/460 Church Street
Parramatta NSW 2150
02 9630 5658

niche-eh.com

From: admin@ilalc.org.au <admin@ilalc.org.au> **On Behalf Of** Heritage Services
Sent: Monday, 18 October 2021 2:31 PM
To: Stella Quast <squast@niche-eh.com>
Cc: Paul Knight <paul.knight@ilalc.org.au>
Subject: Re: Stella Quast shared "6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview" with you.

Good afternoon Stella,

Thank you for your email.

ILALC cannot open these type of shared files Niche sends, no code is received once the 'heritage' email is entered.

Can you send the report to the shared 'google drive' folder link Paul provided you with previously please.

Kind regards,

Donna Hiscox

Illawarra Local Aboriginal Land Council

3 Ellen Street, Wollongong 2500

Telephone: 4226 3338

On Fri, 15 Oct 2021 at 17:09, Stella Quast <squast@niche-eh.com> wrote:



Stella Quast shared a file with you

To whom it may concern,


Niche Environment & Heritage have been commissioned by South 32-IMC to prepare a draft Aboriginal Cultural Heritage Management Plan (ACHMP) for Aboriginal cultural heritage sites that may be impacted by the proposed extraction of Longwalls 21, 22 and 23 within Dendrobium Mine.

If you have any comments, suggestions or queries regarding this draft, please contact Niche by 5pm on Friday 29 October 2021.

Kind regards,
Stella Quast



6261_South32_LW21-23_ACHMP_F2_20211015_RAPreview

 This link only works for the direct recipients of this message.

[Open](#)



[Privacy Statement](#)



Illawarra Local Aboriginal Land Council

3 Ellen Street,

Wollongong NSW 2500

Ph: 4226 3338

Fax: 4226 3360

I acknowledge the traditional owners and custodians of the land I work on as the first people of this country.

The information in this e-mail is confidential and may be legally privileged. It is intended solely for the addressee. Access to this e-mail by anyone else is unauthorised.

If you have received this communication in error, please notify us immediately by return e-mail with the subject heading "Received in error" or telephone 02 4226 3338, then delete the email and destroy any copies of it. If you are not the intended recipient, any disclosure, copying, distribution or any action taken or omitted to be taken in reliance on it, is prohibited and may be unlawful.

Opinions, conclusions and other information in this e-mail and any attachments that do not relate to the official business of the ILALC are neither given nor endorsed by it. Views expressed in this message are those of the individual sender and are not necessarily the views of Illawarra Local Aboriginal Land Council. This email may be made available to third parties in accordance with the Government Information (Public Access) Act 2009.

ILALC cannot guarantee that e-mail communications are secure or error-free, as information could be intercepted, corrupted, amended, lost, destroyed, arrive late or incomplete, or contain viruses.

Illawarra Local Aboriginal Land Council

3 Ellen Street,

Wollongong NSW 2500

Ph: 4226 3338

Fax: 4226 3360

I acknowledge the traditional owners and custodians of the land I work on as the first people of this country.

The information in this e-mail is confidential and may be legally privileged. It is intended solely for the addressee. Access to this e-mail by anyone else is unauthorised.

If you have received this communication in error, please notify us immediately by return e-mail with the subject heading "Received in error" or telephone 02 4226 3338, then delete the email and destroy any copies of it. If you are not the intended recipient, any disclosure, copying, distribution or any action taken or omitted to be taken in reliance on it, is prohibited and may be unlawful.

Annex 3: Geotechnical Risk Assessment Report (Excerpt)

ILLAWARRA METALLURGICAL COAL:

Dendrobium – Longwalls 22 and 23

Subsidence Predictions and Impact Assessments for the Natural and Built Features due to the Extraction of the Proposed Longwalls 22 and 23 in Area 3C at Dendrobium Mine

DOCUMENT REGISTER

Revision	Description	Author	Checker	Date
01	Draft issue	JB	-	12 Oct 20
02	Draft issue	JB	-	10 Mar 21
03	Draft issue	JB	-	17 Mar 21
A	Final issue	JB	KK	31 Mar 21
B	Final issue	JB	KK	22 Jun 21

Report produced to: Support the Subsidence Management Plan Application for the proposed Longwalls 22 and 23 at Dendrobium Mine to be issued to the Department of Planning and Environment.

Previous reports: WKA77 (January 2001) – Dendrobium Mine Project – Report on the Prediction of Mining Subsidence Parameters and the Assessment of Impacts on Surface Infrastructure – Longwalls 1 to 18 (In support of the EIS).

MSEC311 (Rev. D) – The Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure Resulting from the Extraction of Proposed Longwalls 6 to 10 in Area 3A and Future Longwalls in Areas 3B and 3C at Dendrobium Mine (October 2007).

MSEC459 (Rev. B) – Subsidence Predictions and Impact Assessments for Natural Features and Surface Infrastructure in Support of the SMP Application (September 2012).

MSEC865 (Rev. C) – Review of the Subsidence Predictions and Impact Assessments for Natural and Built Features in Dendrobium Area 3B based on Observed Movements and Impacts during Longwalls 9 and 10 (December 2015).

MSEC978 (Rev. E) – Subsidence Predictions and Impact Assessments for the Natural and Built Features due to the Extraction of the Proposed Longwalls 20 and 21 in Area 3C at Dendrobium Mine (August 2019)

Background reports available at www.minesubsidence.com¹:

Introduction to Longwall Mining and Subsidence (Revision A)
General Discussion of Mine Subsidence Ground Movements (Revision A)
Mine Subsidence Damage to Building Structures (Revision A)

¹ Direct link: http://www.minesubsidence.com/index_files/page0004.htm

6.4.3. Previous experience of mining near the reservoirs

The longwalls at Dendrobium Mine have been extracted near the Upper Cordeaux No. 2 reservoir. The dam wall is located approximately 1.5 km from LW1 in Area 1 and approximately 0.9 km from LW3 in Area 2 at the mine.

The mine subsidence effects at the Upper Cordeaux No. 2 reservoir were measured by the, then, Sydney Catchment Authority (SCA) using 3D survey marks located on and around the dam wall. The latest available survey, Survey No. 9a, was carried out in April 2010, during the extraction of LW6 in Area 2. The results of this survey were provided in the monitoring report by SCA (2010).

The maximum measured movements at the Upper Cordeaux No. 2 dam wall were ± 1 mm vertical, +3 mm horizontal in the downstream direction and ± 1 mm in the east and west directions. The SCA monitoring report states that:

“The centre of the dam crest is at its maximum downstream position near July of each year and maximum upstream position near January of each year. This change is very probably caused by the overall change in dam wall temperature as well as the change in the temperature gradient across the dam wall section. The water storage level has remained within 0.1m of FSL since April 2005 and so has no significant effect on deflection. Towards the right bank the movement on the crest is generally smaller and more complex due to the reduced height and the changing curvature of the dam wall. The several cracks in this section of the dam wall may also be influencing how the dam wall moves as it expands and contracts. The fact that both ground and dam wall are vertically stable reduces the likelihood that mining is a factor in the measured horizontal movement.”

The detailed ground monitoring data indicated that the measured movements were very small and were within the order of survey tolerance. That is, the mining-induced movements at the Upper Cordeaux No. 2 dam wall were not measurable above seasonal variations.

6.4.4. Impact assessments for the reservoirs

The Cordeaux Reservoir could experience low-level net opening or net closure movements in the order of ± 25 mm to ± 35 mm due to the mining of the proposed longwalls. The strains associated with the net movements are expected to be less than ± 0.5 mm/m.

Fracturing has been observed up to approximately 400 m outside of previously extracted longwalls in the Southern Coalfield. The furthest reported fracture outside of the previously extracted longwalls at the Mine was located approximately 290 m south of LW12 in Area 3B.

It is possible that fracturing could occur in the bedrock beneath the Cordeaux Reservoir where it is located within approximately 400 m of the proposed longwalls. However, it is unlikely that fracturing would be visible in the bed of the reservoir due to the alluvial deposits. An assessment of the surface water storage is provided in the report by HGeo (2021).

The Cordeaux Dam Wall and Upper Cordeaux No. 1 and No. 2 Dam Walls could experience very low levels of far-field horizontal movements of less than 20 mm. The potential for impacts on the dam walls does not result from the absolute far-field horizontal movement but from differential horizontal movements. The differential horizontal movements (i.e. opening or closure) over the lengths of the dam walls are not expected to be measurable. Adverse impacts on the dam walls are not anticipated due to the mining of the proposed LW22 and LW23.

The Avon Dam wall is located more than 8 km west of the proposed longwalls. At this distance, the dam wall is unlikely to experience measurable movements and, therefore, it is not expected to experience adverse impacts.

6.4.5. Recommendations for the reservoirs

It is recommended that IMC consult with WaterNSW and the DS NSW to develop the appropriate monitoring and management strategies for the reservoirs and dam walls.

6.5. Aboriginal heritage sites

6.5.1. Descriptions of the Aboriginal heritage sites

The locations of the Aboriginal heritage sites are shown in Drawing No. MSEC1104-11. The details of the heritage sites have been provided by Niche (2021b).

There are three Aboriginal heritage sites (Refs. 52-2-1632, 52-2-2219 and 52-2-4499) that have been identified within or adjacent to the Study Area based on the 35° angle of draw. There are eight additional Aboriginal heritage sites (Refs. 52-2-0019, 52-2-0535, 52-2-1633, 52-2-1634, 52-5-0275, 52-5-0276, 52-2-4656 and 52-2-4657) that are located within or adjacent to the Study Area based on the 600 m boundary. Some of these sites could experience far-field or valley-related effects and could be sensitive to these movements and, therefore, they have been included in the assessments.

A summary of the Aboriginal heritage sites identified within the Study Area based on the 600 m boundary is provided in Table 6.9.

Table 6.9 Aboriginal heritage sites identified within the Study Area

Reference	Type	Location relative to the longwalls
52-2-0019	Shelter with Art and Deposit	375 m north of LW23
52-2-0535	Stone Arrangement	335 m north of LW23
52-2-1632	Shelter with Art	230 m north-west of LW23
52-2-1633	Shelter with Art	360 m north-west of LW23
52-2-1634	Shelter with Art	335 m north-west of LW23
52-2-2219	Shelter with Art	Directly above LW22
52-2-4499	Isolated Artefact	270 m north of LW23
52-5-0275	Shelter with Art	300 m south of LW22
52-5-0276	Shelter with Art and Deposit	610 m south of LW22
52-2-4656	Shelter with Art	420 m north of LW23
52-2-4657	Shelter with Deposit	320 m west of LW23

The Aboriginal heritage sites within the Study Area comprise six Shelters with Art, one Shelter with Deposit, two Shelters with Art and Deposits, one Stone Arrangement and one Isolated Artefact. Site Ref. 52-2-2219 is located directly above the proposed LW22. The remaining sites are located outside the proposed mining area at distances ranging between 230 m and 610 m.

Further details on the Aboriginal cultural heritage sites are provided in the report by Niche (2021b).

6.5.2. Predictions for the Aboriginal heritage sites

A summary of the maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites within the Study Area is provided in Table 6.10. The values are the maximum predicted subsidence effects within 20 m of each of the sites due to the mining of the existing, approved and proposed longwalls.

Table 6.10 Maximum predicted total vertical subsidence, tilt and curvatures for the Aboriginal heritage sites within the Study Area

Reference	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km ⁻¹)	Maximum predicted total sagging curvature (km ⁻¹)
52-2-0019	< 20	< 0.5	< 0.01	< 0.01
52-2-0535	< 20	< 0.5	< 0.01	< 0.01
52-2-1632	< 20	< 0.5	< 0.01	< 0.01
52-2-1633	< 20	< 0.5	< 0.01	< 0.01
52-2-1634	< 20	< 0.5	< 0.01	< 0.01
52-2-2219	1400	10	0.30	0.08
52-2-4499	< 20	< 0.5	< 0.01	< 0.01
52-5-0275	< 20	< 0.5	< 0.01	< 0.01
52-5-0276	< 20	< 0.5	< 0.01	< 0.01
52-2-4656	< 20	< 0.5	< 0.01	< 0.01
52-2-4657	< 20	< 0.5	< 0.01	< 0.01

Site 52-2-2219 is located directly above the proposed LW22. The maximum predicted conventional strains for this site, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 4.5 mm/m tensile and 1.0 mm/m compressive. The distribution of the predicted strains due to the extraction of the longwalls is described in Section 4.4. The maximum predicted strains directly above the mining area are 8 mm/m tensile and compressive based on the 95 % confidence levels.

The remaining Aboriginal heritage sites within the Study Area are located well outside the proposed mining area and they are predicted to experience less than 20 mm vertical subsidence. While these sites could experience very low levels of vertical subsidence, they are not predicted to experience measurable tilts, curvatures or strains.

Site 52-2-1634 is located along a tributary to Wongawilli Creek (ref. WC28) and therefore it could experience valley-related effects. The predicted valley-related effects for this site after the mining of LW22 and LW23 are 60 mm upsidence and 125 mm closure. The remaining sites within the Study Area are located on the sides or near the tops of ridgelines and, therefore, they are not expected to experience valley-related effects.

6.5.3. Impact assessments for the Aboriginal heritage sites

Site 52-2-2219 is located directly above the proposed LW22. The rock shelter has formed by blockfall and it is approximately 10.8 m long, 3 m deep and 2.3 m high (NPWS, 2002). The extraction of LW22 is likely to result in fracturing of the exposed bedrock along the ridgeline and, where the rock is marginally stable, it could then result in rockfalls or instabilities. The fracturing and rockfalls could therefore adversely impact this rock shelter.

It is extremely difficult to assess the likelihood of impacts on the rock shelters based upon predicted ground movements. The likelihood of a rockfall or instability is dependent on many factors that are difficult to fully quantify. Some of these factors include jointing, inclusions, weaknesses within the rockmass, groundwater pressure and seepage flow behind the rockface. Even if these factors could be determined, it would still be difficult to quantify the extent to which these factors may influence the stability of the rock shelter naturally or when it is exposed to mine subsidence movements.

It has been assessed that between 7 % and 10 % of the total length, or between 3 % and 5 % of the total face area, of the cliffs located directly or partially above the mining area would be impacted by the extraction of the proposed longwalls. It has also been assessed that between 3 % and 5 % of the total length of the minor cliffs and rock outcrops located directly or partially above the mining area would experience adverse impacts.

Fracturing resulting in spalling or rockfalls could occur at Site 52-2-2219. The potential for adverse impacts at this site has been assessed as *unlikely* (i.e. less than 10 %).

Site 52-2-1634 is located 335 m north-west of the proposed LW23. The rock shelter is located under a waterfall on a side tributary, formed by chemical weathering and exfoliation, and it is approximately 18 m long, 8.2 m deep and 4 m high (NPWS, 1991).

Fracturing has been observed in the Southern Coalfield at distances up to approximately 400 m outside the mining area. It is possible, but unlikely, that fracturing could occur along the tributary near Site 52-2-1634. The potential for adverse impacts at this site has been assessed as *rare* (i.e. less than 5 %).

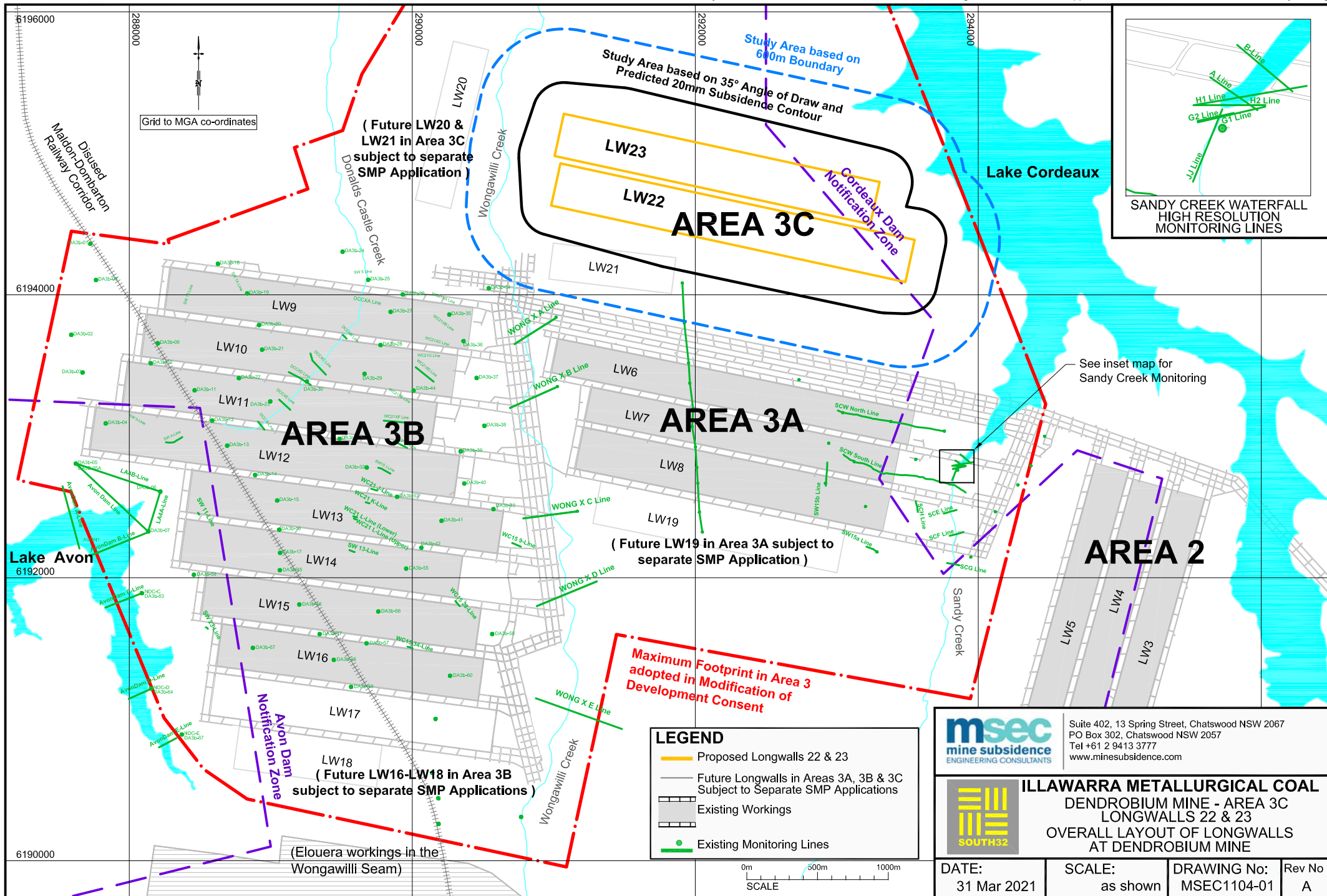
The remaining Aboriginal heritage sites are predicted to experience less than 20 mm vertical subsidence and are not expected to experience valley-related effects. Adverse impacts on these sites therefore are not anticipated due to the mining of LW22 and LW23.

Further discussions on the potential impacts on the Aboriginal heritage sites within the Study Area are provided in the report by Niche (2021b).

6.5.4. Recommendations for the Aboriginal heritage sites

It is recommended that IMC develop an Aboriginal Heritage Management Plan in consultation with the registered parties for the Aboriginal heritage sites.

APPENDIX D. DRAWINGS



Grid to MGA co-ordinates

(Future LW20 & LW21 in Area 3C subject to separate SMP Application)

LW23

LW22

AREA 3C

LW21

AREA 3B

AREA 3A

(Future LW19 in Area 3A subject to separate SMP Application)

AREA 2

Lake Avon
6192000

Lake Cordeaux

SANDY CREEK WATERFALL
HIGH RESOLUTION
MONITORING LINES

See inset map for
Sandy Creek Monitoring

Maximum Footprint in Area 3
adopted in Modification of
Development Consent

(Future LW16-LW18 in Area 3B subject to separate SMP Applications)

(Elouera workings in the
Wongawilli Seam)

LEGEND

- Proposed Longwalls 22 & 23
- Future Longwalls in Areas 3A, 3B & 3C Subject to Separate SMP Applications
- Existing Workings
- Existing Monitoring Lines



Suite 402, 13 Spring Street, Chatswood NSW 2067
PO Box 302, Chatswood NSW 2057
Tel +61 2 9413 3777
www.minesubsidence.com



ILLAWARRA METALLURGICAL COAL
DENDROBIUM MINE - AREA 3C
LONGWALLS 22 & 23
OVERALL LAYOUT OF LONGWALLS
AT DENDROBIUM MINE

DATE:
31 Mar 2021

SCALE:
as shown

DRAWING No:
MSEC1104-01

Rev No
A

0m 500m 1000m
SCALE

This information has been redacted
For more information please contact GM3.

Contact Us

Niche Environment and Heritage

02 9630 5658
info@niche-eh.com

NSW Head Office – Sydney
PO Box 2443 North Parramatta
NSW 1750 Australia

QLD Head Office – Brisbane
PO Box 540 Sandgate
QLD 4017 Australia

Sydney
Brisbane
Cairns
Port Macquarie
Illawarra
Coffs Harbour
Central Coast
Gold Coast
Canberra

Our services

Ecology and biodiversity

Terrestrial
Freshwater
Marine and coastal
Research and monitoring
Wildlife Schools and training

Heritage management

Aboriginal heritage
Historical heritage
Conservation management
Community consultation
Archaeological, built and landscape values

Environmental management and approvals

Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting

Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management

