



APPENDIX F

Aboriginal Cultural Heritage Assessment



Aboriginal Cultural Heritage Assessment

Dendrobium Mine - Plan for the Future: Coal for Steelmaking

Nearest Town:
Local Government Areas:

Wilton, Wollongong
Wollongong, Wingecarribee and
Wollondilly

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Executive Summary

This report presents the findings of an Aboriginal Cultural Heritage Assessment for the Dendrobium Mine - Plan for the Future: Coal for Steelmaking (the Project) proposed by Illawarra Coal Holdings Pty Ltd (Illawarra Coal). The Project is a proposed extension of the underground mining operations at the Dendrobium Mine in two areas (Area 5 and Area 6) within Consolidated Coal Lease (CCL) 768. Extension of the underground mining operations would be supported by existing infrastructure and the development of additional surface infrastructure, including ventilation shafts.

Illawarra Coal is seeking Development Consent for the Project under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (State Significant Development).

Niche Environment and Heritage Pty Ltd was commissioned by Illawarra Coal to produce an Aboriginal Cultural Heritage Assessment report in accordance with the NSW Department of Planning and Environment Secretary's Environmental Assessment Requirements and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation [DEC] 2005a);
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRs) (NSW Department of Environment, Climate Change and Water [DECCW] 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010c);
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS] 2013);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council 2010);
- *Engage Early* (Commonwealth Government 2016); and
- *NSW National Parks and Wildlife Regulation, 2009* (NPW Regulation).

A total of 17 separate Aboriginal stakeholders (including groups and individuals) have registered an interest in the Project's Aboriginal Cultural Heritage Assessment. Consultation with all of these parties has been ongoing through the development of this cultural heritage assessment report.

In addition to comprehensive surveys of the Subject Area and additional meetings with the Aboriginal community, the Aboriginal Cultural Heritage Assessment included a review of previous surveys and assessments from within the Subject Area and surrounds.

A total of 58 Aboriginal heritage sites were identified within the Subject Area, including six newly recorded sites and 52 previously recorded sites. The locations of eight sites identified on the Aboriginal Heritage Information Management System's (AHIMS) could not be confirmed during the assessment. All 58 sites are located within the proposed Dendrobium Area 5 and Area 6 underground mining investigation areas, with one site located in close proximity to a proposed ventilation shaft investigation area. No sites were identified within the proposed Dendrobium Pit Top carpark extension area. The majority of sites (49 of 58) have low scientific significance. There were three sites of moderate significance and a further six of high significance. The eight sites that were not relocated were attributed a low archaeological significance based on the information provided in their AHIMS site cards. The Registered Aboriginal Parties (RAPs) have advised that all sites have cultural significance.

All sites (58) may be subject to some subsidence impacts from the Project. One of these sites - an axe grinding groove site (Dendrobium ACHA AGG-1) - is located in close proximity to the proposed Ventilation Shaft Site No. 5B location, however would not be directly impacted.

Detailed avoidance, mitigation and management measures have been developed to reduce potential impacts on Aboriginal heritage.

Table of Contents

Executive Summary.....	ii
Table of Contents.....	iv
1. Introduction	1
1.1 Scope and Objectives.....	1
2. Site Location and Investigation Area	3
3. Description of the Development Proposal	4
3.1 Proposed Activities	4
3.2 Project Phasing	4
4. Aboriginal Community Consultation Process	5
4.1 Stage 1 – Notifications and Registration	7
4.2 Stages 2 and 3 – Presentation of Project Information and Gathering Information about Cultural Significance	8
4.3 Stage 4 – Review of First Draft Report	14
5. Investigators and Contributors.....	20
5.1 Research and Reporting	20
5.2 Fieldwork	20
6. Landscape Context.....	21
6.1 Overview.....	21
6.2 Geology.....	21
6.3 Colluvial Soil Landscapes	21
6.4 Residual Soil Landscapes	22
6.5 Disturbance and Modification	23
6.6 Summary.....	24
7. Aboriginal Archaeological Context.....	25
7.1 Ethnography and History.....	25
7.2 Heritage Register Searches.....	26
7.3 Local Archaeological Investigations.....	27
7.4 Regional Archaeological Studies.....	30
7.5 Synthesis and Predictive Model	30
8. Survey Methodology.....	32
8.1 Sampling Strategy.....	32
8.2 Survey Methods.....	32
9. Aboriginal Heritage Survey Results.....	33

9.1	Cultural Heritage Survey.....	33
9.2	Survey Coverage	33
9.3	Survey Results.....	34
10.	Analysis and Discussion	47
10.1	Site Distribution, Terrain Landform Type and Land Elements.....	47
10.2	Artefact Sites	47
10.3	Axe Grinding Groove Sites	47
10.4	Sandstone Shelter Sites	48
10.5	Summary.....	48
11.	Cultural Heritage Values and Significance Assessment	50
11.1	The Burra Charter	50
11.2	Scientific (Archaeological) Significance Assessment of Aboriginal Heritage Sites	50
11.3	Cultural Significance Assessment of Aboriginal Heritage Sites	62
11.4	Statement of Significance	63
12.	Impact Assessment	65
12.1	Overview of Potential Impacts	65
12.2	Potential Impacts from Surface Disturbance.....	65
12.3	Potential Impacts from Subsidence.....	67
12.4	Summary of Potential Impacts	72
12.5	Potential Cumulative Impacts.....	78
13.	Management and Mitigation Measures.....	85
13.1	Conservation Principles and Management Framework	85
14.	Recommendations.....	87
	Glossary.....	89
	References.....	91
	Appendix 1: Aboriginal Community Consultation	105
	Appendix 2: Aboriginal Community Consultation Log	105
	Appendix 3: Dendrobium Mine - Coal for Steelmaking: Plan for the Future - Aboriginal Cultural Heritage Assessment: Proposed Methodology	268
	Appendix 4: Information Session Attendance Records.....	289
	Appendix 5: Aboriginal Heritage Site Information	291
	Appendix 6: Supporting Figures	603
	Appendix 7: AHIMS Results	616
	Appendix 8: MSEC Subsidence Assessment Extract.....	625

List of Figures and Diagrams

Figure 1: Regional Project Location (Source: Illawarra Coal and Niche)	604
Figure 2: Project Layout - Underground Investigation Dendrobium Area 5 and Area 6 (Source: Illawarra Coal and Niche)	605
Figure 3: Project Layout - Proposed Ventilation Shaft Locations (Source: Illawarra Coal and Niche)	606
Figure 4: Project Layout - Proposed Dendrobium Pit Top Carpark Extension (Source: Illawarra Coal and Niche)	607
Figure 5: Topography and Hydrology within the Subject Area (Source: DTDB Copyright LPI 2016 [hydrology] DECCW 2009 and Niche)	608
Figure 6: Soil Landscapes within the Subject Area (Source: LPI 2016, DECCW 2009 and Niche)	609
Figure 7: Aboriginal Heritage Information Management System Site Records within Close Proximity to Dendrobium Area 5 and Area 6 (Source: OEH 2017 and Niche)	610
Figure 8: Aboriginal Heritage Information Management System Site Records within close proximity to the Dendrobium Pit Top Carpark (Source: OEH and Niche)	611
Figure 9: Sampling Strategy- Landform Categories (Source: Niche)	612
Figure 10: Sampling Strategy- Slope Categories (Source: Niche)	613
Figure 11: Survey Coverage (Source: Niche)	614
Figure 12: Confirmed Aboriginal Heritage Information Management System Records (Source: Niche)	615
Figure 13: Newly Recorded Aboriginal Cultural Heritage Sites (Source: Niche and OEH)	617

List of Tables

Table 1: Summary of Registered Aboriginal Parties for the Project	8
Table 2: Questions raised by RAPS in regards to the Proposed Methodology	9
Table 3: Aboriginal Cultural Heritage Survey Attendance	11
Table 4: Verbal comment made by RAPs in regards to the first draft ACHA	14
Table 5: Written comment made by RAPs in regards to the draft ACHA	17
Table 6: Aboriginal cultural heritage surveys and assessment – other participants or support personnel....	20
Table 7: Summary of Aboriginal site features within the AHIMS Dataset	27
Table 8: Summary of Archaeological Assessments within and within close proximity to the Subject Area...	28
Table 9: Survey coverage across Subject Area by slope and landform category	34
Table 10: Summary of Aboriginal Sites Located within the Subject Area	34

Table 11: Grinding Groove Sites within the Subject Area	36
Table 12: Summary of Rock Shelter Site within the Subject Area	41
Table 13: Artefact Sites within the Subject Area	46
Table 14: Definition of Heritage Values of the Burra Charter (Australia ICOMOS 2013)	50
Table 15: Criteria for Assessing Scientific Significance	51
Table 16: Scientific Significance Assessment – Individual Sites	53
Table 17: Grades of values and significance	62
Table 18: Summary of Scientific Significance Ratings for Aboriginal Sites in the Surface and Underground Investigation Areas	64
Table 19: Subsidence Predictions for Artefact Scatters and Isolated Finds within the Subject Area	69
Table 20: Subsidence Predictions for the Rock Shelters within the Subject Area	70
Table 21: Subsidence Predictions for Grinding Groove Sites within the Subject Area	72
Table 22: Summary of Potential Impacts of the Project on Aboriginal Heritage Sites and Summary of Potential Harm	73
Table 23: Aboriginal cultural heritage site types monitored within the Southern Coalfields	80
Table 24: Aboriginal sites within the Southern Coalfields observed to have subsidence related changes, during monitoring programs	81

List of Plates

Plate 1: Example of the Hawkesbury landscape	22
Plate 2: Example of a Rock Shelter in the Hawkesbury landscape	22
Plate 3: Example of the Lucas Heights landscape within the Subject Area	23
Plate 4: A Notable Grinding Groove Site – East Cordeaux 34 (AHIMS ID #52-2-1453)	40
Plate 5: A Typical grinding groove at Dendrobium ACHA AGG-2	40

1. Introduction

This report presents an Aboriginal Cultural Heritage Assessment (ACHA) of the Dendrobium Mine - Plan for the Future: Coal for Steelmaking (the Project) proposed by Illawarra Coal Holdings Pty Ltd (Illawarra Coal). The Dendrobium Mine is an existing underground coal mine located in the Southern Coalfield of New South Wales (NSW), approximately 8 kilometres (km) west of Wollongong (Figure 1). The Project seeks to gain access to two new underground mining areas (Area 5 and Area 6) (here on referred to as the 'underground investigation areas'). Extension of the underground mining operations would be supported by existing infrastructure and the development of additional surface infrastructure, and an extension to the approved surface operations. The proposed extensions to the underground extraction area are situated within Consolidated Coal Lease (CCL) 768.

Development Consent for the Project will be sought under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (State Significant Development).

The Secretary's Environmental Assessment Requirements (SEARs) for State Significant Development were issued for the Project on 6 February 2017. With regard to Aboriginal heritage for the Project Environmental Impact Statement (EIS), the SEARs state the following:

The EIS must address the following specific issues:

- **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to OEH's requirements (Attachment 2).

The NSW Office of Environment and Heritage (OEH) requirements concerning Aboriginal heritage are as follows:

A comprehensive program of archaeological survey and Aboriginal community consultation is required so that the impact of the proposed expansion on Aboriginal cultural heritage can be properly assessed. An Aboriginal Cultural Heritage Management Plan (ACHMP) should be prepared for the proposed Areas 5 and 6 expansion.

1.1 Scope and Objectives

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Illawarra Coal to produce an ACHA in accordance with SEARs and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation [DEC] 2005a);
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (ACHCRs) (NSW Department of Environment, Climate Change and Water [DECCW] 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010c);
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011)

- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS] 2013);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council 2010);
- *Engage Early* (Commonwealth Government 2016); and
- *NSW National Parks and Wildlife Regulation, 2009* (NPW Regulation).

The objectives of this report, in consideration of the SEARs and the requirements of the above guidelines and regulations, are as follows:

- Identify and describe Aboriginal objects located within the area of the Project.
- Identify and describe the sensitivity (in relation to cultural heritage) of different landforms present in the landscape affected by the Project.
- Identify and describe the cultural heritage values, including the significance of the Aboriginal objects that exist across the whole area that will be affected by the Project, and the significance of these values for the Aboriginal people who have a cultural association with the land.
- Describe how the requirements for consultation with Aboriginal people as specified in Clause 80C of the NPW Regulation have been met.
- Present the views of those Aboriginal people regarding the likely impact of the Project on their cultural heritage, including a copy of any submissions received and a response as necessary.
- Identify and describe the actual or likely harm posed to Aboriginal objects or declared Aboriginal places from the Project with references to the cultural heritage values identified.
- Provide a description of any practical measures that may be taken to protect and conserve those Aboriginal objects.
- Provide a description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm, or if this is not possible, to manage (minimise) the harm.
- Provide documentation of discussions with the Aboriginal stakeholders regarding commitments from the proponent related to social, economic and/or conservation gains to offset any loss of cultural heritage.

This report will form part of an EIS which will be assessed and determined in accordance with Division 4.7 of Part 4 of the EP&A Act.

2. Site Location and Investigation Area

The Project is located in the Southern Coalfield of NSW, approximately 8 km west of Wollongong (Figure 1). The Subject Area is within the Local Government Areas of Wollongong, Wingecarribee and Wollondilly. The existing and proposed future underground mining areas (Areas 5 and 6) are located within the catchments of the Avon and Cordeaux Rivers, which are within the WaterNSW Metropolitan Special Area. Area 5 is just to the east of the Avon River, with an area of approximately 2958 hectares (ha) potentially subject to subsidence effects associated with mining of the Bulli Seam. Area 6 is located to the northeast of the Cordeaux River, with an area of approximately 1075 ha potentially subject to subsidence effects associated with mining of the Wongawilli Seam. In addition to those areas associated with potential subsidence impacts, there are four ventilation shaft locations considered during this assessment, including the following:

- Ventilation Shaft Site No. 5B (study area approximately 5.5 ha).
- Ventilation Shaft Site No. 6A (study area approximately 11.0 ha).
- Ventilation Shaft Site No. 5A (study area approximately 23.9 ha).
- Ventilation Shaft Site No. 6B (study area approximately 5.5 ha).

In addition, the proposed carpark at the Dendrobium Pit Top comprises approximately 5.5 ha potentially subject to disturbance. As such, this area was also considered during the assessment.

The Subject Area for this ACHA is an area centred over the extent of the proposed Project activities, and encompasses the relevant underground and surface infrastructure investigation areas.

For the purposes of this ACHA, the Subject Area has been divided into investigation areas (with relevant sub-investigation areas) as follows (Figure 2 to Figure 4):

- Underground Investigation Areas (consisting of whichever is the greater of the 20 millimetres [mm] subsidence boundary or the extent of proposed longwall mining) separated into geographically distinct areas as follows (Figure 2):
 - Dendrobium Area 5.
 - Dendrobium Area 6.
- Surface Infrastructure Investigation Area, which includes the four proposed ventilation shaft locations and the Dendrobium Pit Top carpark extension.

A detailed description of the Project is provided in Section 3.

3. Description of the Development Proposal

3.1 Proposed Activities

The main activities associated with the development of the Project would include (Figure 2 to Figure 4):

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- longwall mining of the Wongawilli Seam in a new underground mining area (Area 6);
- development of underground roadways within the Bulli Seam, Wongawilli Seam, and adjacent strata to access mining areas;
- use of existing roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to longwall mining of Areas 5 and 6;
- development of surface infrastructure associated with mine ventilation and gas management and abatement and other ancillary infrastructure;
- handling and processing of up to 5.2 million tonnes per annum of run-of-mine (ROM) coal;
- use of the Cordeaux Pit Top for mining support activities;
- augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top;
- development of surface infrastructure associated with mine ventilation and gas management and abatement and other ancillary infrastructure;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts with minor upgrades and extensions;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks or Port Kembla Coal Terminal for export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), other beneficial uses and/or for replacement at the West Cliff Stage 3 Coal Wash Emplacement;
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement;
- progressive developments of sumps, pumps, pipelines, water storages and other water management infrastructure;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated minor infrastructure, plant, equipment and activities.

This ACHA assesses the additional disturbance areas associated with the proposed activities of the Project that have the potential to harm Aboriginal heritage sites.

3.2 Project Phasing

The Project is proposed to commence as soon as practicable after all the necessary approvals have been obtained and any prerequisite conditions fulfilled.

4. Aboriginal Community Consultation Process

In administering its statutory functions under Part 6 of the NSW *National Parks and Wildlife Act 1974*, the OEH requires that proponents consult with Aboriginal people about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and/or places within any given development area; in accordance with Clause 80C of the NPW Regulation and the ACHCRs (DECCW 2010a). Although state significant development that is authorised by a development consent granted under Division 4.7 of Part 4 of the EP&A Act is exempt from requiring an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the NSW *National Parks and Wildlife Act 1974* and accordingly, from compliance with the consultation process in Clause 80C of the NPW Regulation, consultation with the Aboriginal community for this ACHA has nonetheless been undertaken in compliance with the requirements of these legislative instruments and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005);
- ACHCRs (DECCW 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010c);
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS 2013);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council 2010);
- *Engage Early* (Commonwealth Government 2016); and
- *NSW National Parks and Wildlife Regulation, 2009* (NPW Regulation).

The OEH maintains that the objective of consultation with Aboriginal communities about the cultural heritage values of Aboriginal objects and places is to ensure that Aboriginal people have the opportunity to improve ACHA outcomes by:

- providing relevant information about the cultural significance and values of Aboriginal objects and/or places;
- influencing the design of the method used to assess cultural and scientific significance of Aboriginal objects and/or places;
- actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal objects and/or places within the proposed Subject Area; and
- commenting on draft assessment reports before they are submitted by the proponent to the OEH.

To assist proponents through the required consultation process, the DECCW (2010a) has prepared a guidance document, namely the ACHCRs. Consultation in the form outlined in the ACHCRs is a formal requirement where a proponent is aware that their development activity has the potential to harm Aboriginal objects and/or places. The OEH also recommends that these requirements be used when the certainty of harm is not yet established but a proponent has, through some formal development mechanism, been required to undertake a cultural heritage assessment to establish the potential harm their proposal may have on Aboriginal objects and places.

Consultation for this Project has been undertaken in accordance with the ACHCRs as these meet the fundamental tenants of the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005), whilst also meeting current industry standards for community consultation.

The ACHCRs outline a four stage consultation process that includes detailed step by step guidance as to the aim of each stage, how it is to proceed and what actions are necessary for it to be successfully completed. The four stages are:

- Stage 1 – Notification of Project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed Project.
- Stage 3 – Gathering information about the cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The document also outlines the roles and responsibilities of the OEH, Aboriginal parties including Local and State Aboriginal Land Councils, and proponents throughout the consultation process. To meet the requirements of consultation it is expected that proponents will (DECCW 2010a):

- Bring the RAPs or their nominated representatives together and be responsible for ensuring appropriate administration and management of the consultation process.
- Consider the cultural perspectives, views, knowledge and advice of the RAPs involved in the consultation process in assessing cultural significance and developing any heritage management outcomes for Aboriginal objects and/or places.
- Provide evidence to the OEH of consultation by including information relevant to the cultural perspectives, views, knowledge and advice provided by the RAPs.
- Accurately record and clearly articulate all consultation findings in the final cultural heritage assessment report.
- Provide copies of the cultural heritage assessment report to the RAPs who have been consulted.

The consultation process undertaken for this Project to seek active involvement from relevant Aboriginal people followed the current NSW framework, namely, the ACHCRs and Clause 80C of the NPW Regulation. Section 1.3 of the ACHCRs describes the guiding principles of the document. The principles have been derived directly from the Australian Heritage Commission's *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission 2002). Both documents share the aim of creating a system where free prior informed advice can be sought from the Aboriginal community.

The following sections outline the process and results of the consultation conducted during the preparation of this ACHA to ascertain and manage the Aboriginal cultural heritage values of the Subject Area.

4.1 Stage 1 – Notifications and Registration

This stage of the consultation process is used to identify, notify and register any Aboriginal people or groups who may have a cultural interest in and/or possess cultural knowledge relevant to determining the cultural significance of Aboriginal objects or places within the Subject Area.

In accordance with Section 4.1.2 of the ACHCRs, Project notifications were sent on 3 January and 31 January 2017 to the following organisations:

- Greater Sydney Local Land Services;
- Illawarra Local Aboriginal Land Council;
- Native Title Services Corporation Limited (NTS Corp Limited);
- Office of the Registrar, *Aboriginal Land Rights Act 1983*;
- South East Local Land Services;
- Tharawal Local Aboriginal Land Council;
- Wollongong City Council;
- Wollongong Regional Operations Group, OEH;
- Wollondilly Shire Council;
- Wingecaribbee Shire Council; and
- National Native Title Tribunal (NNTT).

Responses to the Project notifications were received from the following organisations:

- NNTT (4 January 2017);
- Tharawal Local Aboriginal Land Council (12 January 2017);
- Office of the Registrar, *Aboriginal Land Rights Act 1983* (13 January 2017);
- Wollondilly Shire Council (16 January 2017);
- Wingecaribbee Shire Council (17 January 2017); and
- Wollongong Regional Operations Group, OEH (18 January 2017).

As a result of the responses received, a total of 75 individuals and organisations were identified as potential knowledge holders for the Subject Area. A full record of all correspondence received from and sent to the Aboriginal community and the abovementioned organisations is contained in Appendix 2, while copies of all relevant correspondence is provided in Appendix 1.

The NNTT advised that there is no Native Title Claim covering the Subject Area. No Indigenous Land Use Agreements exist within the Subject Area. Since this initial request a Native Title Claim was made by the South Coast People (NC2017/003). This request was registered with the tribunal on the 31 January 2018. As this occurred outside of the current consultation process the South Coast People Claimants were not included in this assessment.

The Office of the Registrar, *Aboriginal Land Rights Act 1983* advised that there were no Aboriginal owners pursuant to Division 3 of the *NSW Aboriginal Land Rights Act 1983*.

In accordance with Sections 4.1 and 4.2 of the consultation requirements outlined in the ACHCRs, all 75 individuals and organisations identified through the above correspondence were contacted in writing on 18 January and 8 February 2017, and were invited to register an interest in the Project. Advertisements

inviting the registration of Aboriginal persons or groups who hold cultural knowledge relevant to, or who have a right or interest in, determining the cultural heritage significance of Aboriginal object(s) and/or place(s) in the Subject Area were published in the following newspapers (Appendix 1):

- *Illawarra Mercury* (17 January 2017);
- *Macarthur Advertiser* (18 January 2017);
- *Illawarra Mercury* (8 February 2017); and
- *Macarthur Advertiser* (8 February 2017).

Individuals and organisations were contacted twice, and newspaper advertisements were published in both newspapers a second time, in order to further clarify the surface infrastructure requirements of the Project.

As a result of the above consultation 17 individuals and organisations were registered as RAPs to the Project during the registration period (17 January – 22 February 2017). A copy of the list of the 17 RAPs, along with a copy of the written notifications and advertisements, were provided to the Illawarra Regional OEH Environment Protection and Regulation Group Office, Illawarra Local Aboriginal Land Council (ILALC) and Tharawal Local Aboriginal Land Council (TLALC) on 22 February 2017, in accordance with Section 4.1.6 of the ACHCRs. A list of RAPs is provided in Table 1.

Table 1: Summary of Registered Aboriginal Parties for the Project

Registered Aboriginal Parties (registered during the registration period 17 January - 22 February 2017)		
Name	Name	Name
Bellambi Indigenous Corporation Gandangara Traditional Owners	Gulaga	Peter Falk Consultancy
Biamanga (Murrin Clan/Peoples)	Illawarra Local Aboriginal Land Council	Tharawal Local Aboriginal Land Council
Cubbitch Barta Native Title Claimants	Kamilaroi Yankuntjatjaka Working Group	Warra Bingi Nunda Gurri
Cullendulla (Murrin clan/Peoples)	Kawul Cultural Services	Woronora Plateau Gundungara Elders Council
Didge Ngunawal Clan	Montaga	Wurrumay Consultants
Goobah Development PTY LTD (Murrin Clan/People)	Murramarang (Murrin Clan/Peoples)	

A consultation log detailing all Aboriginal community consultation undertaken for the Project is provided in Appendix 2. A copy of relevant written correspondence sent and received is provided in Appendix 1.

4.2 Stages 2 and 3 – Presentation of Project Information and Gathering Information about Cultural Significance

4.2.1 Proposed Methodology and Information Session

Information regarding the Project, as well as an invitation to attend an information session, a copy of the Proposed Methodology (Appendix 3) for review and comment, request for valid insurances and questionnaire to assist with field team selection was provided to the RAPs on 6 February 2017, in accordance with the ACHCRs (DECCW 2010a). A minimum of 28 days was allowed for RAPs to provide input in regards to the following aspects:

- the nature of the Proposed Methodology;
- any Aboriginal objects or places of cultural value within the Subject Area, or issues of cultural significance;

- any restrictions or protocols considered necessary in relation to any information of sensitivity that may be provided; and
- any other factors considered to be relevant to the ACHA to be adopted into the information gathering process and assessment methodology.

An information session was held at the Cordeaux Colliery on 6 March 2017. At the information session, a representative of Illawarra Coal provided a presentation on the nature and scale of the Project, an overview of the impact assessment process, critical timelines and milestones for the completion of assessment activities and delivery of reports, a discussion of the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information. The information session also provided RAPs with an opportunity to raise any cultural issues or comments/perspectives and assessment requirements (if any) regarding the Project or the Proposed Methodology.

As described above, Illawarra Coal recorded that the proposed Project information had been presented to the RAPs. This record (i.e. the Proposed Methodology provided to the RAPs [Appendix 3] and the information session presentation [Appendices 1 and 2] also provided to all RAPs) includes any agreed outcomes and contentious issues that required further discussion to establish mutual resolution (where applicable). A copy of this record, along with a list of the RAPs who attended the information session, is provided in Appendix 4.

The period for commenting on the Proposed Methodology closed on 8 March 2017. The methodology was also discussed at the information session.

4.2.2 Responses to Comments Received on Proposed Methodology

As described in Section 4.2.1, a copy of the Proposed Methodology was provided to all RAPs for their review and comment on 6 February 2017, with comments requested by 8 March 2017, allowing for a 28 day review period.

Further to this, Illawarra Coal offered all RAPs the opportunity to attend a Project information session regarding the Proposed Methodology and the proposed Project at Cordeaux Colliery on 6 March 2017. This information session provided an opportunity for the RAPs to provide comments on the Proposed Methodology. Questions raised during this information session in regards to the Proposed Methodology are listed in Table 2. A full copy of the minutes from this meeting have been provided in Appendix 4.

Table 2: Questions raised by RAPs in regards to the Proposed Methodology

Question	Illawarra Coal/ Niche response
Although the methodology is targeting AHIMS registered sites, will other areas be surveyed?	<p>In addition to previously registered sites that fall within the underground investigation area, the survey will investigate other areas of the Subject Area. As stated in the Proposed Methodology, the surveys will also target:</p> <ul style="list-style-type: none"> • Areas designated within the Subject Area that would be disturbed by surface infrastructure. • Creek lines and large sandstone rock platforms that have the potential to be affected by subsidence within the Subject Area.
If members of RAP groups were not present at the meeting, will they be excluded from the survey?	<p>All RAPs will have an opportunity to attend the survey in accordance with the Aboriginal cultural heritage consultation requirements.</p> <p>In addition, during the draft ACHA review period, all RAPs will be invited to attend an information session and site inspection where they will have the opportunity to view a selection of the Aboriginal cultural heritage sites recorded within the Study Area, and to discuss and/or provide comments or feedback on the draft ACHA.</p>

There were no further written responses received in regards to the Proposed Methodology prior to the comment cut-off date.

4.2.3 Aboriginal Cultural Heritage Assessment Surveys

4.2.3.1 Survey Engagement Application Process

All RAPs were invited to participate in the field survey. The invitation described the requirements that Illawarra Coal needed applicants to satisfy for engagement in regards to fitness for work and personal protective equipment.

The invitation included a *Field Survey Engagement Application Form* which sought responses on:

- cultural, social and historical connections to the Subject Area;
- traditional knowledge of the Subject Area;
- previous experience in ACHA survey; and
- copies of current insurances.

A completed questionnaire (to assist with field team selection) and valid insurances were received from the following RAPs:

- Biamanga (Murrin Clan/Peoples).
- Cubbitch Barta Native Title Claimants.
- Cullendulla (Murrin Clan/Peoples).
- Didge Ngunawal Clan.
- Goobah Development PTY LTD (Murrin Clan/People).
- Gulaga.
- Illawarra Local Aboriginal Land Council.
- Kamilaroi Yankuntjatjaka Working Group.
- Kawul Cultural Services.
- Murramarang (Murrin Clan/Peoples).
- Warra Bingi Nunda Gurri.
- Woronora Plateau Gundungara Elders Council.
- Wurrumay Consultants.

4.2.3.2 Engagement for Surveys

Representatives from the following 13 RAPs were invited to participate in the conduct of the survey:

- Biamanga (Murrin Clan/Peoples).
- Cubbitch Barta Native Title Claimants.
- Cullendulla (Murrin Clan/Peoples).
- Didge Ngunawal Clan.
- Goobah Development PTY LTD (Murrin Clan/People).
- Gulaga.
- Illawarra Local Aboriginal Land Council.
- Kamilaroi Yankuntjatjaka Working Group.
- Kawul Cultural Services¹.

¹ Whilst a representative of Kawul Cultural Services was invited to attend the field assessment, they did not attend or provide explanation as to why they had not sent a representative on the days rostered.

- Murramarang (Murrin Clan/Peoples).
- Warra Bingi Nunda Gurri.
- Woronora Plateau Gundungara Elders Council.
- Wurrumay Consultants.

4.2.3.3 Aboriginal Heritage Surveys

Aboriginal cultural heritage surveys were conducted over several periods, including the following dates:

- 13 March 2017;
- 1 May to 5 May 2017;
- 11 May to 12 May 2017;
- 16 May to 18 May 2017;
- 22 May to 26 May 2017; and
- 22 June 2017.

The majority of the survey work was completed in May 2017. Additional survey was undertaken on 22 June 2017 to assess changes to one of the ventilation shaft sites.

Further to this the RAPs were informed in writing on 7 May 2018 that a revision had been made to the proposed longwall layout; and as a result additional survey would be required. The survey of this additional area was desirable to achieve the level of survey sampling indicated in the Proposed Methodology (Appendix 3). This additional survey was conducted on the following dates:

- 28 to 29 May 2018;
- 5 June 2018;
- 26 to 28 June 2018; and
- 3 July 2018.

Survey dates relied on weather conditions; due to both safety and restrictions on access to the Subject Area due to rainfall restriction.

Further details regarding the survey and the survey coverage are provided in Sections 8, 9.1 and 9.2. Table 3 summarises the survey dates and representatives of the RAPs who attended the surveys.

Table 3: Aboriginal Cultural Heritage Survey Attendance

Representative	Registered Aboriginal Party
13 March 2017 and 1 May 2017	
Ebony Chalker	Cubbitch Barta Native Title Claimants
Nathanial Kennedy	Warra Bingi Nunda Gurri
Kayla Williams	Woronora Plateau Gundungara Elders Council
2 May 2017	
John Carriage	Biamanga
Keenden Bell	Cullendulla
Paul Boyd	Didge Ngunawal Clan
3 May 2017	
John Carriage	Goobah
Richard Dutton	Gulaga
Jake Bell	Murramurrang

Representative	Registered Aboriginal Party
4 May 2017	
Kiran Wapau	Kamilaroi Yankuntjatjaka Working Group
Representative was invited however did not attend	Kawul Cultural Services
Representative was invited however did not attend	Wurrumay Consultants
5 May 2017	
Kristy-Lee Chalker	Cubbitch Barta Native Title Claimants
Leanne Tungai	Illawarra Local Aboriginal Land Council
Shakiah Tungai	Warra Bingi Nunda Gurri
11 May 2017	
John Carriage	Biamanga
Paul Boyd	Didge Ngunawal Clan
Richard Dutton	Cullendulla
12 May 2017	
Keeden Bell	Goobah
Richard Dutton	Gulaga
John Carriage	Murramurrang
16 May 2017	
John Carriage	Cullendulla
Representative was invited however did not attend	Illawarra Local Aboriginal Land Council
Paul Cummins	Woronora Plateau Gundangara Elders Council
17 May 2017	
Ebony Chalker	Cubbitch Barta Native Title Claimants
Linda Kennedy	Warra Bingi Nunda Gurri
Paul Cummins	Woronora Plateau Gundangara Elders Council
18 May 2017	
John Carriage	Biamanga
Richard Dutton	Cullendulla
Paul Cummins	Woronora Plateau Gundangara Elders Council
22 May 2017	
Paul Boyd	Didge Ngunawal Clan
Kiran Wapau	Kamilaroi Yankuntjatjaka Working Group
Representative was invited however did not attend	Kawul Cultural Services
23 May 2017	
John Carriage	Biamanga
Paul Boyd	Didge Ngunawal Clan
Representative was invited however did not attend	Illawarra Local Aboriginal Land Council
24 May 2017	
Richard Dutton	Goobah
Representative was invited however did not attend	Kawul Cultural Services
Keeden Bell	Murramurrang
25 May 2017	
Keeden Bell	Biamanga
Richard Dutton	Cullendulla
Paul Boyd	Didge Ngunawal Clan
26 May 2017	

Representative	Registered Aboriginal Party
Paul Boyd	Didge Ngunawal Clan
Keeden Bell	Goobah
Richard Dutton	Gulaga
Representative was invited however did not attend	Kamilaroi Yankuntjatjaka Working Group
Representative was invited however did not attend	Kawul Cultural Services
John Carriage	Murramurrang
Representative was invited however did not attend	Wurrumay Consultants
22 June 2017	
Keenan Bell	Murramurrang
Richard Dutton	Gulaga
28 May 2018	
Frank Thomas	Gulaga
John Carriage	Biamanga
Paul Cummins	Woronora Plateau Gundungara Elders Council
29 May 2018	
Kayla Williamson	Woronora Plateau Gundungara Elders Council
Frank Thomas	Gulga
Mark Dutton	Biamanga
5 June 2018	
Frank Thomas	Gulaga
Shanece Ardler	Goobah
Kayla Williamson	Woronora Plateau Gundungara Elders Council
26 June 2018	
Colin Walker	Cullendulla
Frank Thomas	Biamanga
Representative was invited however did not attend	Cubbitch Barta Native Title Claimant
27 June 2018	
Frank Thomas	Murramarrang
Dwana Chalker	Cubbitch Barta Native Title Claimants
Paul Cummins	Woronora Plateau Gundungara Elders Council
28 June 2018	
Frank Thomas	Murramarrang
Rebecca Chalker	Cubbitch Barta Native Title Claimants
Kayla Williamson	Woronora Plateau Gundungara Elders Council
3 July 2018	
Frank Thomas	Goobah
Representative was invited however did not attend	Kamilaroi Yankuntjatjaka Working Group
Representative was invited however did not attend	Gulaga

4.3 Stage 4 – Review of First Draft Report

A previous draft of this report (i.e. the first draft ACHA) was provided to all RAPs for their review and comment on 5 January 2018 in accordance with Sections 4.3 and 4.4 of the ACHCRs (DECCW 2010a). RAPs were given 28 days to provide comment on the draft ACHA. The closing date for these comments was 5 February 2018. Prior to this closing date an information session was undertaken on the 22 January 2018 at Cordeaux Colliery. The purpose of the information sessions was to discuss the key findings of the draft ACHA and to provide an opportunity for RAPs and other community stakeholders and Elders to discuss, ask questions and/or provide comment on the draft ACHA. The following RAP groups attended this information session:

- Biamanga (Murrin Clan/Peoples)
- Cullendulla (Murrin Clan/Peoples)
- Didge Ngunawal Clan
- Goobah Development PTY LTD (Murrin Clan/people)
- Gulaga
- Kamilaroi Yankuntjatjaka Working Group
- Walnuja (Murrin Clan/peoples)
- Warra Bingi Nunda Gurri
- Woronora Plateau Gundungurra Elders Council

Details of this verbal comment is outlined in Table 4.

Table 4: Verbal comment made by RAPs in regards to the first draft ACHA

Representative Group	Comment	Illawarra Coal/ Niche Response
Didge Ngunawal Clan	Asked for confirmation that no sites were at risk of direct damage from the Project.	Confirmed that the main surface impacts were at the ventilation shaft sites, and that there were no sites located within these footprints. It was noted that there was one site (Dendrobium ACHA AGG-1 (52-2-4468)), which is close to Ventillation Shaft Site No. 5B, but this would be barricaded during construction to mitigate any risk of harm. Any sites that are mined under and subject to subsidence movements could be impacted, but impacts are generally minor and only occur in fewer than 10% of cases.
Goobah Development PTY LTD	Noted that there was a huge amount of Aboriginal heritage in the area and that the community would like to access it for teaching and education.	Access to the Metropolitan Special Area is administered by WaterNSW.
Woronora Plateau Gundungara Elders Council	The community are after reasonable access to the area.	Where the sites overlap with South32 operations, South32 can facilitate access but beyond that

Representative Group	Comment	Illawarra Coal/ Niche Response
Walnuja		<p>South32 have no authority or ability to organise access.</p> <p>Suggested that the RAPs put their desire/ requests for access to these areas in their response to the Draft ACHA as WaterNSW will be provided with these documents.</p>
Goobah Developments PTY LTD	Asked about WaterNSW's involvement in the Project.	They are the landowner/ manager and a key stakeholder for mining.
Walnuja	<p>Interested in organising Aboriginal community access for an annual event, irrespective of the place.</p> <p>Further noted the importance of the presence and continuity of culture at the sites, and that it comes down to the RAPs attending sites and making regular observations.</p> <p>A reiteration was made of the importance of maintaining continuity at the sites and places.</p>	This feedback was welcomed/ understood and appreciated as it is valuable broader feedback.
	Asked if South32 and Niche Environment and Heritage were aware of the Native Title Claim that had been made by the South Coast Peoples. Described that the claim went all the way up the coast from the far South Coast to the Hawkesbury.	This feedback was welcomed. As a result a revised Native Title Search was completed for inclusion in this current assessment.
Woronora Plateau Gundungara Elders Council	How frequently will the sites be accessed under an Aboriginal Cultural Heritage Management Plan (ACHMP), would it be similar to what is done at other collieries within the Southern Coalfield?	It depends on the mining schedule and condiditons, but typically there is an inspection every 12 months. The point of the observation is to make records prior to and then at each subsidence event. Therefore, things like length of the longwall, position of the sites relative to the longwalls all affect the frequency of observations under an ACHMP.
Warra Bingi Nunda Gurri	Asked what the response would be if there was movement detected at the site- is it a stop work or other action.	<p>The response will depend on the management procedures and Trigger Action Response Plan (TARP) approved by the government.</p> <p>Generally, there have been no major or significant impacts to sites in the Southern Coalfield. There are management responses that anticipate larger impacts, although these are infrequently needed, and</p>

Representative Group	Comment	Illawarra Coal/ Niche Response
		usually there is no specific management action needed.
	Asked what the point of monitoring was then [if the response was nothing]?	In some cases, there are options in which physical interventions can be used to manage impacts - things like artificial driplines for example. Management actions including stop work orders would be considered as part of the Project management plans, so it is important that we don't get too far ahead of ourselves.
Walnuja	Has there been any radiocarbon dating and age of sites in the area?	Dates are generally "young" with dates less than 4,000 years BP and most often less than 2,000 and sometimes a few hundred years old. There are some challenges with dating sandy deposits, such as date inversion with old dates being above young dates in the soil sequence.
Warra Bingi Nunda Gurri	Would the report be available to the public?	There is a broader consultation process within the public exhibition process under the EP&A Act. RAPs were encouraged to look out for this and to provide comments directly to the Department of Planning and Environment through this process. Illawarra Coal/ Niche would provide the RAP group with details of the public exhibition when it happens, so further comments can be made, should they be required.
Warra Bingi Nunda Gurri	Asked whether the shaft site will impact the nearby axe grinding grooves.	Not likely, and the axe grinding groove would be avoided and barricaded (during construction).
Walnuja	Asked how many jobs would be created for Aboriginal people and if there was any chance of there being identified positions for Aboriginal people during the operations- even if its 0.5% of the jobs - does 0.5% seem reasonable? Further noted that it would be good that the Traditional Owners (Illawarra and South Coast people) are given priority or further defined/targeted within that.	Job opportunities for Aboriginal people is a very reasonable suggestion. There is also a social impact assessment being prepared for the Project. This social impact assessment includes consideration of the Aboriginal community and there will be recommendations for targeted employment. This is something that comes through strongly in the report recommendations.

All RAPs were provided with a printed copy of the main text of the first draft ACHA, and an electronic copy of the full first draft ACHA (including all supporting appendices). All RAPs were also advised if they wish to discuss anything within the report they could get in contact with Renée Regal (Niche) directly.

4.3.1 Comments received on first draft report and consideration

Comments on the first draft ACHA received during the 28 day review period (Section 4.3) included those from the following RAPs:

- Cubbitch Barta Native Title Claimants
- Kamilaroi Yankuntjatjaka Working Group
- Warra Bingi Nunda Gurri
- Woronora Elder Plateau Gundungara Elders Council

Copies of the submissions are included in Appendix 1. Responses to each submission received by the RAPs on the draft ACHA are provided in Table 5.

Table 5: Written comment made by RAPs in regards to the draft ACHA

Representative Group	Comment	Illawarra Coal/ Niche Response
Cubbitch Barta Native Title Claimants	The locations of the sites should not be in any public document, so therefore that includes the site cards. I realise that there is a need to include them for approvals, and RAPs etc, but not for the public.	Appendices 3, 5, 7 and 8 as well as Figures 12 and 13 will be removed from the public documentation as requested.
	The areas that will be impacted for ventilation shafts and other infrastructure should be looked at more closely. These areas are from that I can make out on the maps, are on level ridgelines that may have been used for open camp sites. We should not just be considering the impacts of mining on shelters and grinding grooves, but also the impacts on possible subsurface materials, located in these infrastructure areas. I realise that these areas were inspected during the survey, but there was probably little visibility at the time, I cannot find anything specific about these areas in the report.	Your comments have been noted and can be further explored during the Aboriginal Cultural Heritage Management Plan, should the Project be approved.
	The monitoring process should continue as part of this project, as it allows us the opportunity to keep informed of any impacts that may be taking place. I have seen many of the damaged listed in Table 22, over the years in the southern coalfields, and have also seen a complete shelter collapse, that the mining company put down to environmental factors, not the mine subsidence that had caused the	Continued monitoring is a recommendation of this assessment. This will be further explored during the development of the Aboriginal Cultural Heritage Management Plan, should the Project be approved. Many thanks for yours, Ebony, Kirsty-Lee's and Daniel's assistance with the Aboriginal Cultural Heritage Assessment and survey efforts. Your

Representative Group	Comment	Illawarra Coal/ Niche Response
	cracking in the same creek line. Not all impacts are predictable, some damage can occur when not predicted, and yet other predictions of major damage does not occur.	feedback has been incorporated within the assessment report.
Kamilaroi Yankuntjatjaka Working Group	I am happy with the Draft Assessment Report and have no problems with it Thanks again	Many thanks for your assistance with the Aboriginal Cultural Heritage Assessment and survey efforts. Your feedback has been incorporated within the assessment report.
Warra Bingi Nunda Gurri	p. 73 Sites that can not be avoided Recommendation for the archival recording to include artefact casting in case of damage to the grinding groove on the southern boundary of the proposed location of Ventilation Shaft Site No. 5B	Your comments have been noted and can be further explored during the Aboriginal Cultural heritage Management Plan, should the Project be approved. Many thanks for yours and Linda's assistance with the Aboriginal Cultural Heritage Assessment and survey efforts. Your feedback has been incorporated within the assessment report.
	p. 74 Recommendations No. 6- Recommendation for the subsidence monitoring program to be adaptive to respond to any unpredicted subsidence impacts.	Your comments have been noted and can be further explored during the Aboriginal Cultural Heritage Management Plan, should the Project be approved.
Woronora Plateau Gundungarra Elders Council (WPGEC)	A minimum of three RAP's to undertake the monitoring of the relevant sites in conjunction with a suitably qualified archaeologist.	Requirements for monitoring will be discussed with the RAP groups during the development of Extraction Plans, should the Project be approved.
	In relation to the site that can not be avoided (ACHA AGG-1) due to the proposed ventillation shaft. W.P.G.E.C recommend that prior to this occurring RAP groups get the opportunity to re visit the site with a suitably qualified archaeologist to help fence the site and take further pictures for their own records.	Requirements for monitoring will be discussed with the RAP groups during the development of Extraction Plans, should the Project be approved.
	In collaboration with Water NSW, Illawarra Coal & Niche try to establish an annual event to gain access for the Aboriginal community to visit numerous sites to further enhance and educate the local	This requirement can be discussed during the development of the Aboriginal Cultural Heritage Management Plan process, should the Project be approved.

Representative Group	Comment	Illawarra Coal/ Niche Response
	community and local cultural knowledge of this land.	Many thanks for yours and Paul's assistance with the Aboriginal Cultural Heritage Assessment and survey efforts. Your feedback has been incorporated within the assessment report.

4.3.2 Review of second draft report

Due to the revision to the proposed longwall layout and undertaking additional field surveys, the Stage 4 Review of the draft Report was undertaken a second time for this assessment. As a result, a revised draft report was sent to the RAPs on the 2 October 2018 and 28 days was provided for comment on the draft ACHA. The closing date for these comments was 29 October 2018. There were no further comments provided by the RAPs on the second draft report.

4.3.3 Review of final report

A copy of the final ACHA report will be made available by the Department of Planning and Environment to all RAPs during the public exhibition period for the Dendrobium Mine Project EIS. During this exhibition period all RAPs will have the opportunity to review and provide additional comment on the final ACHA report as well as any other part of the EIS (e.g. including the ecological and water assessments).

5. Investigators and Contributors

5.1 Research and Reporting

This investigation was managed by Renée Regal (BA Hons), Niche Heritage Team Leader, who has 13 years of experience as a professional archaeologist and heritage consultant. Aboriginal community consultation, research, field assessment and report writing were conducted by Renée Regal. Clare Leever (BArch, GradDipArch) and Caitlin Marsh (BA Hons), who each have five years' experience as professional archaeologists and heritage managers, and Sam Richards (BA Hons) who has four years' experience as a professional archaeologist and heritage manager all assisted with the field assessment. Isabel Tickle (BArch), has two years' experience as a professional archaeologist and heritage manager and assisted with the report writing for this assessment.

Sections of the historical context presented in this report have been prepared and written by Clare Leever (Heritage Consultant) and Fiona Leslie (Heritage Team Principal) of Niche.

The ACHA was reviewed internally by Jamie Reeves (BA Hons), Director of Niche, who has 20 years' experience as a professional archaeologist and heritage consultant.

5.2 Fieldwork

In addition to the representatives of the RAPs listed in Table 3, the individuals listed in Table 6 attended and/or supported the surveys and assessment in various capacities.

Table 6: Aboriginal cultural heritage surveys and assessment – other participants or support personnel

Name	Representing
Gary Brassington	Illawarra Coal
Josh Carlon	Illawarra Coal
Clare Leever	Niche
Caitlin Marsh	Niche
Renée Regal	Niche
Jamie Reeves	Niche
Sam Richards	Niche
Isabel Tickle	Niche

6. Landscape Context

6.1 Overview

Understanding the past and present environmental contexts of an area is requisite in any Aboriginal archaeological and cultural heritage investigation (DECCW 2010a). The nature and distribution of Aboriginal archaeological sites are closely related to the environmental context. This section provides a broad overview of the environmental setting of the Subject Area, before describing each of the soil landscapes that are contained within it. Soil landscapes, when considered with the levels of past land use and modification, are a useful tool in identifying environmental proxies for the likely preservation and burial of Aboriginal objects in a landscape and resources that may have been available to Aboriginal people in the past; such as the presence of rock outcrops to provide surfaces for art or to sharpen and prepare implements, stone for the manufacture of stone tools and plant species.

6.2 Geology

Broadly, the Subject Area is located on the southern Woronora Plateau within the Cordeaux and Avon Dam catchment areas (Figure 5). The Project is located within the southern portion of the Permo-Triassic Sydney Basin. The terrain of the Subject Area is characterised by Middle Triassic Hawkesbury Sandstone, which is comprised of overlapping beds of quartz-rich sandstone. Under the sandstone formations the substrates comprise of deep Permian Coal Measures that consist of shale sandstone, conglomerates, tuff, chert and coal (Branagan and Packhan 2000).

There are four soil landscapes present within the Subject Area which are defined by Hazelton and Tille (1990) as the Hawkesbury, Lucas Heights, Volcanic (in less than 5% of the Subject Area) and Illawarra Escarpment (Dendrobium Pit Top carpark extension area). These formations are divided into colluvial and residual landscapes and are further described in Sections 6.3 to 6.4. The soil landscapes within the Subject Area are shown on Figure 6.

6.3 Colluvial Soil Landscapes

In colluvial soil landscapes the dominant form of landscape formation is mass movement (rock fall) hazard with steep sloped, rock outcrops with shallow stony highly permeable soil (Hazelton and Tille 1990:45, 58). There are two colluvial soil landscapes within the Subject Area; the Hawkesbury soil landscape and the Illawarra Escarpment soil landscape.

The Hawkesbury soil landscape ranges from rolling and rugged hills to very steep sandstone escarpment and ridges. Within this landscape sandstone outcrops are very common and often occur as horizontal benches and broken scarps up to 10 metres (m) high. Rock outcrops and surface boulders and cobbles make up to half of the ground surface (Hazelton and Tille 1990:45-46). This outcropping is evident around the Avon and Cordeaux Rivers within the Subject Area. The soils comprise of shallow sandy lenses; up to 30 centimetres (cm) deep. The topsoil of colluvial landscapes has low erodibility, consisting of permeable, loose, coarse sands and organic matter. The Hawkesbury soil landscape is highly susceptible to concentrated flow erosion. This landscape is the most archaeologically sensitive within the Subject Area, as the blocks and weathered scarps provide suitable overhangs to be used for shelter. Within these overhangs there is often suitable surfaces for art, as well as floor space for the accumulation of archaeological deposit. However, there is limited space for a deep accumulation of stratified subsurface deposits due to the size of the majority of the overhangs, as evidenced by the number of shelter sites previously recorded within the Subject Area (Figure 7).

The vegetation within this landscape is mostly uncleared woodland and open-forest with some areas of tall open forest, and rainforest within the sheltered gullies. On the open crests and ridges, woodland and open forest contains red bloodwood, narrow leaved stringy bark, snappy gum, hard-leaved scribbly-gum, blue mountains mallee ash and old man banksia. Sheltered side slopes of the landscape are characterised by open-forest containing silver top ash, Sydney peppermint, smooth-barked apple and black she-oak with an understorey of Epacridaceae, Myrtaceae, Fabaceae and Proteaceae (Hazelton and Tille 1990: 46).

The Illawarra Escarpment soil landscape comprises of debris mantle covering the upper slopes and benches on steep to very steep slopes. Large landslips are very common as well as large surface and subsurface boulders, and streamlines are unidirectional (Hazelton and Tille 1990:58). The dominant soils are dark sandy clays. The topsoil of colluvial landscapes has low erodibility, consisting of permeable, loose, coarse sands and organic matter. The Illawarra Escarpment soil landscape is also highly susceptible to concentrated flow erosion, in addition to mass movement such as major slumping and landslips. The blocks and weathered scarps of this landscape provide suitable overhangs to be used for shelter. Within these overhangs there is often suitable surfaces for art, as well as floor space for the accumulation of archaeological deposit. Similar to the Hawkesbury soil landscape there is limited space for a deep accumulation of stratified subsurface deposits due to the size of the majority of the overhangs, as evidenced by the number of shelter sites previously recorded within the Subject Area.

The vegetation within this landscape is mostly uncleared tall open forest and rainforest. Tall open forest is dominated by blackbutt and includes lilly pilly, sandpaper fig, moreton bay fig, small-leaved fig, port jackson fig, deciduous fig, coachwood and red cedar. Rainforest of the escarpment includes grey myrtle, brush bloodwood, whitewood and cabbage tree palm (Hazelton and Tille 1990, 58-59).



Plate 1: Example of the Hawkesbury landscape



Plate 2: Example of a Rock Shelter in the Hawkesbury landscape

6.4 Residual Soil Landscapes

The dominant geomorphic process in residual soil landscapes is the *in situ* weathering of parent rock and soil material. The landscape comprises of shallow, highly permeable soils, with isolated rock outcrops (Hazelton and Tille 1990: 20). Two residual landscapes occur within the Subject Area, the Lucas Heights and Volcanic soil landscapes.

The Lucas Heights soil landscape consists of gently undulating crests, ridges and plateaus of the Mittagong Formation, that alternates between bands of shale and fine-grained sandstones. Rock outcrop is absent within this landscape, with slopes of less than 10%. Unlike the aforementioned Hawkesbury Landscape, the soil of this landscape comprises of moderately deep hard setting yellow soils on ridge and plateau surfaces (Hazelton and Tille 1990: 23). There is some archaeological potential associated with this landscape,

however the site types found within it often comprise of isolated artefacts rather than large open camp sites with multiple stone artefacts present.

The vegetation within this landscape is eucalypt low open-forest and eucalypt low woodland with a shrub understorey. The most dominant tree species include turpentine, smooth-barked apple, red bloodwood, silvertop ash, scribbly gum and Sydney peppermint (Hazelton and Tille 1990: 23).



Plate 3: Example of the Lucas Heights landscape within the Subject Area

The Volcanic landscape is an associated soil landscape of the Hawkesbury formation and makes up less than 5% of the Subject Area landform. It consists of gently undulating valley floors surrounded by steep colluvial side slopes formed on volcanic intrusions within the Hawkesbury Sandstone and Wianamatta Group Shales. The soils are moderately reactive subsoils with low wet bearing strength; erosion and mass movement hazards on steep slopes (Hazelton and Tille 1990:143).

Due to its high erodibility and hardsetting tendencies this soil landscape has limited archaeological potential.

This landscape is difficult to distinguish from the Hawkesbury Landscape with its vegetation comprising of tall open-forest on the side slopes with Sydney blue gum, cabbage gum, deans gum, scattered Australian red cedar, turpentine and burrawang being the dominate species. The understorey comprises of ferns and bracken (Hazelton and Tille 1990: 144).

6.5 Disturbance and Modification

The above soil landscapes have been subject to limited impacts over time, due to the area being used as water catchment and therefore excluded from development. Land use impacts include:

- creation of the Avon and Cordeaux Dams;
- installation of services (powerlines, pipes, roads, railway corridor); and
- exploration drilling and seismic activities.

Each of the above land uses and activities impacts the preservation and visibility of the archaeological record within the Subject Area. The majority of the Subject Area has been subject to very limited modification and disturbance.

6.6 Summary

The Subject Area consists of rugged sandstone ridgelines and escarpments, with moderate to steep slopes and narrow incised valleys around the Avon and Cordeaux Rivers that have had limited disturbance or modification due to the area being used as a water catchment. This landscape is most likely to contain sandstone overhangs that were used for shelter and for art. Those sandstone platforms located within the rivers, tributaries and adjacent to swamps are most likely to contain axe grinding grooves.

7. Aboriginal Archaeological Context

7.1 Ethnography and History

The Project underground mining areas are the traditional country of the Tharawal people. Tindale (1940, 1974) has identified the Tharawal boundaries as being from the south side of Botany Bay to north of the Shoalhaven River, and running inland to the Campbelltown and Camden area (Attenbrow 2010: 34, SA Museum 2010). 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 Tharawal country. The Wodi Wodi also spoke the Tharawal dialect, and they inhabited the coastal plains and escarpment around Wollongong where the Dendrobium Pit Top and coal handling infrastructure is located. Tharawal 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 2005b: 6).

The records and histories of the Tharawal and their country at the time of contact with Europeans are subject to bias and are generally fragmented, providing nothing like a complete picture of the way Aboriginal people were living prior to European contact. Nevertheless, we know the Tharawal regularly communicated, moved, traded and participated in ceremonies between their country and neighbouring areas. It is most likely family groups or clans would ‘intermingle and interact along both physical and social boundaries’ rather than be strictly confined to the ‘tribal’ borders that were to be artificially imposed by European anthropologists (Organ 1990: xliii).

It is generally accepted that Aboriginal occupation of Australia dates back at least 40,000 years (Allen and O’Connell 2003). The result of this extensive and continued occupation of the Sydney Basin, of which the Woronora Plateau is a part, has left a vast amount of accumulated depositional evidence. The oldest date generally considered to be reliable for the earliest occupation around the region comes from excavations at Parramatta where archaeological material has been dated to 30,735 ± 407 Before Present (BP) (McDonald 2005). Nearer to the Dendrobium Mine area, the site of Bass Point at Shellharbour was occupied from 20,000 years ago, indicating a great antiquity of Aboriginal occupation in the region (Attenbrow 2010: 153, Flood 1995: 112).

The majority of reliably dated archaeological sites within the region are less than 5,000 years old, with previous excavations of rock shelters on the Woronora Plateau providing the oldest date of just over 2,000 years BP (Sefton 1998 a, 1998b). A combination of reasons has been suggested for this collection of relatively recent dates. There is an argument that an increase in population and ‘intensification’ of much of the continent took place around this time leading to a great deal more evidence being deposited than was deposited as a result of the sparser former occupation period. It is also the case that many archaeological sites along the former coastline may have been submerged as the seas rose to approximately their current level around 6,000 years ago. This would have had the effect of covering evidence of previous coastal occupation. In addition, it is also true that the acidic soils that predominate around the Sydney region are not conducive to the long-term survival of sites (Hiscock 2008: 106).

The arrival of the First Fleet in Sydney Cove in 1788 was followed the next year by a smallpox epidemic, which spread to the neighbouring regions and, although the exact effects are not known, killed over half the Aboriginal population of the areas effected (Organ 1990: 5).

Early in the nineteenth century European graziers began taking land in the south of the Cumberland Plain and the coastal plains around Wollongong, with cedar getting in the narrower northern coastal plain and rainforest areas of the escarpment (DEC 2005b). Access to traditional and everyday resources (such as water) and clearing the land of trees would have had a major impact on the ways in which Aboriginal people would have been living, and also caused significant social disruption between Aboriginal groups, and pressure between Aboriginal people and the ever-increasing European population. This period was a time of drought, and the competition for resources between the Europeans and the Tharawal, who were adapting to the massive changes that were so quickly upon them, led to several years of conflict. Organ (1990) documents the various skirmishes, killings and reprisals between Europeans and the Tharawal during the 1814 – 1815 period in the Cowpastures, Camden and Appin districts. Eventually this sporadic bloodshed would lead to larger scale conflict, with Governor Macquarie implementing a sustained punitive action against the Aboriginal population in the district. This resulted in the Appin Massacre of 17 April 1816, in which Aboriginal people were shot and driven over the steep cliffs (probably near Broughtons Pass) to their death during a surprise attack by a detachment of the 46th Regiment, in the middle of the night.

Despite the massive changes that were so quickly brought to the Aboriginal people of the region, they maintained a sense of community, traditional customs and practices, cultural knowledge and continued to care for significant sites and the land in general. Today there are many thousands of Aboriginal people living in the Illawarra. They continue to be custodians of the land, whilst traditional owners maintain cultural knowledge (DEC 2005b).

7.2 Heritage Register Searches

7.2.1 AHIMS Register

Three searches of the Aboriginal Heritage Information Management System (AHIMS) were conducted of the Subject Area on 30 January and 31 January 2017 (AHIMS Search ID's 264280, 264481 and 264485; results listed in Appendix 7). There were 60 previously recorded sites within the Subject Area (Figure 7 and 8). Of these 60 sites, two (2) records were duplicates of the same sandstone shelter site with art (AHIMS ID #52-2-1280 and #52-2-3635) and have been presented as a single site (AHIMS ID #52-2-3635) for the purpose of this assessment; and two records were duplicates of the same axe grinding groove site (AHIMS ID #52-2-0286 and #52-2-1278) and have been presented as a single site (AHIMS ID #52-2-1278) for the purpose of this assessment (sections 9.3.1. and 9.3.2).

Due to the length of time since the initial searches these searches were revised on the 17 July 2018 and the 3 September 2018 (AHIMS search ID's 357906, 358020 and 367709, results listed in Appendix 7). The results remained the same as the initial searches with the addition of the new sites that have been accessioned to date as part of this assessment (AHIMS ID #52-2-4465, 52-2-4466, 52-2-4467, 52-2-4468 and 52-2-4469).

The majority of Aboriginal sites recorded in the AHIMS dataset comprised a single feature, with rock shelters with art and/or deposits (n=38, 63.3%) and axe grinding groove sites (n=21, 35.0%) being the most common (Table 7).

Table 7: Summary of Aboriginal site features within the AHIMS Dataset

Site Type	AHIMS Site Feature	Number	Total Percentage (%)
Grinding Groove	Axe Grinding Grooves	21	35.0
Shelter with Art and/or Deposit, and/or midden	Art (pigment or engraved)	38	63.3
Potential Archaeological Deposit (PAD)	Potential Archaeological Deposit	1	2.3
Shelter with Art, PAD	Art as well as Potential Archaeological Deposit	1	2.3
Artefacts / Isolated Find	Artefacts	1	1.7
	Total	60²	100

The majority of the archaeological assessments that have been undertaken within close proximity to the Subject Area are the result of environmental impact assessments for proposed mining activities.

There are a number of limitations to the AHIMS dataset. These limitations include the following:

- the absence of reports identifying the survey coverage for a number of the previous surveys;
- duplication of site recordings;
- some datum and locational errors within the AHIMS dataset; and
- a number of Aboriginal sites which are known to be present within the Subject Area that were not yet added into the AHIMS database at the time of the search.

Where possible, corrections to site location have been made and a revised Aboriginal site dataset for the Project has been created.

7.2.2 Other Registers

In addition to AHIMS, the following heritage registers were searched on 27 October 2016 for Aboriginal heritage items:

- National Heritage List and Commonwealth Heritage List (via the Australian Heritage Database);
- Register of the National Estate (via the Australian Heritage Database);
- State Heritage Register;
- The s170 Heritage and Conservation Register; and
- The National Trust Register.

Two heritage items pertaining to Aboriginal history are located at Wilton, outside of the Subject Area. These items (Place IDs: 1307 and 3316) are included on the Register of the National Estate. There were no items identified within the Subject Area or immediate surrounds on any of the aforementioned heritage registers.

7.3 Local Archaeological Investigations

Archaeological studies provide material evidence of Aboriginal use of the landscape at times both before and after written history, and complements the oral histories and cultural knowledge held by the Aboriginal

² The total number has removed the two duplicate sites, bringing the total number from 62 to 60.

community. As noted in Section 7.2, a number of archaeological investigations have been undertaken in the Subject Area, including the following:

- a series of surveys undertaken by the Illawarra Prehistory Group (IPHG); and
- due diligence assessments for exploration activities undertaken within the Subject Area by Niche, Biosis and Navin Officer.

A description of these past archaeological assessments within the Subject Area and wider surrounds is provided in the subsections below. Other local investigations undertaken beyond the Subject Area include assessments prepared for Dendrobium Areas 1 to 3 and the Bulli Seam Operations Project (Section 7.3.1).

7.3.1 Summary of Local Archaeological Studies

A summary of local archaeological assessments undertaken within the Subject Area and surrounds is provided in Table 8, including assessments and surveys undertaken between 1990 and 2017.

Table 8: Summary of Archaeological Assessments within and within close proximity to the Subject Area

Assessment and date	Summary of findings
Sefton 1990 <i>1989-1990 Archaeological Survey of the Cordeaux River by the Illawarra Prehistory Group</i>	An assessment of the Cordeaux and Woronora River was completed with a grant received from the Australian Institute of Aboriginal and Torres Strait Islander Studies. A total of 89 archaeological sites were identified during this assessment. Sefton provided useful statistical data about the site types and art techniques.
McDonald 1994 <i>Dreamtime Superhighway: An analysis of Sydney Basin Rock Art and Prehistoric Information Exchange</i>	Jo McDonald completed a PhD thesis on the prehistoric rock art within the Sydney region. This thesis highlighted that shelter sites with art have greater visibility to a broader section of the community and had the potential to function in a different fashion to the engraved art of the region, which is not associated with habitation debris (McDonald 1994: 124). The thesis highlights the motif types present within the region and observes that within inland areas land animals make up a high percentage of motifs used. In conclusion, McDonald demonstrates that there are also a number of major variations in art techniques and motif type between the southern areas of the Woronora Plateau and the eastern and northern areas of the Sydney basin.
Sefton 1994 <i>1993-1994 Archaeological Survey of the Avon River by the Illawarra Prehistory Group</i>	Sefton received a further grant from the Australian Institute of Aboriginal and Torres Strait Islander Studies to complete an assessment of the Avon River. The surveys focused on sandstone outcrops and formed a model of site types that would be present within the Subject Area, which is of the same typography as the current Subject Area for the Project. Site types that were highlighted were stone arrangements, grinding grooves, groove channels and rock engravings, overhangs with art and/or deposit, grinding grooves. During this assessment 53 sandstone shelter sites, 13 grinding groove sites, two stone arrangements and one engraved channel were assessed.
Sefton 1998a <i>Site and Artefact Patterns on the Woronora Plateau</i>	Sefton completed a post graduate thesis that focused on the artefact and Aboriginal archaeological site patterns of the Woronora Plateau. The data used for this assessment had been collected by the IPHG between 1970 and 1998. The associations considered by Sefton included the relationship between sites, the material evidence remaining and their location within the landscape. This assessment focussed on sandstone overhangs, axe grinding grooves and rock engravings. During her assessment, Sefton argues that site density within the plateau area can be used to indicate the spatial distribution or density of the Aboriginal population within the study area using multivariate analysis (Sefton 1998a: 62). In analysing the shelter sites with their attributes, clear patterns form between shelters, their attributes and the drainage basins of the Woronora Plateau and the inland/coastal associations of the shelter sites (Sefton 1998a:166). According to Sefton these changes indicate a difference in settlement patterns across the plateau.

Assessment and date	Summary of findings
Navin Officer 2000 <i>Dendrobium Coal Project: Cultural Heritage Assessment</i>	In 2000 Navin Officer completed a cultural heritage assessment for the Dendrobium Coal Project, which included Longwalls 1 to 3 within Dendrobium Area 1; which is to the south east of the current Subject Area. The survey sample for this assessment was confined to areas that were proposed to have impacts associated with them. Similar to this current assessment, sites that were registered on AHIMS were reassessed. Large trees were assessed for scarring and ridgelines and open sandstone platforms were surveyed. During this assessment 19 AHIMS accessioned sites were assessed and 11 previously unrecorded sites were identified. These site types comprised of sandstone shelters with art and/or deposit and PAD, open artefact scatter sites, and a stone arrangement.
Sefton 2000 <i>Overview of the monitoring of sandstone overhangs for the effects of mining subsidence in the Illawarra Coal Measures</i>	Sefton completed an overview of the monitoring of sandstone overhangs for the effects of mining subsidence for Illawarra Coal. The purpose of this assessment was to develop a monitoring program to gauge the effects of subsidence on sandstone overhangs and to relate these effects to the following parameters: <ul style="list-style-type: none"> Topographic location Overhang shape and size and overhang formation process The presence of jointing in bedding planes Mining subsidence Comprehensive and tensile strains and tilts Overhang location relative to longwalls and geological anomalies This assessment (further outlined in Section 12.5) has been used as a template for Aboriginal archaeological site monitoring programs within the Southern Coalfield and the principles outlined for site recording will be used during this assessment.
Sefton 2002 <i>Archaeological Survey of longwall 9 and 10 Application Elouera Colliery</i>	Sefton was commissioned to complete an assessment of previously identified sites for Illawarra Coal and to provide management strategies and comment on their archaeological significance.
Biosis Research 2004 <i>Dendrobium Area 3 Lake Cordeaux foreshore seismic testing REF: Archaeological survey</i>	Dendrobium Area 3 and Lake Cordeaux foreshore seismic testing REF: Archaeological survey. Biosis Research were commissioned to complete a Review of Environmental Factors (REF) for the proposed seismic testing of part of Dendrobium Area 3 and the Lake Cordeaux foreshore. This REF include Aboriginal and European heritage. This assessment was used to assist with the development of the predictive modelling and survey methodology for the Project, as the Subject Area used for the previously completed assessment was also located within a similar landscape area.
Biosis Research 2007b <i>West Cliff Colliery Stage 3 Coal Wash Emplacement Archaeological and Cultural Heritage Assessment</i>	This assessment was completed in 2004 as part of the proposed Stage 3 West Cliff Colliery Coal Wash Emplacement works. This assessment was used to assist with the development of the predictive modelling and survey methodology for the Project, as the Subject Area used for the previously completed assessment was also located within a similar landscape area.
Biosis Research 2007a <i>Dendrobium Area 3 Archaeological and Cultural Heritage Assessment</i>	In 2007 Biosis Research was commissioned by BHP Billiton to complete an assessment of Dendrobium Area 3 for Aboriginal and European Heritage. The Subject Area for this assessment is located to the south-east of Dendrobium Area 5. During this assessment a total of 65 Aboriginal cultural heritage sites were identified. Of these 65, 14 were located within Dendrobium Area 3A, 24 were located within Dendrobium Area 3B and 18 were located within Dendrobium Area 3C. Similar to Navin Officer 2000 and the current study the site types identified comprised of sandstone shelters with art and/or deposit, deposit, Isolated artefacts, axe grinding grooves and a suspected stone arrangement. As a result of this assessment it was recommended that an Aboriginal Heritage Impact Permit be applied for a number of the Aboriginal cultural heritage sites.
Biosis Research 2009a <i>Bulli Seam Operations Aboriginal Cultural Heritage Assessment</i>	Biosis Research Pty Ltd was commissioned by Illawarra Coal to conduct an Aboriginal Cultural Heritage Assessment for the proposed Bulli Seam Operations Project. During this assessment a total of 646 previously recorded and 45 newly identified sites were surveyed. The survey methodology for this assessment included targeted survey of previously recorded AHIMS sites and associated ridgelines. This assessment is similar to the scope of the current assessment and has been used to assist with developing the current predictive model and survey methodology.

Assessment and date	Summary of findings
Niche Environment and Heritage 2012	Dendrobium Area 3 Archaeological Assessment supporting the Dendrobium Area 3 Subsidence Management Plan (SMP).
Niche Environment and Heritage 2009-2017	Dendrobium Exploration Review of Environmental Factors (REF): Aboriginal Cultural Heritage Due Diligence Assessments. On behalf of Illawarra Coal Niche has completed five exploration REFs. These exploration works comprise seismic line and exploration borehole works. These assessments have been carried out within Dendrobium Areas 3B, 3C, 3D, 4 and 5. The assessment for these works included assessing all ridgelines and creek beds within close proximity to the proposed works, and relocating works within 100 m of AHIMS registered Aboriginal sites. During these investigations there have been no previously unregistered AHIMS sites located.

7.4 Regional Archaeological Studies

The local archaeological studies fit more broadly into the wider Woronora Plateau area, which encompasses the entire Subject Area. The antiquity of Aboriginal occupation in the region is demonstrated through a number of archaeological excavations that have been undertaken in the region surrounding the Subject Area. The oldest recorded date for Aboriginal occupation of the plateau is 2,200 +/- 70 BP at Mill Creek 11 (Sefton 1998a), this early date may be attributable to the archaeological site preservation, as opposed to evidence of Aboriginal occupation in the area in antiquity.

Generally, Aboriginal sandstone shelters' occupation levels within the greater Sydney region date to between 3,000 and 5,000 years of age. Dibden (2003) attributes the apparent increase in population within the region to the sea level stabilisation after the last ice age at approximately 5,000 years ago.

7.5 Synthesis and Predictive Model

This section summarises the landscape and archaeological context of the Subject Area to provide predictive statements about the likelihood and nature of archaeological evidence in the Subject Area.

The predictive model developed for the Subject Area included the consideration of previous archaeological surveys and assessments in the local area and wider surrounds, the distribution and patterning of known sites within the Subject Area and surrounds, the landform units and landscape context of the Subject Area and the previous known land uses in the area. As highlighted in Section 10 of this assessment, consideration has been made of Biosis Research's 2007 predictive model for the assessment completed on Dendrobium Area 3. Due to the rugged nature of the Hawkesbury Sandstone landscape the majority of the sites suitable for Aboriginal occupation and transient use comprise of sandstone overhangs; as outlined in Section 6.6. A comparison of slope analysis and distribution based on slope gradient has been considered and has assisted with compiling the following predictive model.

A summary of the known Aboriginal heritage sites listed in the AHIMS database is provided in Section 7.2.1, and the complete AHIMS search results are listed within Appendix 7.

The predictive model developed for the Subject Area is as follows:

- Sandstone shelters or rock overhangs with archaeological deposits, art, midden and/or artefacts will be the most common site type identified within the Subject Area. This is due to the steep slopes and ridgelines present along the Avon and Cordeaux Rivers; as well as Donalds Castle Creek and their small unnamed tributaries. Of the sites identified within the Subject Area, 63.3% are sandstone shelter sites.
- Grinding groove sites are the second most common site type within the Subject Area, making up approximately 35% of the AHIMS registered site numbers:

- Axe grinding groove sites will most likely occur on sandstone outcrops associated with drainage lines, swamps, creek lines and river beds.
- The bulk of grinding groove sites will contain fewer than 50 grinding grooves.
- Grooves will generally be between 25 cm and 50 cm in length, 5 cm to 8 cm in width and between 2 cm and 5 cm in depth and represent the sharpening or preparing of ground edge hatchets or fire hardened points.
- Axe grinding grooves are often located on large sandstone platforms within creek beds and swamp.
- Stone artefact scatters and isolated stone artefacts will be a less common class of site type or feature within the Subject Area:
 - The identification of this type of site depends on ground surface visibility, as site extent and artefact numbers are only visible on the surface. Due to the vegetation cover of the Subject Area this site type is difficult to relocate. Areas of open ground surface will be assessed for such site types.
 - The majority of these types of site occur on level to gently inclined alluvial plains, floodplains, terraces, foot slopes and simple slopes.
 - The majority of sites will occur within 200 m of temporary or permanent water with the average distance between a site and water being 70 m.
 - The majority of sites will occur on alluvial and transferral soil landscapes, neither of which are present within the Subject Area.
- Culturally modified trees will be the least represented class of site type in the Subject Area:
 - Culturally modified trees are a site type that is formed from the removal of bark from a tree for use in the manufacture of canoes, shields, shelters and containers for sorting or carrying items.
 - Whilst the area has been protected from large scale timber felling operations, due to its use as a water catchment area, the area is frequently subject to intense bushfires that would significantly reduce this site type's survival.
- Burials, an uncommon site type, are present within soft alluvial sediments, caves or hollow trees. Such sites are more commonly located within the sand dunes of the coast region. It is highly unlikely that this site type will occur within the Subject Area.
- Stone arrangements, a rare site type, may be located within the Subject Area. This type of site can include mounds of rocks for burial, or markers, mythological sites or areas of spiritual connection. There are no stone arrangements previously identified within the Subject Area.
- The bulk of archaeological sites within the Subject Area will relate to the last 2,000 years of occupation and the late Holocene period.
- Older archaeological deposits may be present in rock shelters or buried archaeological deposits associated with the infill of drainage lines, swamps and in areas with multiple depositional layers.

8. Survey Methodology

8.1 Sampling Strategy

A Proposed Methodology for the Project ACHA was developed by Niche. A copy of the Proposed Methodology is available in Appendix 3. The Proposed Methodology follows the:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005);
- ACHCRs (DECCW 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b); and
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

As part of the development of the Proposed Methodology, a sampling strategy for an archaeological survey of the Subject Area was developed.

The field surveys for the assessment concentrated on the areas of the surface that will be disturbed by the four proposed ventilation shaft locations and the Dendrobium Pit Top carpark. Previously registered sites that fall within the Subject Area were also relocated (where possible) and recordings updated from their original site cards. Further to this, rivers, creek lines and large sandstone rock platforms that have the potential to be affected by subsidence within the Subject Area were all subject to systematic survey.

8.2 Survey Methods

In accordance with the Proposed Methodology for the assessment (Appendix 3), the survey coverage varied in both focus and intensity across the Subject Area in relation to the nature of potential impacts. As described in the Proposed Methodology, the survey of the underground investigation area focused on those areas which would receive the most impact by the Project, such as creek lines and steep slopes. Slope classes between 20 and 35 degrees were targeted (Biosis Research 2007: 68).

The primary impacts associated with the investigation area would occur from underground mining related subsidence with only minimal surface impacts. As such, the survey undertaken within these areas was of a moderate intensity with the focus of the inspection on obtrusive site types most likely to be susceptible to subsidence impacts (e.g. grinding grooves and sandstone shelters).

Survey teams walked a series of transects through the terrain units. All survey transects were conducted on foot. The number of participants in a transect ranged between 3 and 5 individuals. Survey participants were generally spaced between 10 m and 20 m apart. These transects were labelled survey units and were recorded on survey recording forms. Environmental variables such as overall landform, slope, and distance from water, visibility, soils and the presence of sandstone outcrops were recorded for the survey units. Photographs of the sites were also recorded.

Sites were recorded using pre-prepared forms and handheld GPS with an average accuracy of ± 7 m. Data was then recorded in an excel spreadsheet system to form an Aboriginal Site Database (Appendix 5).

The results of the survey are presented in Section 9.3.

9. Aboriginal Heritage Survey Results

9.1 Cultural Heritage Survey

As described in Section 4.2.3, Aboriginal cultural heritage surveys for the Project were conducted over several periods, including the following dates:

- 13 March 2017;
- 1 May to 5 May 2017;
- 11 May to 12 May 2017;
- 16 May to 18 May 2017;
- 22 May to 26 May 2017;
- 22 June 2017;
- 28 May to 29 May 2018;
- 5 June 2018;
- 26 June to 28 June 2018, and
- 3 July 2018

During the entire survey program, the survey was conducted using a single survey team. This team comprised two archaeologists and between one and four representatives from the RAPs (see Table 3).

In summary, the survey involved 24 days of assessment. The survey conditions during all days of survey were dry and sunny. Field work was cancelled during days of predicted heavy rain due to WaterNSW catchment entry conditions. Cancelled days were rescheduled to the next available fine day, so that no survey days were lost to weather.

9.2 Survey Coverage

Approximately 278.53 ha (6.91%) of the 4033 ha of the Subject Area was surveyed. This relatively low survey coverage number is attributed to the assessment focusing on ridge and creek lines that have archaeological potential as outlined in Section 8, and given the predominately underground nature of the Project, it is considered adequate for the purpose of this assessment.

The survey coverage achieved for the Subject Area presents a strong representative sample of the landscape, given the relative lack of anticipated impacts to Aboriginal objects from underground mining.

Navin Officer Heritage Consultants (Navin Officer 2000: 49-50) discusses the considerations for visibility within the Illawarra Escarpment and Woronora Plateau that can be applied to the WaterNSW catchment areas. The obtrusive nature of sandstone shelter sites and rock platforms suitable for Aboriginal occupation and use is always high, even in areas as highly vegetated as WaterNSW catchment areas, so these sites are likely to be identified during survey efforts regardless of vegetation coverage. Further to this, the concept of archaeological visibility is also applicable to shelter sites that have artefact deposits and artefacts exposed within the shelter's dripline or on the shelter floor (Biosis Research 2009a: 48).

A summary of survey coverage by slope and landform categories across the Subject Area is provided in Table 9 and Figure 9 and Figure 10. It should be noted that as per Requirement 10 of the OEH (2010) *Code of Practice for archaeological Investigation of Aboriginal Objects in New South Wales* this assessment has

not included tables outlining the visibility due to the obtrusive, above surface evidence of the Aboriginal occupation of the Subject Area, as per the Navin Officer (2000) assessment.

Table 9: Survey coverage across Subject Area by slope and landform category

Slope Class	Slope degrees	Total Area Surveyed (ha)	Percentage Total of 278.53 ha surveyed
Flat	0°	9.36	3.36%
Very gently inclined	Up to 1.75°	22.04	7.91%
Gently inclined	1.75-5.75°	93.79	33.67%
Moderately inclined	5.75-18°	109.69	39.38%
Steep	18-30°	31.55	11.33%
Very steep	35-40°	7.31	2.62%
Precipitous	40-45°	1.48	0.53%
Cliff	>45°	3.31	1.2%
Total		278.53ha	100%

9.3 Survey Results

The survey campaigns undertaken for this ACHA identified a total of 58 sites within the Subject Area, including six newly recorded sites and 52 previously recorded sites.

Of the six sites that had not been previously identified during surveys and assessments (i.e. those newly recorded sites identified during the surveys undertaken for this ACHA) two of these sites were sandstone shelter sites with art (Dendrobium ACHA Shelter-1, Dendrobium ACHA Shelter-2) and four were axe grinding grooves within creek beds (Dendrobium ACHA AGG-1, Dendrobium ACHA AGG-2, Dendrobium ACHA AGG-3 and Dendrobium ACHA AGG-4). Detailed descriptions of all sites inspected (including both previously and newly recorded sites) are provided in Appendix 5.

Table 10 provides a summary of the site types recorded in the Subject Area (including newly recorded sites), and survey effort and coverage is shown on Figure 11. The re-located AHIMS sites are outlined in Figure 12, with newly recorded sites presented on Figure 13. A description of the individual sites recorded is presented in Sections 9.3.1 to 9.3.3. There were no re-located AHIMS sites or newly recorded sites within the Dendrobium Pit Top carpark extension area.

Table 10: Summary of Aboriginal Sites Located within the Subject Area

Site Type	Number of Sites Recorded in the Subject Area
Axe Grinding Groove	23
Shelter with Art	26
Shelter with Deposit	2
Shelter with Art and Deposit	6
Isolated Find	1
Total	58

9.3.1 Axe Grinding Groove Sites

A total of 23 axe grinding groove sites have been recorded in the Subject Area, across a broad spread of simple slopes, gullies and depressions in very gently inclined to steep terrain (Table 11). The AHIMS records for AHIMS ID #52-2-0286 and AHIMS ID #52-2-1278 were determined to be duplicate records.

Ground-truthing during the survey showed the AHIMS ID #52-2-1278 record to be the most accurate. For this reason, AHIMS ID #52-2-0286 is not assessed further in this report and is not included in the above count. AHIMS ID #52-2-1729, 52-2-1279, 52-2-1758, 52-2-1779, and 52-2-1781 could not be relocated during this assessment, which is likely due to the vegetation growth over the site locations since their recording on AHIMS. The entire drainage lines where the sites are registered on AHIMS were inspected. As a result of the inability to relocate these sites, they have been removed from this assessment, as it is likely to be an incorrect location recording on AHIMS. Typical axe grinding groove sites are represented in Plate 4 and Plate 5. Further photographs and plans of each of the axe grinding grooves within the Subject Area are produced in Appendix 5.

Table 11: Grinding Groove Sites within the Subject Area

Figure Reference	AHIMS ID	Site Name	No.	Investigation Area	Recorded	Description
Figure 13	52-2-4468	Dendrobium ACHA AGG-1	1	Area 5	New recording during this assessment	The platform on which the grinding grooves are situated is 2 x 4 metres (m), the platform is in a creek bed. There was a single grinding groove located on the platform. The groove measured 290 mm x 70 mm x 20 mm.
Figure 13	52-2-4467	Dendrobium ACHA AGG-2	13	Area 5	New recording during this assessment	The platform on which the grinding grooves are situated is 5.70 x 12.50 m, the platform is in a creek bed. There are thirteen grooves located on either side of a pothole. The largest groove measured 390 mm x 90 mm x 15 mm.
Figure 13	52-2-4466	Dendrobium ACHA AGG-3	1	Area 5	New recording during this assessment	The platform on which the grinding grooves are situated is 2 x 4 m, the platform is in a creek bed. There was a single grinding groove located on the platform. The groove measured 310 mm x 70 mm x 10 mm.
Figure 13	52-2-4465	Dendrobium ACHA AGG-4	6	Area 5	New recording during this assessment	The platform on which the grinding grooves are situated is 8 x 8 m, the platform is in a creek bed. There are six grinding grooves located on the platform. The largest groove measured 320 mm x 100 mm x 25 mm.
Figure 12	52-2-1278	Wallandoola Site 39	15	Area 6	Illawarra Prehistory Group 25/02/1986	The platform on which the grinding grooves are situated is 30 x 6 m, the platform is an area of sandstone that is situated on the lower edge of a swamp. Of the 32 grinding grooves originally recorded at the site by Sefton there are now only 15 visible due to the movement of sediment and vegetation growth over the platform. The average groove size is 300 mm x 60 mm x 12 mm.
Figure 12	52-2-1279	Wallandoola Site 38	0	Area 6	Illawarra Prehistory Group 25/02/1989	The platform on which the grinding grooves are situated is 16 x 9 m, the platform is an area of sandstone that makes up the roof of recorded Aboriginal site Metrop Catchment-Art01 (AHIMS ID# 52-2-3635). Of the 2 grinding grooves originally recorded at the site by Sefton, neither could be relocated due to leaf litter coverage.
Figure 12	52-2-1452	East Cordeaux 33	4	Area 6	Illawarra Prehistory Group 12/10/1989	The platform on which the grinding grooves are situated is 3 x 7 m, the platform is located in a creek bed. Only 4 of the original 8 grinding grooves recorded by Sefton could be relocated during this assessment due to moss and algae growth over the platform. The average groove size is 420 mm x 100 mm x 15 mm.
Figure 12	52-2-1453	East Cordeaux 34	39	Area 6	Illawarra Prehistory Group 12/10/1989	The platform on which the grinding grooves are situated is 14 x 3 m, the platform is located in the top of an area that has seepage from a swamp. Of the 92 grinding grooves originally recorded at the site by

Figure Reference	AHIMS ID	Site Name	No.	Investigation Area	Recorded	Description
						Sefton, 53 could not be relocated due moss and algae coverage. The average groove size is 450 mm x 100 mm x 4 mm.
Figure 12	52-2-1456	Tega Site 1	40	Area 6	Illawarra Prehistory Group 10/10/1989	The platform on which the grinding grooves are situated is 13 x 11 m, and is located within a creek bed. Of the 55 grinding grooves originally recorded at the site by Sefton, only 40 could be relocated. The channel recorded at the northern end of the platform could not be relocated during this assessment. The average groove size is 340 x 70 x 8 mm.
Figure 12	52-2-1460	Tega Site 6	9	Area 6	Illawarra Prehistory Group 17/10/1989	The platform on which the grinding grooves are situated is 11x 9 m, the platform is an area of the main water flow in the creek bed. Of the 14 grinding grooves originally recorded at the site by Sefton, only 9 could be relocated due to vegetation growth. The average groove size is 350 x 50 x 5 mm.
Figure 12	52-2-1465	Tega Site 11	2	Area 6	Illawarra Prehistory Group 10/10/1989	The platform on which the grinding grooves are situated is 40 x 12 m, the platform is located in a swamp. Of the nine grooves originally recorded only two could be relocated during this assessment. The average groove size is 320 x 80 x 8 mm.
Figure 12	52-2-1466	Tega Site 12	5	Area 6	Illawarra Prehistory Group 10/10/1989	The platform on which the grinding grooves are situated is 25 x 3 m. The platform is an area of sandstone and is located within a creek bed. All five of the grinding grooves initially recorded by Sefton were relocated during this assessment. The average groove size is 270 x 70 x 8 mm.
Figure 12	52-2-1566	Donalds Castle Creek Site 5	4	Area 5	Illawarra Prehistory Group 22/05/1990	The platform on which the grinding grooves are situated is 12 x 7 m, the platform is located within the creek bed. All four of the originally recorded grinding grooves were relocated during this assessment. The average groove size is 350 x 70 x 8 mm.
Figure 12	52-2-1568	Donalds Castle Creek Site 7	7	Area 5	Illawarra Prehistory Group 22/05/1990	The platform on which the grinding grooves are situated is 7 x 8 m, the platform is located within a creek bed. Of the eight grinding grooves originally recorded at the site by Sefton, only seven could be relocated. The groove underwater is no longer visible as a large section of rock has been worn away. The average groove size is 340 x 70 x 8 mm.
Figure 12	52-2-1577	Donalds Castle Creek Site 16	3	Area 5	Illawarra Prehistory Group 29/05/1990	The platform on which the grinding grooves are situated is 30 x 5 m, the platform is situated within the bed of a creek just below a small drop. The three grooves are badly eroded due to water wash. As a result, a maximum length could not be measured.

Figure Reference	AHIMS ID	Site Name	No.	Investigation Area	Recorded	Description
Figure 12	52-2-1578	Donalds Castle Creek Site 17	3	Area 5	Illawarra Prehistory Group 29/05/1990	The platform on which the grinding grooves are situated is 5 x 2 m, the platform is located within a creek bed. All three of the grinding grooves initially recorded by Sefton were relocated during this assessment.
Figure 12	52-2-1592	Donalds Castle Creek Site 31	14	Area 5	Illawarra Prehistory Group 12/06/1990	The platform on which the grinding grooves are situated is 15 x 3 m, the platform is located in the bed of a creek. All 12 of the grinding grooves initially recorded by Sefton were relocated during this assessment. In addition to the 12 recorded by Sefton a further 2 grooves were relocated during this assessment. The average groove size is 400 x 120 x 20 mm.
Figure 12	52-2-1729	Ricki Lee 1	0	Area 5	Illawarra Prehistory Group 15/05/1995	The platform on which the two grinding grooves are situated is 4 x 4 m, and is located in the small flow on the side of the outcrop which is above a small waterfall. Neither of these grinding grooves were relocated during this assessment, due to a tree having fallen over the platform.
Figure 12	52-2-1730	Ricki Lee 2	15	Area 5	Illawarra Prehistory Group 15/05/1995	The platform on which the grinding grooves are situated is 6 x 4 m, and is located within the bed of a creek, on a small waterfall. Of the 20 grinding grooves originally recorded at the site by Sefton, 15 were relocated as part of this assessment.
Figure 12	52-2-1739	Ricki Lee 12	25	Area 5	Illawarra Prehistory Group date note specified	The platform on which the grinding grooves are situated is 12 m x 3m and is located just at the top of a water fall. The site comprises five grinding grooves located above the third pothole from the top, a single groove located at the side of the seepage area and a series of 19 grooves below the last pothole before the waterfall drops into the creek.
Figure 12	52-2-1758	Upper Avon 54	2	Area 5	Illawarra Prehistory Group 15/05/1995	This site comprises two axe grinding grooves, on a shandstone platform within a creek bed. This site could not be found during the current assessment, however the location is accurate based on the site card details.
Figure 12	52-2-1779	Upper Avon 42	0	Area 5	Illawarra Prehistory Group date not specified	This site comprises seven axe grinding grooves on a sandstone plateform within a creek bed. This site's location could not be confirmed during this assessment.

Figure Reference	AHIMS ID	Site Name	No.	Investigation Area	Recorded	Description
Figure 12	52-2-1781	Upper Avon 44	0	Area 5	Illawarra Prehistory Group 15/05/1995	The platform on which the grinding grooves are situated is 7 x 9 m, the platform is located to the south of the creek. None of the three grinding grooves could be relocated during this assessment due to the growth of moss and algae over the platform.

¹ The AHIMS records for AHIMS ID #52-2-0286 and AHIMS ID #52-2-1278 were determined to be duplicate records. For this reason, AHIMS ID #52-2-0286 is not assessed further in this ACHA. Site reference AHIMS ID #52-2-1278 is used in this report herein, as ground-truthing during the survey showed this record to be the most accurate.

² Although the location for AHIMS ID #52-2-1758 could not be confirmed during the surveys undertaken, this site has been still been included in Table 12 as the location is accurate based on the site card details.



Plate 4: A Notable Grinding Groove Site – East Cordeaux 34 (AHIMS ID #52-2-1453)



Plate 5: A Typical grinding groove at Dendrobium ACHA AGG-2

A total of 13 of the 23 grinding groove sites contain between one and 10 grinding grooves, four sites have between 12 and 15 grinding grooves, one site has 27 grooves and two sites have between 32 and 40 grinding grooves remaining visible since their initial recording on AHIMS. Grinding grooves at five sites were unable to be located during this survey. Grinding groove shapes are typical of the sharpening of ground edge implements and dimensions of individual grooves fall within the normal ranges of regional grinding groove sites. All of the grinding groove sites except one (Wallandoola Site AHIMS ID #38 52-2-1279) are located within permanent water sources.

9.3.2 Sandstone Shelter Sites

There are 34 sandstone shelter sites identified within the Subject Area. These shelter types comprise Shelters with Art, Shelters with Deposit, Shelters with Art and Deposit, and Shelter with Potential Archaeological Deposit (PAD). The AHIMS records AHIMS ID #52-2-1280 and #52-2-3635 were determined to be duplicate records. Ground truthing during the survey showed the AHIMS ID #52-2-3635 record to be the most accurate. For this reason, AHIMS ID #52-2-1280 is not assessed further within this ACHA.

During this assessment, AHIMS ID #52-2-1467, #52-2-1734, #52-2-1735, # 52-2-1736 and #52-2-1737, all recorded as Shelters with Art, could not be re-located, despite repeated attempts within the general area, and along the surrounding ridgelines and drainage lines that they were originally recorded. Further to this extended search, any newly identified Aboriginal shelter sites were compared with the previous recordings that could not be relocated. As is demonstrated between Figure 7 and Figure 12, in one case (AHIMS ID #52-2-1457) there has been considerable distance between the AHIMS registered location and the actual location of some sites. As a result, these sites have not been physically assessed as part of this ACHA further details have been taken from their AHIMS site cards and are presented in Appendix 5.

Further details and photographs of each registered site in Table 12 outlined in Appendix 5.

Table 12: Summary of Rock Shelter Site within the Subject Area

Figure Reference	AHIMS ID	Site Name	Investigation Area	Recorded	Description
Records of Shelter with Art					
Figure 13	52-2-4469	Dendrobium ACHA Shelter-1	Area 6	New recording during this assessment	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter, and is in very poor condition.
Figure 13	AHIMS number pending	Dendrobium ACHA Shelter-2	Area 5	New recording during this assessment	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter, and is in very poor condition.
Figure 12	52-2-1450	East Cordeaux 31	Area 6	Illawarra Prehistory Group 12/10/1989	This small shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art located at this shelter is in very poor condition, and was observed as being much worn in some sections. It is in the same condition as initially recorded by Sefton. The art has had some case hardening occur over the panels which has saved some sections from fading.
Figure 12	52-2-1459	Tega Site 5	Area 6	Illawarra Prehistory Group 17/10/1989	<p>This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is in the same condition as described by Sefton on the AHIMS site card (i.e. poor condition due to natural weathering processes). Tiny cracks associated with weathering processes have started to form over each of the motifs.</p> <p>In addition to the art recorded by Sefton, seven artefacts were relocated in the northern end of the shelters drip line. Four artefacts were made from grey silcrete and three from rose quartz.</p>
Figure 12	52-2-1461	Tega Site 7	Area 6	Illawarra Prehistory Group 12/10/1989	This shelter is formed out of Hawkesbury sandstone by block fall in antiquity. The art is very worn through natural weathering processes, and the open nature of the site. The goanna motif has case hardened due to water wash across the art panel. In addition to the art described on the original recording by Sefton some charcoal indeterminate lines were identified between the Kangaroo and goanna motifs.
Figure 12	52-2-1462	Tega Site 8	Area 6	Illawarra Prehistory Group 12/10/1989	<p>This shelter was formed out of Hawkesbury sandstone by cavernous weathering in antiquity. The art is located on the rear wall, and is in the same condition as initially described by Sefton. Since the original recording some blue crayon graffiti (KW 197?) has been written under the charcoal infill macropod.</p> <p>A wombat has also been burrowing in the floor of the shelter.</p>
Figure 12	52-2-1464	Tega Site 10	Area 6	Illawarra Prehistory Group 10/10/1989	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the roof of the shelter and is in the same condition as initially described by Sefton.
Figure 7	52-2-1467	Tega Site 13	Area 6	Illawarra Prehistory Group 10/10/1989	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the ceiling and comprises of three child's red ochre hand stencils. Unfortunately this shelter's location could not be confirmed during this assessment, so the following details are taken from the original AHIMS recording form.
Figure 12	52-2-1474	Tega Site 20	Area 6	Illawarra Prehistory Group 17/10/1989	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and blockfall in antiquity. The art is located on the rear wall and it is in poor condition, as initially recorded by Sefton due to lichen growth.

Figure Reference	AHIMS ID	Site Name	Investigation Area	Recorded	Description
Figure 12	52-2-1733	Ricki Lee 5	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter. The child hand stencil is in the same condition as initially recorded by Sefton, however part of the red ochre patch has started to exfoliate due to natural weathering processes.
Figure 7	52-2-1734	Ricki Lee 6	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. Located on the rear wall of the shelter are three frontal male figures in charcoal outline with infill. One arms down figure has a 'headdress'. One charcoal indeterminate is located under the western end of the shelter and one charcoal outline with infill male human figure. Could not be relocated due to the AHIMS location data being incorrect.
Figure 7	52-2-1735	Ricki Lee 8	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. Located on the rear wall of the shelter are three frontal male figures in charcoal outline with infill. One arms down figure has a 'headdress'. One charcoal indeterminate is located under the western end of the shelter and one charcoal outline with infill male human figure. Could not be relocated due to the AHIMS location data being incorrect.
Figure 7	52-2-1736	Ricki Lee 10	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the ceiling of the shelter, and survives only where a silica skin has formed over it, due to mineral leeching. Unfortunately this shelter's location could not be confirmed during this assessment, so the following details are taken from the original AHIMS recording form. Could not be relocated due to the AHIMS location data being incorrect
Figure 7	52-2-1737	Ricki Lee 9	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the ceiling of the shelter, and survives only where a silica skin has formed over it, due to mineral leeching. Could not be relocated due to the AHIMS location data being incorrect.
Figure 12	52-2-1747	Upper Avon 53	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter, and comprises a worn red ochre hand stencil; that has faded considerably since Sefton's initial recording; only the three central fingers are still visible.
Figure 12	52-2-1752	Upper Avon 47	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering antiquity. The art is located on the ceiling and back wall of the shelter, and is in the same excellent condition as initially recorded by Sefton, except in a few areas where there has been some microvegetal growth and granular loss.
Figure 12	52-2-1753	Upper Avon 48	Area 5	Illawarra Prehistory Group date 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering. The art is located on the ceiling and back wall of the shelter, and is in the same poor condition as initially recorded by Sefton.
Figure 12	52-2-1755	Upper Avon 50	Area 5	Illawarra Prehistory Group date not specified	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located at the back wall and is in the same condition as initially recorded by Sefton.

Figure Reference	AHIMS ID	Site Name	Investigation Area	Recorded	Description
Figure 12	52-2-1756	Upper Avon 51	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall. The art is located on the backwall and is in the same poor condition as described by Sefton originally.
Figure 12	52-2-1759	Upper Avon 55	Area 5	Illawarra Prehistory Group date not specified	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter, all art except the 'indeterminate' charcoal drawing initially described by Sefton have weathered away, due to the overgrowth of microvegetals and the active chemical weathering at the site.
Figure 12	52-2-1761	Upper Avon 46	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located at the southern end of the shelter with the majority of the motifs being located under the lower ceiling overhang. The art is in the same condition as previously described by Sefton.
Figure 12	52-2-1780	Upper Avon 43	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The shelter is 11 m long, 6.4 m wide and 2.8 m high. The art although generally in poor condition is located mostly on the roof of the shelter and was drawn in charcoal. The motifs comprise of kangaroos, frontal humans and a number of indeterminate lines.
Figure 12	52-2-1782	Upper Avon 45	Area 5	Illawarra Prehistory Group 15/05/1995	The shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter and is in poor condition as recorded by Sefton. The shelter measures 17 m long, 4 m wide and 3.4 m high. Art motifs were drawn in charcoal and red ochre with motifs comprising of male frontal figures as well as a number of indeterminates. The art surfaces have heavy microflora growth due to waterwash and the location of the shelter within the landscape.
Figure 12	52-2-3635	Metro Catchment-Art01	Area 6	Department of Environment and Climate Change 30/09/2008	This shelter is formed out of Hawkesbury sandstone by cavernous weathering in antiquity. The art is located on the ceiling and back wall of the shelter, the art is in excellent condition.
Figure 12	52-2-3730	Ricki Lee 11	Area 5	Illawarra Prehistory Group 13/11/2009	The shelter is formed out of Hawkesbury sandstone by cavernous weathering. The shelter measures 7 m long, 2 m wide and is 1.4 m high. The art comprises 46 red ochre hand stencils and is in the same condition as previously described on site card. The artefacts could not be relocated.
Figure 12	52-2-1757	Upper Avon 52	Area 5	Illawarra Prehistory Group 15/05/1989	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The artefacts initially recorded by Sefton could not be relocated during this assessment. The art comprises of a charcoal indeterminate along the back wall.

Figure Reference	AHIMS ID	Site Name	Investigation Area	Recorded	Description
Records of Shelter with Art and Deposit					
Figure 12	52-2-1451	East Cordeaux 32	Area 6	Illawarra Prehistory Group 12/10/1989	This shelter is formed out of Hawkesbury Sandstone by cavernous weathering and block fall in antiquity. The art that is located at this shelter has been subject to water wash in sections and some case hardening has occurred as a result. The art is located at the northern end of the shelter, and comprises a frontal human figure, one elongated frontal male drawn around a stain on the sandstone and two indeterminates on the rear wall. All motifs are charcoal infill. The artefacts noted in the original recording could not be relocated during this assessment due to the leaf litter cover within the shelter floor.
Figure 12	52-2-1457	Tega Site 2	Area 6	Illawarra Prehistory Group 13/05/1989	<p>This shelter is formed out of Hawkesbury sandstone by block fall and cavernous weathering at the eastern end of the ridgeline in antiquity.</p> <p>Art is present on the rear wall of the shelter, but it is generally in poor condition, due to exfoliation and water wash. The following motifs could not be relocated during this assessment: the human head with upraised right arm and two small charcoal indeterminates.</p> <p>The hammerstone like a small axe head made from a water worn stone was relocated during this assessment.</p>
Figure 12	52-2-1754	Upper Avon 49	Area 6	Illawarra Prehistory Group no date specified	This shelter is formed out of Hawkesbury sandstone by block fall in antiquity. The art is located on the back wall of the shelter, and is in excellent condition at the southwestern end under the roof while scratched drawings have faded considerably.
Figure 12	52-2-1776	Upper Avon 40	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering. The art recorded at this site is in the same condition as previously described by Sefton. During this assessment a further two motifs were identified- Motif 4 a partial charcoal macropod (head only) and a charcoal infill indeterminate.
Figure 12	52-2-1784	Ricki Lee 7	Area 5	Illawarra Prehistory Group 15/05/1995	The shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall and is in the same poor condition as described by Sefton. The artefacts could not be relocated.
Figure 12	52-2-3955	M2D PAD 2	Area 5	Navin Officer Heritage Consultants 15/01/2013	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. Originally this shelter was registered on AHIMS as containing deposit only. During this assessment several art motifs were identified. The art is located on the back wall of the shelter, and are very worn due to water wash.
Records of Shelter with Deposit					
Figure 12	52-2-1778	Upper Avon 41	Area 6	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The artefacts recorded by Sefton could not be relocated during this assessment.
Figure 12	52-2-1775	Upper Avon 39	Area 6	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. During this assessment the three artefacts noted on the site card could not be relocated.

The AHIMS records AHIMS ID #52-2-1280 and #52-2-3635, were determined to be duplicate records. For this reason, AHIMS ID #52-2-1280 is not assessed further in this ACHA. Site reference AHIMS ID #52-2-3635 is used in this report herein, as ground-truthing during the survey showed this record to be the most accurate.

Figure Reference	AHIMS ID	Site Name	Investigation Area	Recorded	Description
				Group no date specified	
Figure 12	52-2-1776	Upper Avon 40	Area 5	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering. The art recorded at this site is in the same condition as previously described by Sefton. During this assessment a further two motifs were identified- Motif 4 a partial charcoal macropod (head only) and a charcoal infill indeterminate.
Figure 12	52-2-1784	Ricki Lee 7	Area 5	Illawarra Prehistory Group 15/05/1995	The shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall and is in the same poor condition as described by Sefton. The artefacts could not be relocated.
Figure 12	52-2-3955	M2D PAD 2	Area 5	Navin Officer Heritage Consultants 15/01/2013	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. Originally this shelter was registered on AHIMS as containing deposit only. During this assessment several art motifs were identified. The art is located on the back wall of the shelter, and are very worn due to water wash.
Records of Shelter with Deposit					
Figure 12	52-2-1778	Upper Avon 41	Area 6	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The artefacts recorded by Sefton could not be relocated during this assessment.
Figure 12	52-2-1775	Upper Avon 39	Area 6	Illawarra Prehistory Group 15/05/1995	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. During this assessment the three artefacts noted on the site card could not be relocated.

The AHIMS records AHIMS ID #52-2-1280 and #52-2-3635, were determined to be duplicate records. For this reason, AHIMS ID #52-2-1280 is not assessed further in this ACHA. Site reference AHIMS ID #52-2-3635 is used in this report herein, as ground-truthing during the survey showed this record to be the most accurate.

9.3.3 Artefact Sites

There was a single isolated artefact recorded on AHIMS within the Subject Area, off Fire Road 6 (Table 13). This site could not be relocated during this assessment, due to the length of time between recording and reassessment as well as the location of the artefact. The artefact may have been washed further down the track during a rain event. Notwithstanding, Avon Dam IF1 is assessed as part of this ACHA.

Table 13: Artefact Sites within the Subject Area

Figure Reference	AHIMS ID	Site Name	No.	Investigation Area	Recorded	Description
Figure 12	52-2-3204	Avon Dam IF1	1	Area 5	Illawarra Prehistroy Group 11/01/2001	The site is recorded on the AHIMS site card as a white quartzite core, measuring 25 mm x 20 mm x 30 mm, with several negative flake scars. The recording further notes that it is unlikely to be <i>in situ</i> due to its location. During this inspection the artefact could not be relocated.

10. Analysis and Discussion

10.1 Site Distribution, Terrain Landform Type and Land Elements

Site distribution within the Subject Area follows the same pattern that has previously been outlined by Biosis Research 2007's predictive model for the archaeological and cultural heritage assessment for Dendrobium Area 3. Due to the rugged nature of the Hawkesbury Sandstone landscape, the majority of the sites suitable for Aboriginal occupation and transient use comprise of sandstone overhangs, as outlined in Section 7.5. Comparing slope analysis and distribution of sites per slope gradient in Diagram 1, 25 of the 49 sites located within the AHIMS search area (highlighted in Figure 7) are located on moderately inclined slopes. In this case moderately inclined slopes are defined as slopes of between 5.75 and 18 degrees, steep is defined as between 18 and 30 degrees. As per Biosis 2007's model the Aboriginal heritage sites located within Dendrobium Areas 5 and 6 are mostly located within the moderate to steep slope set, which are the slope classes where there is the formation of overhangs suitable for use for occupation. A number are also present on the gently inclined slopes that move towards open water ways and large open sandstone platforms that are suitable for axe grinding grooves.

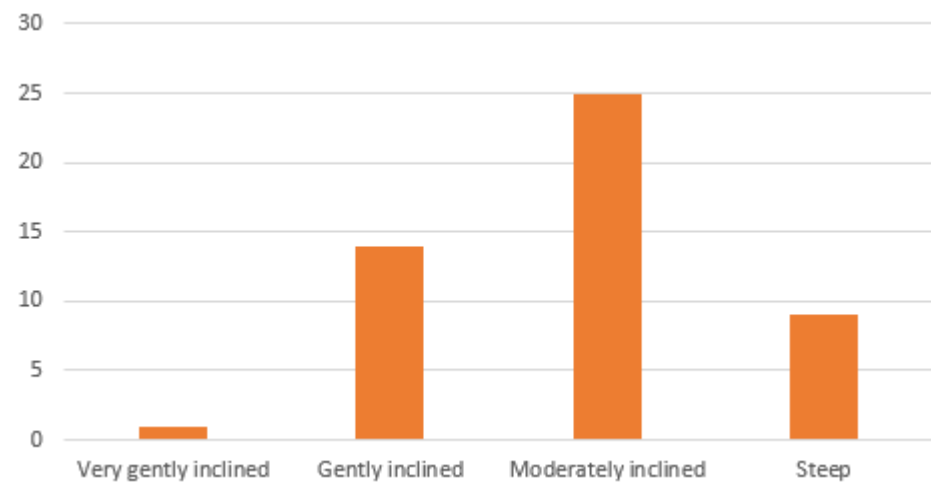


Diagram 1: Histogram of site distribution on slopes

10.2 Artefact Sites

The Subject Area contains only a single Isolated Artefact site. This can be attributed to the landforms within the Hawkesbury Sandstone formation and the vegetation coverage across the underground investigation area and Ventilation Shaft Sites having limited exposure. The location of the Dendrobium Pit Top carpark extension area, whilst having exposure, has been heavily disturbed due to the development of the drill core storage facility, a powerline easement and access road, giving the site low potential for further subsurface archaeological deposits and artefact scatter sites.

10.3 Axe Grinding Groove Sites

The Subject Area contains a relatively high number of grinding groove sites; accounting for 23 of the 58 Aboriginal sites identified within the Subject Area. This can be attributed to the landforms within the Hawkesbury Sandstone formation comprising of large areas of sandstone plateau and large rivers and creeks with sandstone beds suitable for use for the making of stone tools. These sites hold significance to the local Aboriginal community as evidence of past occupation and use of the Subject Area as well as an educational tool for younger generations.

10.4 Sandstone Shelter Sites

Of the 58 Aboriginal cultural heritage sites, 34 comprise sandstone shelter sites that have either one or a combination of deposit, art, or axe grinding grooves. As outlined in Section 10.1, the Hawkesbury Sandstone landform of the Subject Area lends itself to this site type to be used by past Aboriginal peoples for artistic expression, occupation and transient use. Similar to axe grinding grooves, these site types are significant to the local Aboriginal community as they evidence the past occupation of the area, and can be used as an educational tool for younger generations.

Whilst the Subject Area is not large enough to detect major trends in motif types, a number of the motif types have previously been observed during assessment within the adjoining Dendrobium mining lease areas. Sefton suggests (Sefton 1988) that in the area surrounding Lake Avon and Lake Cordeaux, human motifs are relatively more frequent than in the remainder of the region. Examples of human figures within the current Subject Area were assessed at East Cordeaux 31 (AHIMS ID #52-2-1450), East Cordeaux 32 (AHIMS ID #52-2-1451), Tega Site 5 (AHIMS ID #52-2-1459), Tega Site 20 (AHIMS ID #52-2-1474), Upper Avon 43 (AHIMS ID#52-2-1780), Upper Avon 45 (AHIMS ID#52-2-1782), Upper Avon 46 (AHIMS ID#52-2-1754), Metro Catchment-Art01 (AHIMS ID #52-2-3635) and M2D PAD2 (AHIMS ID #52-2-3955). As outlined in Appendix 5 there are a number of other motif types represented including macropods, eels, snakes, bush tucker, gliders, goannas, kangaroos, anthromorphs and children's hand stencils.

As with previous assessments the most common type of expression is charcoal outline/infill. Red ochre is used for outline and solid motifs at Tega Site 20 (AHIMS ID #52-2-1474) and Upper Avon 47 (AHIMS ID #52-2-1752). Red ochre is also used for hand stencils at Ricki Lee 5 (AHIMS ID #52-2-1733), Ricki Lee 11 (AHIMS ID#52-2-3730) and Metro Catchment Art-01 (AHIMS ID #52-2-3635), and a full frontal outline/infill male figure and other indeterminate art at Tega Site 5 (AHIMS ID #52-2-1459). There is one example of a white ochre hand stencil of a fist located at Upper Avon 49 (AHIMS ID#52-2-1754). There are no examples of stencils of feet or material culture such as boomerangs or axes, as has been previously identified within the areas surrounding Tahmoor (Niche 2017b) and Helensburgh (Kayandel Archaeological Services 2008, Niche 2016b and Niche 2016c).

There has been one example where the art has been scratched into the sandstone surface at Upper Avon 49 (AHIMS ID# 52-2-1754).

10.5 Summary

The Subject Area contains a range of archaeological and cultural sites which provide information about past Aboriginal land use and settlement of the area. The types and locations of sites can be interpreted to provide an insight into what events took place in the past, and how the landscape was used in the past.

The sites present represent a range of activities and events, such as living places, stone artefact manufacture, the grinding of stone axes, the use of flaked stone artefacts to prepare foods and utilitarian items, the grinding of plant foods to produce flour and the removal of bark and cambium from trees for utilitarian items such as shelters and coolamon style dishes.

The location of the sites in the Subject Area are dependant in many cases on the natural environment – grinding grooves only occur where there are suitable stone platform outcrops, and sandstone shelters only occur in areas where there are suitable rock formations, which generally occur on moderate and steeply inclined slopes. However, within this framework of the landscape Aboriginal people will have used the land in different ways, at different times and for different purposes – dictated by both utilitarian and non-utilitarian influences and objectives. Resource rich areas such as creeks, and rivers may have been a focus of occupation when resources were abundant or readily available, and hence we expect to find more archaeological sites in association with these landforms. On the other hand, the nature and timing of occupation will also have been dictated by non-utilitarian objectives such as ceremonies, rituals and gatherings.

In conclusion, the archaeological and cultural values work that has been undertaken for the Project provides an insight into past Aboriginal land use within the Subject Area and the wider region. Some of the largest archaeological sites identified are located in close proximity to the Cordeaux River, which would have provided abundant and reliable resources.

11. Cultural Heritage Values and Significance Assessment

11.1 The Burra Charter

The Burra Charter (Australia ICOMOS 2013) defines the basic principles and procedures to be observed in the conservation of important heritage places. It provides a primary and 'best-practice' framework within which decisions about the management of heritage sites in Australia should be made. The Burra Charter and the OEH policy *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) define cultural significance as being derived from the four values presented in Table 14:

Table 14: Definition of Heritage Values of the Burra Charter (Australia ICOMOS 2013)

Value	Description
Aesthetic	This value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.
Historic	This value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.
Scientific	The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.
Social	This value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

11.2 Scientific (Archaeological) Significance Assessment of Aboriginal Heritage Sites

The categorisation into aesthetic, historic, scientific and social values is one approach to understanding the concept of cultural significance. However, more precise categories may be developed as an understanding of a particular place or site increases.

The NSW Aboriginal cultural heritage regulatory framework supports the significance assessment of Aboriginal archaeological sites and provides guidelines for this ACHA within the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011). The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) outlines two main themes in the overall Aboriginal cultural heritage significance assessment process, namely, the identification of the cultural/social significance of Aboriginal objects and/or places to Aboriginal people and the identification of the scientific (archaeological) significance to the scientific/research community. These themes encapsulate those aspects of the Burra Charter that are of particular relevance to Aboriginal objects and places.

The Guidelines specify that information about scientific values will be gathered through archaeological investigation carried out according to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b). The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b) itself does not specify criteria for assessment of Aboriginal objects, but rather suggests to “identify the archaeological values and assess their significance.” The assessment must be supportable and the assessment criteria must reflect best practice assessment processes as set out in the Burra Charter.

Notwithstanding the circularity of this advice, the scientific values described in the Burra Charter (Section 11.1) were considered further by the then NSW National Parks and Wildlife Service in their *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC 1997).

In lieu of specific criteria, the advice from the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC 1997) is summarised and paraphrased below to provide guidance to the assessment of scientific values.

Table 15: Criteria for Assessing Scientific Significance.

Scientific value	Description
Research Potential	It is the potential to elucidate past behaviour which gives significance under this criterion rather than the potential to yield collections of artefacts. Matters considered under this criterion include the intactness of a site, the potential for the site to build a chronology and the connectedness of the site to other sites in the archaeological landscape.
Representativeness	As a criterion, representativeness is only meaningful in relation to a conservation objective. Presumably all sites are representative of those in their class or they would not be in that class. What is at issue is the extent to which a class of sites is conserved and whether the particular site being assessed should be conserved in order to ensure that we retain a representative sample of the archaeological record as a whole. The conservation objective which underwrites the ‘representativeness’ criteria is that such a sample should be conserved.
Rarity	This criterion cannot easily be separated from that of representativeness. If a site is ‘distinctive’ then by definition, it will be part of the variability which a representative sample would represent. The criteria might best be approached as one which exists within the criteria of representativeness, giving a particular weighting to certain classes of site. The main requirement for being able to assess rarity is to determine what is common and what is unusual in the archaeological record, but also the way that archaeology confers prestige on certain sites because of their ability to provide certain information. The criterion of rarity may be assessed at a range of levels including local, regional, state, national, and global.
Educational Potential	This criterion relates to the ability of the cultural heritage item or place to inform and/or educate people about one or other aspects of the past. It incorporates notions of intactness, relevance, interpretative value and accessibility. Where archaeologists or others carrying out cultural heritage assessments are promoting/advocating the educational value of a cultural heritage item or place it is imperative that public input and support for this value is achieved and sought. Without public input and support the educative value of the items/places is likely to not ever be fully realised.
Aesthetics	In relation to heritage places, aesthetic significance is generally taken to mean the visual beauty of the place. Aesthetic value is not inherent in a place but arises in the sensory response people have to it. The guidelines provide no expectation for archaeologists to consider aesthetic values, it is often the case that the aesthetics including the physical setting of an archaeological site or a landscape contributes to its cultural heritage significance. Examples of archaeological sites that may have high aesthetic values include rock art sites or sites located in environments that evoke strong sensory responses.

Educational potential and aesthetic values are not considered to be criteria against which scientific values and significance can be assessed. Aesthetic values should be considered as a distinct category (rather than a criterion that contributes to scientific value) in accordance with the Burra Charter and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011). Educational potential is considered to be a criterion that contributes to social value, rather than scientific value, and hence this is considered below in the overall cultural significance assessment.

The scientific significance assessments for each site, with consideration given to each criterion, are presented in Table 16. There were no observations or finds made at any previously recorded sites that would alter their previously determined significance.

Table 16: Scientific Significance Assessment – Individual Sites

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-3204	Avon Dam IF1	Isolated Find	Area 5	Avon Dam IF 1 is assessed to be of low scientific significance due to the low density nature of the isolated artefact, the moderate level of disturbance has removed the archaeological integrity of the deposit, and the common nature of the raw material.	Low	Low	Low	Low
52-2-4468	Dendrobium ACHA AGG-1	Axe Grinding Groove	Area 5	Dendrobium ACHA AGG-1 is assessed to be of low scientific significance due to the site comprising of a single axe grinding groove only.	Low	Low	Low	Low
52-2-4467	Dendrobium ACHA AGG-2	Axe Grinding Groove	Area 5	Dendrobium ACHA AGG-2 is assessed to be of low scientific significance due to the site comprising thirteen axe grinding grooves, each of the grooves are of a uniform length, as demonstrated at a number of sites within the Dendrobium Mine area.	Low	Low	Low	Low
52-2-4466	Dendrobium ACHA AGG-3	Axe Grinding Groove	Area 5	Dendrobium ACHA AGG-3 is assessed to be of low scientific significance due to the site comprising a single axe grinding groove only.	Low	Low	Low	Low
52-2-4465	Dendrobium ACHA AGG-4	Axe Grinding Groove	Area 5	Dendrobium ACHA AGG-4 is assessed to be of low scientific significance due to the site comprising six axe grinding grooves, each of the grooves are of a uniform length, as demonstrated at a number of sites within the Dendrobium Mine area.	Low	Low	Low	Low
52-2-1278	Wallandoola Site 39	Axe Grinding Groove	Area 6	Wallandoola Site 39 is assessed as having a low scientific significance due to the large number of axe grinding grooves at the site and the close proximity of the site to Metro Catchment-Art01, in antiquity these sites may have been frequented in conjunction with one another.	Low	Low	Low	Low
52-2-1279	Wallandoola Site 38	Axe Grinding Groove	Area 6	Wallandoola Site 38 comprises two axe grinding grooves on the rock platform that makes up the roof of Metro Catchment-Art01, in antiquity this site may have been used in conjunction with the shelter site as well as with Wallandoola Site 39. A moderate scientific significance is given to the site as an overall rating.	Moderate	Moderate	Moderate- Due to its location on the roof of Metro Catchment-Art01	Moderate
52-2-1452	East Cordeaux 33	Axe Grinding Groove	Area 6	East Cordeaux 33 comprises five axe grinding grooves, as a result it is given a low scientific significance rating due to the grooves being of a uniform size, and small in number.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1453	East Cordeaux 34	Axe Grinding Groove	Area 6	East Cordeaux 34 comprises 39 axe grinding grooves that are still visible from the originally recorded 92 axe grinding grooves. The site is given an overall scientific significance rating of moderate, due to the large number of grooves and the rare nature of an axe grinding groove site within the Dendrobium Mine area to have so many.	Low	Moderate- A large number of grooves	Moderate- Due to the number of grooves	Moderate
52-2-1456	Tega Site 1	Axe Grinding Groove	Area 6	Tega Site 1 comprises 40 axe grinding grooves, which are still visible from the originally recorded 55 axe grinding grooves. The site is given an overall scientific significance rating of moderate, due to the large number of grooves and the rare nature of an axe grinding groove site within the Dendrobium Mine area to have so many.	Low	Moderate- A large number of grooves	Moderate- Due to the number of grooves	Moderate
52-2-1460	Tega Site 6	Axe Grinding Groove	Area 6	Tega Site 6 comprises 9 axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1465	Tega Site 11	Axe Grinding Groove	Area 6	Tega Site 11 comprises two axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1466	Tega Site 12	Axe Grinding Groove	Area 6	Tega Site 12 comprises five axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1566	Donalds Castle Creek Site 5	Axe Grinding Groove	Area 5	Donalds Castle Creek Site 5 comprises four axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1568	Donalds Castle Creek Site 7	Axe Grinding Groove	Area 5	Donalds Castle Creek Site 7 comprises seven axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1577	Donalds Castle Creek Site 16	Axe Grinding Groove	Area 5	Donalds Castle Creek Site 16 comprises three axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1578	Donalds Castle Creek Site 17	Axe Grinding Groove	Area 5	Donalds Castle Creek Site 17 comprises three axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1592	Donalds Castle Creek Site 31	Axe Grinding Groove	Area 5	Donalds Castle Creek Site 31 comprises 12 axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1729	Ricki Lee 1	Axe Grinding Groove	Area 5	Ricki Lee 1 comprises two axe grinding grooves, neither of which are still visible, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1730	Ricki Lee 2	Axe Grinding Groove	Area 5	Ricki Lee 2 comprises 15 axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform axe grinding grooves.	Low	Low	Low	Low
52-2-1739	Ricki Lee 12	Axe Grinding Groove	Area 6	Rick Lee 12 comprises 25 axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform grinding grooves.	Low	Low	Low	Low
52-2-1758	Upper Avon 54	Axe Grinding Grooves	Area 6	This site comprises two axe grinding grooves, on a sandstone platform within a creek bed. This shelter's location could not be confirmed during this assessment, so the following details are taken from the original AHIMS recording form.	Low	Low	Low	Low
52-2-1779	Upper Avon 42	Axe Grinding Grooves	Area 6	Upper Avon 42 comprises seven axe grinding grooves, as a result it is given a low scientific significance rating due to the low number of uniform grinding grooves.	Low	Low	Low	Low
52-2-1781	Upper Avon 44	Axe Grinding Grooves	Area 6	Upper Avon 44 comprises three axe grinding grooves, as a result it is given a low scientific significance rating due to the axe grinding grooves no longer being visible.	Low	Low	Low	Low
52-2-4469	Dendrobium ACHA Shelter-1	Shelter with Art	Area 6	Dendrobium ACHA Shelter-1 comprises a sandstone shelter formed through block fall and cavernous weathering. The art comprises two charcoal infill indeterminates. Due to the poor condition of the remaining art at the site it is given a low scientific significance.	Low	Low	Low	Low
AHIMS number pending	Dendrobium ACHA Shelter-2	Shelter with Art	Area 5	Dendrobium ACHA Shelter-2 comprises a sandstone shelter formed through blockfall and cavernous weathering. The art is comprised of two charcoal indeterminate lines. Due to the poor condition of the remaining art at the site it is given a low scientific significance.	Low	Low	Low	Low
52-2-1450	East Cordeaux 31	Shelter with Art	Area 6	East Cordeaux 31 comprises a sandstone shelter with art, the shelter was formed via cavernous weathering. The art is in poor condition, with the sections that have survived having done so due to case hardening of the surfaces. The motifs comprise charcoal indeterminates. Due to the poor condition of the remaining art at the site it is given a low scientific significance.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1457	Tega Site 2	Shelter with Art and Deposit	Area 6	Tega Site 2 comprises a sandstone shelter, that was formed via cavernous weathering and blockfall. The art is in poor condition, due to natural exfoliation and water wash across the panel. A number of motifs could not be relocated during this assessment. Due to the poor condition of the remaining art the site is given a low scientific significance.	Low	Low	Low	Low
52-2-1459	Tega Site 5	Shelter with Art	Area 6	Tega Site 5 comprises a shelter that has formed through cavernous weathering and blockfall processes. The art is in poor condition due to the natural weathering processes that are active across the site, a number of motifs have come off the wall and are now sitting in the floor of the shelter. Due to the poor condition, and the natural weathering processes the shelter is given a low scientific significance.	Low	Low	Low	Low
52-2-1464	Tega Site 10	Shelter with Art	Area 6	Tega Site 10 comprises a sandstone shelter that was formed via cavernous weathering and blockfall. The art is in poor condition, due to water wash adjacent to the art and the natural weathering processes underway at the site. The art remaining comprises two charcoal indeterminate lines. As a result, the site is given a low scientific significance.	Low	Low	Low	Low
52-2-1474	Tega Site 20	Shelter with Art	Area 6	Tega Site 20 comprises a sandstone shelter site that was formed via cavernous weathering and blockfall. The art is in poor condition due to macrovegetal growth across the panel. The motifs of two large red infill ochre figures with wide eyes and raised hands are a rarity within the area. Two previous examples include O'Hares Creek HB 5 (AHIMS ID #52-2-0973) and East Woronora 5 (AHIMS ID #52-2-854) which were both most recently observed during the survey for the Bulli Seam Operations Project. Due to the rarity of these motifs the site is given a high scientific significance.	High- Uncommon motif of men with large eyes and upraised hands. Potential to provide evidence of local chronology	High- Uncommon motif of men with large eyes and upraised hands	High- Uncommon motif of men with large eyes and upraised hands	High. Local
52-2-1733	Ricki Lee 5	Shelter with Art	Area 5	Ricki Lee 5 is a sandstone shelter formed through cavernous weathering and blockfall. The art at the shelter comprises of a single red ochre, child's left hand stencil. Red ochre hand stencils are a frequent motif within the area as a result the site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-1735	Ricki Lee 8	Shelter with Art	Area 6	Ricki Lee 8 is a sandstone shelter formed through cavernous weathering and blockfall. The art in the shelter comprises two charcoal indeterminate lines. These are a frequent motif within the area and as a result the site is given a low scientific significance rating.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1736	Ricki Lee 9	Shelter with Art	Area 6	Ricki Lee 9 is a sandstone shelter formed through cavernous weathering and block fall. The art in the shelter comprises a single red ochre hand stencil, a red ochre indeterminate and two charcoal indeterminates. These are a frequent motif within the area and as a result the site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-1737	Ricki Lee 10	Shelter with Art	Area 6	Ricki Lee 10 is a sandstone shelter formed through cavernous weathering and block fall. The art comprises two red ochre indeterminate lines. These are a frequent motif within the area and as a result the site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-1747	Upper Avon 53	Shelter with Art	Area 5	Upper Avon 53 is a sandstone shelter formed through cavernous weathering and blockfall. The art at the shelter comprises a single red ochre, child's left hand stencil. Red ochre hand stencils are a frequent motif within the area as a result the site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-1752	Upper Avon 47	Shelter with Art	Area 5	Upper Avon 47 is a sandstone shelter formed through cavernous weathering and blockfall. Whilst the art has faded due to pigment loss and some surface flaking, the red ochre motifs are in good condition generally, some of these motifs have been infilled with charcoal. The motifs comprise of macropods, gliders, kangaroos, goannas and 'bush tucker' these motifs are frequently superimposed. Whilst the motifs singly are not rare within the area, they are not often depicted together frequently, the bicolour nature of some of the depictions is also rare within the area. There is one example of a previously registered site within the region that has a bicolour macropod depicted, this site is Flat Rock Creek 305 (AHIMS ID #52-2-3497). As a result of this rarity, the site is given a high scientific significance.	High- Intactness of art motifs, high density of motifs with potential to provide evidence of local chronology	High-Uncommon large amount of animal and 'bush tucker' motifs	High-Uncommon large amount of animal and 'bush tucker' motifs	High, Local
52-2-1759	Upper Avon 55	Shelter with Art	Area 5	Upper Avon 55 is a sandstone shelter formed through cavernous weathering and blockfall. The art is in poor condition due to the rapid nature of the natural weathering processes at this site. Large sandstone blocks have fallen onto the floor of the site, there is only a single charcoal indeterminate still visible on the outside of the shelter. As a result of this the site is given a low scientific significance.	Low	Low	Low	Low
52-2-1778	Upper Avon 41	Shelter with Archaeological Deposit	Area 6	Upper Avon 41 comprises a sandstone shelter formed through cavernous weathering and blockfall. This shelter has deposit only and could not be relocated during this assessment. As a result this site is given a low scientific significance.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1780	Upper Avon 43	Shelter with Art	Area 5	Upper Avon 43 comprises a sandstone shelter formed through cavernous weathering and block fall in antiquity. The art motifs are in the same condition as previously described by Sefton and comprise kangaroos, full frontal female and male figures, as well as a charcoal infill snake. One example of the full frontal female figure has her hands raised above her head- a motif not before seen within the Southern Coalfields. As a result of this grouping of motifs and their rareness to the area this site has been given a high scientific significance.	High- Intactness of art motifs, high density of motifs with potential to provide evidence of local chronology	High-Uncommon layering and grouping of motifs	High-uncommon grouping of motifs	High
52-2-1782	Upper Avon 45	Shelter with Art	Area 5	The shelter is formed out of Hawkesbury Sandstone by cavernous weathering and block fall in antiquity. The art is located on the back wall of the shelter and is in poor condition as recorded by Sefton. Art motifs were drawn in charcoal and red ochre with motifs comprising male frontal figures as well as a number of indeterminates. The art surfaces have heavy microflora growth due to waterwash and the location of the shelter within the landscape. The site has been given a low scientific significance due to the poor condition of the art.	Low	Low	Low	Low
52-2-1784	Ricki Lee 7	Shelter with Art and Deposit	Area 5	Ricki Lee 7 is a sandstone shelter formed through cavernous weathering and block fall in antiquity. The art comprises one charcoal indeterminate line on the backwall. The artefacts described by Sefton could not be relocated during this assessment. As a result this site is given a low scientific significance.	Low	Low	Low	Low
52-2-3635	Metro Catchment- Art01	Shelter with Art	Area 6	Metro Catchment Art01 comprises a sandstone shelter that was formed via cavernous weathering and blockfall. The art is in excellent condition with no natural weathering processes occurring within the shelter. The art comprises of two charcoal line drawings of females, along the bottom of the panel are eleven, superimposed red ochre hand stencils of varying sizes. Images of women giving birth are rare within the area. One previously assessed example is Site 5C No. 1 (AHIMS ID #52-2-0281) which was identified during the survey for the Bulli Seam Operations Project assessment. Due to the rarity of the motif, as well as the overlaid nature of the red ochre hand stencils of varying sizes the shelter is given a high scientific significance.	High-uncommon layering of varying sizes of hand stencils in conjunction with charcoal motifs of females	High- Uncommon layering of hand stencils and charcoal females	High-uncommon motifs	High, Local
52-2-1757	Upper Avon 52	Shelter with Art	Area 5	Upper Avon 52 comprises a sandstone shelter with deposit, shelters with deposit are a frequent site type within the region as a result the site is given a low scientific significance.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-3955	M2D PAD 2	Shelter with Art and Deposit	Area 5	M2D PAD 2 comprises a sandstone shelter with art and deposit. The art is very worn due to water wash. Shelters with deposit are a frequent site type within the region and the art is of a poor quality, as a result the site is given a low scientific significance.	Low	Low	Low	Low
52-2-1451	East Cordeaux 32	Shelter with Art and Deposit	Area 6	East Cordeaux 32 comprises a sandstone shelter formed through cavernous weathering and blockfall. This shelter is within the same ridgeline as East Cordeaux 31 (AHIMS ID #52-2-1450). The art at the shelter has been subject to water wash, there is also some graffiti present on the art panel. As a result of the poor nature of the site, the shelter has been given a low scientific significance.	Low	Low	Low	Low
52-2-1461	Tega Site 7	Shelter with Art	Area 6	Tega Site 7 comprises a sandstone shelter formed through cavernous weathering and block fall. The shelter art comprises a number of charcoal line motifs including a charcoal infill goanna and a number of kangaroo heads, one of which appears to be graffiti. The shelter is rapidly exfoliating and the art only services where case hardening has occurred across the panels. The site has been given a low scientific significance due to the poor nature of the art.	Low	Low	Low	Low
52-2-1462	Tega Site 8	Shelter with Art	Area 6	Tega Site 8 is a sandstone shelter formed through cavernous weathering. The art consists of a partial infill goanna and a complete macropod. There is some blue crayon graffiti and some charcoal graffiti across the panel. The site has been given a low scientific significance due to the poor nature of the art and the graffiti on the art panel.	Low	Low	Low	Low
52-2-1467	Tega Site 13	Shelter with Art	Area 6	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. The art is located on the ceiling and comprises of three child's red ochre hand stencils. Unfortunately this shelter's location could not be confirmed during this assessment, so the following details are taken from the original AHIMS recording form.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1734	Ricki Lee 6	Shelter with Art	Area 6	This shelter is formed out of Hawkesbury sandstone by cavernous weathering and block fall in antiquity. Located on the rear wall of the shelter are three frontal male figures in charcoal outline with infill. One arms down figure has a 'headdress'. One charcoal indeterminate is located under the western end of the shelter and one charcoal outline with infill male human figure. Could not be relocated due to the AHIMS location data being incorrect.	Low	Low	Low	Low
52-2-1753	Upper Avon 48	Shelter with Art	Area 5	Upper Avon 48 comprises a sandstone shelter that was formed through cavernous weathering and blockfall in antiquity. The art comprises an eel, a red ochre hand stencil and a charcoal indeterminate. All of these motif types are common within the area. As a result, this site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-3730	Ricki Lee 11	Shelter with Art	Area 6	The shelter is formed out of Hawkesbury sandstone by cavernous weathering. The shelter measures 7 m long, 2m wide and is 1.4 m high. The art comprises of 46 red ochre hand stencils and is in the same condition as previously described on site card. The artefacts could not be relocated.	High- Large number of layered hand stencils	High- Large number of layered hand stencil, which is uncommon in the Dendrobium Area	High- Uncommon	High
52-2-1754	Upper Avon 49	Shelter with Art and Deposit	Area 5	Upper Avon 49 comprises a sandstone shelter formed through blockfall in antiquity. The art at this shelter is in excellent condition and comprises at least 30 motifs. A number of these motifs are scratched into the sandstone, a technique that is not common within the region, however this has been seen previously within the Dendrobium Area 3B mining area at DM 21 (AHIMS ID#52-2-3645) where a circle is scrated between two red ochre hand stencils. The motifs at this shelter are layered and the application techniques vary from charcoal infill, white ochre hand and fist stencil, scratching and red ochre line drawings. Such a broad range of techniques is rare within the region.	High- uncommon layering of varied application techniques and motif types	High- uncommon motif types (white ochre hand stencils in the Dendrobium Mine area), uncommon application- in the form of scratching	High- uncommon motifs and application techniques	High
52-2-1755	Upper Avon 50	Shelter with Art	Area 5	Upper Avon 50 comprises a sandstone shelter formed through cavernous weathering and blockfall in antiquity. The art comprises charcoal macropod and indeterminate lines. These motif types are common within the area and as a result this site is given a low scientific significance rating.	Low	Low	Low	Low

AHIMS ID	Site Name	Features	Impact Area	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-1756	Upper Avon 51	Shelter with Art	Area 5	Upper Avon 51 comprises a sandstone shelter formed through cavernous weathering and blockfall in antiquity. The art comprises charcoal indeterminate lines. These motif types are common within the area and as a result this site is given a low scientific significance rating.	Low	Low	Low	Low
52-2-1761	Upper Avon 46	Shelter with Art	Area 5	Upper Avon 46 comprises a sandstone shelter formed through cavernous weathering and blockfall in antiquity. The art is in poor condition due to water wear and comprises charcoal indeterminates, two macropods and a partial male figure. These motifs are common within the region and as a result this site is given a low scientific significance.	Low	Low	Low	Low
52-2-1775	Upper Avon 39	Shelter with Archaeological Deposit	Area 5	Upper Avon 39 comprises a sandstone shelter formed through cavernous weathering and blockfall in antiquity. The site type, shelter with deposit is common within the region and as a result a low scientific significance rating is given to the site.	Low	Low	Low	Low
52-2-1776	Upper Avon 40	Shelter with Art and Deposit	Area 5	Upper Avon 40 comprises a sandstone shelter formed through cavernous weathering and blockfall in antiquity. The art is in poor condition and comprises charcoal indeterminates, three macropods and a partial male figure. These motifs are common within the region and as a result this site is given a low scientific significance.	Low	Low	Low	Low

11.4 Statement of Significance

Statements of significance for the Subject Area are presented in the following sub-sections. These statements of significance have been prepared in consideration of comments received from the RAPs during the consultation process, including those comments relating to the cultural significance of all sites and the interrelationships between the cultural and spiritual values with the natural landscape. All comments received from RAPs are considered in Section 4.

11.4.1 Social Value

The Subject Area is of social significance to the Aboriginal community because it contains landscapes and resources that help define the communities' identity. The Subject Area has a rich prehistory as demonstrated by the archaeological record.

11.4.2 Aesthetic Value

The Subject Area has aesthetic values as it is an environmentally intact section of the Woronora Plateau. This intactness is due to the area forming part of the WaterNSW catchment area of the Illawarra and greater Sydney regions. The sandstone shelters and axe grinding groove sites located within this landscape are set within such striking and intact landscapes which further adds to the strong sense of beauty and Aboriginal connectivity to the landscape.

No specific cultural values associated with biodiversity were identified during the current assessment. Previous assessments of the Woronora Plateau have demonstrated that the overall biodiversity of the Woronora Plateau contributes to Aboriginal cultural values because it provides a strong sense of place through the juxtaposition of Aboriginal heritage sites in a dramatic natural bushland setting, the presence of sites and the bush is well known to the community and is a touchstone of identity for Aboriginal people of the Illawarra region (Biosis Research 2009: 78-79).

11.4.3 Historic Value

The Subject Area contains no identified historic values relating to Aboriginal heritage.

11.4.4 Scientific (Archaeological) Value

The Subject Area contains 58 identified Aboriginal archaeological and cultural heritage sites, including sandstone shelters, axe grinding groove sites and an isolated artefact. The archaeological sites within the Subject Area are predominately of low scientific (archaeological) value (approximately 84% of known, and relocated sites), with three sites of moderate (archaeological) value (approximately 7% of known sites). There are a further six sites of high (archaeological) values (approximately 9% of known sites). The Subject Area has the potential to yield information that would contribute to a further understanding of the cultural history of the local area and region. In particular, the nature of past Aboriginal land-use of the Woronora Plateau, and the relationship between past Aboriginal land use and the available resources—including the Cordeaux and Avon Rivers prior to the development of the dams – as expressed through archaeological sites and their context.

11.4.5 Summary

Forty nine of the 58 Aboriginal sites assessed during this Project were identified as having low scientific significance. A further three were determined to be of moderate scientific significance, with six being of a high scientific significance due to the rarity of their motifs and their application within the shelters. A list of Aboriginal sites in the Subject Area, their scientific significance rating and a statement of significance is presented in Table 16. A summary of scientific significance ratings is presented in Table 18.

Table 18: Summary of Scientific Significance Ratings for Aboriginal Sites in the Surface and Underground Investigation Areas

Investigation Area/Scientific Significance Rating	Site Count	Percentage of Sites	Sites
Area 5 and Area 6	58	100%	
<i>Low Significance</i>	49	84%	East Cordeaux 31 (52-2-1450), East Cordeaux 32 (52-2-1451), East Cordeaux 33 (52-2-1452), Tega Site 2 (52-2-1457), Tega Site 5 (52-2-1459), Tega Site 6 (52-2-1460), Tega Site 7 (52-2-1461), Tega Site 8 (52-2-1462), Tega Site 10 (52-2-1464), Tega Site 11 (52-2-1465), Tega Site 12 (52-2-1466), Tega Site 13 (52-2-1467), Donalds Castle Creek Site 5 (52-2-1566), Donalds Castle Creek Site 7 (52-2-1568), Donalds Castle Creek Site 16(52-2-1577), Donalds Castle Creek Site 17 (52-2-1578), Donalds Castle Creek Site31 (52-2-1592), Ricki Lee 1 (52-2-1729), Ricki Lee 2 (52-2-1730), Ricki Lee 5 (52-2-1733), Ricki Lee 6 (52-2-1734), Upper Avon 53 (52-2-1747), Upper Avon 52 (52-2-1757), Upper Avon 55 (52-2-1759), Upper Avon 44 (52-2-1781), Avon Dam IF 1 (52-2-3204), M2D PAD 2 (52-2-3955), Ricki Lee 8 (52-2-1735), Ricki Lee 9 (52-2-1736),Ricki Lee 10 (52-2-1737), Ricki Lee 12 (52-2-1739), Upper Avon 48 (52-2-1753), Upper Avon 50 (52-2-1755), Upper Avon 51 (52-2-1756), Upper Avon 54 (52-2-1758), Upper Avon 46 (52-2-1761), Upper Avon 39 (52-2-1775), Upper Avon 40 (52-2-1776), Upper Avon 41 (52-2-1778), Upper Avon 42 (52-2-1779), Upper Avon 45 (52-2-1782), Ricki Lee 7 (52-2-1784), Wallandoola Site 39 (52-2-1278), Dendrobium ACHA Shelter-1 (52-2-4469), Dendrobium ACHA Shelter-2 (AHIMS Pending), Dendrobium ACHA AGG-1 (52-2-4468), Dendrobium ACHA AGG-2 (52-2-4467), Dendrobium ACHA AGG-3 (52-2-4466) and Dendrobium ACHA AGG-4 (52-2-4465)
<i>Moderate Significance</i>	3	7%	Wallandoola Site 38 (52-2-1279), East Cordeaux 34(52-2-1453) and Tega Site 1 (52-2-1456).
<i>High Significance</i>	6	9%	Tega Site 20 (52-2-1474), Upper Avon 47 (52-2-1752), Upper Avon 49 (52-2-1754), Upper Avon 43 (52-2-1780) and Metro Catchment- Art01 (52-2-3635), Ricki Lee 11 (52-2-3730),
Total	37	100%	

12. Impact Assessment

12.1 Overview of Potential Impacts

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) requires that both direct and indirect harm to Aboriginal objects and Aboriginal places be considered. Generally, direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as an indirect consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area as a result of an activity.

As described in Section 9.3, a total of 58 Aboriginal heritage sites were identified within the Subject Area, including six newly recorded sites and 52 previously recorded sites. Of all the sites identified there was only one site within close proximity to proposed surface infrastructure (Ventilation Shaft Site No. 5B). This was the newly identified Dendrobium ACHA AGG-1 (AHIMS ID#4468) that comprised of a single axe grinding groove within the bed of an unnamed tributary of Donalds Castle Creek. Although located in close proximity to Ventilation Shaft Site No. 5B, this site would not be directly disturbed.

This section provides an impact assessment for the Aboriginal heritage sites located within the Subject Area including potential surface disturbance impacts from both surface infrastructure and ancillary infrastructure (Section 12.2), as well as potential subsidence impacts from underground mining activities (Section 12.3). Section 12.4 provides a summary of the potential impacts and harm from the Project, while Section 12.5 considers potential cumulative impacts on Aboriginal heritage sites.

The potential impacts of the Project have been evaluated in consideration of comments received from the RAPs during the consultation process. These comments include those relating to the archaeological potential of landforms and the likelihood of occurrence and distribution of sites. All comments received from the RAPs are considered in Section 4.

12.2 Potential Impacts from Surface Disturbance

12.2.1 Surface Infrastructure

A detailed description of the surface infrastructure components of the Project is provided in Section 3 of this report, including the development of ventilation shaft sites and proposed carpark extension at the Dendrobium Pit Top.

The main surface infrastructure components of the Project (Section 3) would be developed within the surface investigation areas that cover an area of approximately 51.5 ha (Section 2). Whilst the precise layout and detailed design of the infrastructure components is not yet finalised, disturbance would only occur within this footprint and not all areas would be subject to disturbance. For the purposes of this ACHA it is therefore conservatively assumed that the development of surface infrastructure for the Project would be wholly within the determined footprint and would be of a nature that would cause direct harm to any Aboriginal objects or areas of cultural value located within the footprint.

The direct harm associated with surface disturbance activities is anticipated to cause either a total or partial loss of heritage value at effected sites, and would have a cumulative or landscape impact of partial loss of values for the area as a whole. The activities that may cause harm to Aboriginal objects or areas of cultural value would include:

- vegetation clearance and topsoil stripping;
- disturbance of soil units or the ground surface with Aboriginal objects on the surface or within the soil profile;
- changes to a site or place's context that has secondary impacts to the site or place, resulting in the loss of cultural values; and
- excavation works and the removal and redistribution of soil by heavy machinery during site regrading or development of suitable surface conditions for various construction activities.

The proposed surface infrastructure avoids all rock shelters, grinding grooves and natural landscape features and therefore there would be no potential surface disturbance impacts to any of these site types or any sites with moderate or high scientific significance. Although located in close proximity to Ventilation Shaft Site No. 5B, site Dendrobium ACHA AGG-1 (AHIMS ID#52-2-4468) would not be directly impacted as measures would be implemented to avoid impacts during construction.

12.2.2 Ancillary Infrastructure

In addition to the proposed surface disturbance works located within the surface investigation area (Figure 2 to Figure 4) the Project also includes ancillary infrastructure. Ancillary infrastructure comprises minor surface infrastructure, although the location of such infrastructure cannot be determined at this stage in the Project. Ancillary infrastructure includes, for example, the following activities:

- The construction and/or maintenance of access tracks (e.g. for the installation and/or maintenance of surface infrastructure).
- Internal Project power infrastructure.
- Minor infrastructure such as water pipelines.
- Surface works associated with emergency and communication systems.
- Service boreholes (e.g. air, diesel and water supply) and related infrastructure.
- Subsidence monitoring.
- Subsidence remediation works (where required).
- Surface rehabilitation works (where required).
- Other associated minor infrastructure, plant, equipment and activities.

The location and design of ancillary infrastructure would be flexible and would be located in an attempt to avoid Aboriginal heritage sites and areas of cultural sensitivity as far as practicable. The location of the ancillary infrastructure would be determined as required over the life of the Project.

While the design and location of the ancillary infrastructure is somewhat flexible, some Aboriginal heritage sites may not be able to be avoided completely. Where this occurs, appropriate management measures would be implemented including salvage activities where necessary (Section 14).

12.3 Potential Impacts from Subsidence

Subsidence predictions for the Subject Area (including specific predictions for Aboriginal heritage sites) have been provided by Mine Subsidence Engineering Consultants (MSEC) (MSEC856 2018-Appendix 8). The subsidence predictions are informed by previous experience of underground mining in the region as well as an understanding of the geological formations in the Subject Area.

As described in Section 3, the Project would involve longwall mining in Area 5 and Area 6. The area that has been assessed for these underground mining areas in this ACHA covers approximately 4,033 ha (Section 2).

Longwall Mining

Longwall mining involves removing rectangular sections of coal from between supported underground roadways by cutting a wide, continuously retreating panel of the coal (the longwall). The roof of the mine is held up by hydraulic jacks, which are moved behind the retreating face where coal is cut. Once moved the jacks no longer support the roof and the roof collapses into the void left behind. This process can result in the subsidence of the ground surface above the mine (NSW Minerals Council 2013).

Impacts of Subsidence on Aboriginal Heritage

The potential for mine subsidence induced ground movements to harm Aboriginal objects or areas of Aboriginal cultural value is dependent on many factors, including the nature of the Aboriginal objects or areas of cultural value themselves. MSEC (2014:33) describes how longwall mining can result in the cracking, heaving and stepping at the ground surface. The magnitude of these effects is largely dictated by factors such as the mine's geometry, the depth of cover (how deep the coal is below the ground surface), the extracted seam thickness, the geology above the mine, and the presence of geological features such as joints or faults, especially near the ground surface.

In the case of Aboriginal cultural heritage, the nature of the heritage sites and features is also a very important consideration in the potential effects of subsidence induced ground movements. Whether a site is an open site with stone artefacts, or a culturally significant area, or whether the site is a rock shelter or grinding groove platform are important considerations in determining the likely impact, if any.

In the case of open sites that occur in an area with a soil profile, subsidence induced ground movements will result in stresses and strains generally within the tolerance limits of the soil profile (therefore showing little to no impact on the surface), although isolated cracking of soils at the surface may occur (MSEC 2014:34). If this cracking is coincident with a surface Aboriginal heritage site or object, then it could be impacted. This is considered a low risk and the greater risk to sites in this instance may be from remediation measures, such minor earthworks as described below. Other possible impacts may be from changes to surface or sub-surface drainage, which may alter local erosion and potentially expose, slump or bury sites. Such cases, especially in respect of isolated objects, would be very difficult to predict. MSEC (2014:33) note that whilst cracks can occur above the longwall as the subsidence trough develops, larger cracks that may require remediation generally only occur on the surface at an area coincident with the perimeters of the longwalls. In some cases, where steep slopes are present, large surface cracks can develop due to downslope mass movement triggered by subsidence related ground movements.

For sites which occur on bedrock platforms, or in areas where the landscape is comprised of rock formations (such as sandstone and rock outcrops) the risks of harm to the sites are greater than for open sites on soil landscapes. These sites are mostly grinding groove platforms. When observed as surface effects, bedrock or rock formations will behave differently than soil to the strains and pressures associated with subsidence induced ground movements. For rock platforms there is a risk that the rock will buckle and deform, and the types of changes that can occur in this case are cracking or delamination of the surface strata (MSEC 2014). For rock shelters the types of changes can include cracking, delamination of surface rock, exfoliation, block fall and in some cases overhang collapse (although this has never been documented within the Dendrobium Mine area) or slumping of rock.

For rock shelters, the types of changes will be similar or identical to those that would be expected due to natural weathering processes, but exacerbated by subsidence. For example, a naturally weathering block which will have detached and fallen at some point in time may be detached and fall sooner due to differential movements of the rock strata induced by subsidence (Biosis Research and The Ecology Lab 2007: 29).

Monitoring of the effects of subsidence induced ground movements to Aboriginal heritage sites (such as rock shelters and grinding groove platforms) has been conducted since the 1990s (see Sefton 2000, Biosis Research 2007, Biosis Research 2009, ERM 2010, Kayandel 2008, Niche 2013 to 2017). Previous experience shows that approximately 1 in 10 rock-based sites that have been subjected to subsidence induced ground movements show demonstrable changes that can be attributed to subsidence. These changes take the form of block fall, exfoliation, cracking, opening and/or closing of existing faults and fissures (Biosis Research 2009).

Preventative management measures can be implemented in some circumstances, but for the most part the management of Aboriginal heritage sites relies on monitoring of the sites and implementing pre-arranged management responses should they be triggered by harm to the site. For most Aboriginal heritage sites there are often no suitable remediation measures as these can often be more intrusive and harmful to heritage value than the effects of the subsidence, which as described above is usually an extension or acceleration of pre-existing natural weathering processes. As an example, the process of accessing a site and cutting stress relief slots, which requires heavy drilling or sawing machinery, in close proximity to a grinding groove platform would be likely to be more damaging to the site and its cultural context than the subsidence induced cracking or shearing of surface strata.

For the Project, the consideration of potential harm to Aboriginal heritage sites from subsidence induced ground movements falls into three distinct categories:

- sites relatively more susceptible to harm from subsidence (e.g. grinding groove platforms, rock shelters);
- sites relatively less susceptible to harm from subsidence (e.g. open artefact sites); and
- other sites of cultural value where landscape changes (such as mass movement) may impact heritage values.

Table 19 to Table 21 present the subsidence predictions for each of the Aboriginal heritage sites located within the Subject Area that would not otherwise be impacted by surface disturbance works associated with the surface and ancillary infrastructure described in Section 12.2.

12.3.1 Open Artefact Sites

There is one open site located within the Subject Area (which comprises of one stone artefact). Table 19 provides a summary of the subsidence predictions for Avon Dam IF 1 (AHIMS ID #52-2-3204). Avon Dam IF 1 (AHIMS ID #52-2-3204) is predicted to experience less than 20 mm vertical subsidence. Whilst the site may experience very low levels of vertical subsidence, it is not expected to experience measurable tilts, curvatures or strains (MSEC 2017: 56). Being located approximately 510 m west of the proposed Dendrobium Area 5 longwalls it is unlikely that cracking in the surface soils would occur in the location of the artefact, due to this distance. It is expected, therefore, that the isolated find would experience no adverse impacts due to the proposed mining (MSEC 2017:57).

Table 19: Subsidence Predictions for Artefact Scatters and Isolated Finds within the Subject Area

AHIMS ID	Site Name	Scientific Significance	Location	Predicted Total Subsidence (mm)	Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km ⁻¹)	Maximum Predicted Sagging Curvature (km ⁻¹)
52-2-3204	Avon Dam IF1	Low	Area 5	<20	<0.5	<0.01	<0.01

12.3.2 Rock Shelter Sites

There are 34 sandstone rock shelter sites identified within the Subject Area, nine of these sites (Donalds Castle Creek Site 6 [AHIMS ID #52-2-1567], Upper Avon 55 [AHIMS ID#52-2-1759], Upper Avon 43 [AHIMS ID# 52-2-1780], Upper Avon 45 [AHIMS ID # 52-2-1782], Upper Avon 53 [AHIMS ID #52-2-1747], M2D PAD [AHIMS ID #52-2-3955] and Dendrobium ACHA Shelter-2 [AHIMS ID#pending]) are located directly over the proposed longwalls in Area 5. Further to this, Dendrobium ACHA Shelter-1 [AHIMS ID# 52-2-4469] and Tega Site 10 (AHIMS ID #52-2-1464) are located over the proposed longwalls within Area 6.

MSEC (2018) has predicted that the maximum tilt for the rock shelters is 20 mm/m. The maximum predicted curvatures are 0.60 km⁻¹ hogging and 0.45 km⁻¹ sagging, which represent as minimum radii curvatures of 1.7 km and 2.2 km respectively (MSEC 2018: 92).

The potential for adverse effects to rock shelters located directly over the longwalls is assessed by MSEC as being unlikely (MSEC 2018:94).

The remaining shelter sites (23) are located outside of the extent of the proposed longwalls and are expected to experience less than 20 mm vertical subsidence, they are also not expected to experience measurable conventional tilts, curvatures, strains or valley related upsidence or compressive strains due to valley closure (MSEC856 2018:94). However Upper Avon 47 [AHIMS ID352-2-1752] and Ricki Lee 8 [AHIMS ID #52-2-1735] are predicted to experience vertical subsidence of 50 mm and 100mm, respectively.

Table 20 provides the subsidence predictions for the rock shelter sites within the Subject Area.

Table 20: Subsidence Predictions for the Rock Shelters within the Subject Area

AHIMS ID	Site Name	Scientific Significance	Location	Predicted total vertical subsidence (mm)	Predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km ⁻¹)	Maximum predicted total sagging curvature (km ⁻¹)
52-2-4469	Dendrobium ACHA Shelter-1	Low	Area 6	200	4.0	0.08	0.03
AHIMS ID pending	Dendrobium ACHA Shelter-2	Low	Area 6	775	20.0	0.50	0.20
52-2-1450	East Cordeaux 31	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1451	East Cordeaux 32	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1457	Tega Site 2	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1459	Tega Site 5	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1461	Tega Site 7	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1462	Tega Site 8	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1464	Tega Site 10	Low	Area 6	875	6.0	0.13	0.09
52-2-1467	Tega Site 13	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1474	Tega Site 20	High	Area 6	<20	<0.5	<0.01	<0.01
52-2-1567	Donalds Castle Creek Site 6		Area 5	275	6.0	0.12	0.02
52-2-1733	Ricki Lee 5	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1735	Ricki Lee 8	Low	Area 5	100	3.5	0.07	0.04
52-2-1736	Ricki Lee 10	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1737	Ricki Lee 10	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1747	Upper Avon 53	Low	Area 5	800	2.0	0.10	0.05
52-2-1752	Upper Avon 47	High	Area 5	50	1.0	0.02	<0.01
52-2-1753	Upper Avon 48	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1754	Upper Avon 49	High	Area 5	<20	<0.5	<0.01	<0.01
52-2-1755	Upper Avon 50	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1756	Upper Avon 51	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-3730	Ricki Lee 11	High	Area 5	<20	<0.5	<0.01	<0.01
52-2-3635	Metro Catchment-Art01	High	Area 6	<20	<0.5	<0.01	<0.01
52-2-1757	Upper Avon 52	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1759	Upper Avon 55	Low	Area 5	625	17.0	0.35	0.05
52-2-3955	M2D PAD 2	Low	Area 5	1050	12.0	0.25	0.04
52-2-1451	East Cordeaux 32	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1761	Upper Avon 46	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1775	Upper Avon 39	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1776	Upper Avon 40	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1778	Upper Avon 41	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1780	Upper Avon 43	High	Area 5	1650	10.0	0.12	0.18
52-2-1782	Upper Avon 45	Low	Area 5	1250	20.0	0.60	0.45

12.3.3 Axe Grinding Grooves

There is a total of 22 grinding groove sites identified within the Subject Area, eight of these sites (Donalds Castle Creek Site 5 [AHIMS ID #52-2-1566], Donalds Castle Creek 31 [AHIMS ID #52-2-1592], Upper Avon 54 [AHIMS ID#52-2-1758], Upper Avon 42 [AHIMS ID#52-2-1779], Dendrobium ACHA AGG-4 [AHIMS ID #52-2-4465], Dendrobium ACHA AGG-3 [AHIMS ID#52-2-4466], Dendrobium ACHA AGG-2 [AHIMS ID#52-2-4467] and Dendrobium ACHA AGG-1 [AHIMS ID #52-2-4468]) are located above the proposed longwalls within Area 5. Further to this, three sites (Tega Site 1 [AHIMS ID #52-2-1456], Tega Site 11 [AHIMS ID #52-2-1465] and Tega Site 12 [AHIMS ID #52-2-1466]) are located over the proposed longwalls within Area 6. All three of these sites are located on sandstone platforms that align with waterways.

MSEC (2018) has predicted that the maximum predicted total conventional subsidence across any grinding groove site within the Subject Area is 2,150 mm, with a maximum predicted total conventional tilt of 16 mm/m, maximum predicted total conventional hogging curvature of 0.30 km^{-1} and a maximum predicted total conventional sagging curvature of 0.40 km^{-1} , which represents minimum radii curvatures of 3.3 km and 2.5km, respectively.

The extraction of the proposed longwalls is likely to result in the fracturing of platforms along waterways. The fracturing is expected to predominately occur directly above the proposed longwalls and, to a lesser extent within the 35 degree angle of draw. Minor and isolated fracturing could occur up to approximately 400 m from the proposed longwalls (MSEC 2018: 94).

Similar to rock shelter sites, it is extremely difficult to “assess the likelihood that fracturing would be coincident with the grinding groove sites themselves, as this is dependent on the localised response of the bedrock to the mining-induced ground movements. The potential for impacts on the grinding groove sites have been based on the previous experience of mining longwalls directly beneath these types of sites within the Southern Coalfield” (MSEC 2018: 94).

Potential of adverse impacts on grinding groove sites located directly above longwalls has been assessed by MSEC as unlikely. It is possible however, sites that lie over longwalls would be impacted by fracturing of the bedrock due to the proposed mining (MSEC 2018: 94).

Table 21 provides the subsidence predictions for axe grinding groove sites within the Subject Area.

Table 21: Subsidence Predictions for Grinding Groove Sites within the Subject Area

AHIMS ID	Site Name	Scientific Significance	Location	Predicted Total Subsidence (mm)	Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km ⁻¹)	Maximum Predicted Sagging Curvature (km ⁻¹)
52-2-4468	Dendrobium ACHA AGG-1	Low	Area 5	600	3.0	0.11	0.02
52-2-4467	Dendrobium ACHA AGG-2	Low	Area 5	1250	11.0	0.30	0.25
52-2-4466	Dendrobium ACHA AGG-3	Low	Area 5	725	1.5	0.07	0.06
52-2-4465	Dendrobium ACHA AGG-4	Low	Area 5	950	8.0	0.20	0.05
52-2-1278	Wallandoola Site 39	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1279	Wallandoola Site 38	Moderate	Area 6	<20	<0.5	<0.01	<0.01
52-2-1452	East Cordeaux 33	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1453	East Cordeaux 34	Moderate	Area 6	<20	<0.5	<0.01	<0.01
52-2-1456	Tega Site 1	Moderate	Area 6	1700	16.0	0.25	0.05
52-2-1460	Tega Site 6	Low	Area 6	<20	<0.5	<0.01	<0.01
52-2-1465	Tega Site 11	Low	Area 6	1850	15.0	0.20	0.16
52-2-1466	Tega Site 12	Low	Area 6	2150	16.0	0.12	0.40
52-2-1566	Donalds Castle Creek Site 5	Low	Area 5	650	13.0	0.20	0.17
52-2-1568	Donalds Castle Creek Site 7	Low	Area 5	40	1.0	0.03	<0.01
52-2-1577	Donalds Castle Creek Site 16	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1592	Donalds Castle Creek Site 31	Low	Area 5	1250	11.0	0.20	0.25
52-2-1729	Ricki Lee 1	Low	Area 5	<20	<0.5	0.03	<0.01
52-2-1730	Ricki Lee 2	Low	Area 5	30	1.5	0.06	<0.01
52-2-1739	Ricki Lee 12	Low	Area 5	<20	<0.5	<0.01	<0.01
52-2-1758	Upper Avon 54	Low	Area 5	325	3.5	0.10	0.01
52-2-1779	Upper Avon 42	Low	Area 5	1150	10.0	0.18	0.06
52-2-1781	Upper Avon 44	Low	Area 5	20	1.0	0.06	<0.01

12.4 Summary of Potential Impacts

For the purposes of this ACHA (and as described in Section 12.3 above), some Aboriginal heritage sites located within the underground investigation areas have the potential to be impacted by subsidence.

12.4.1 Potential Impacts

Table 22 provides a summary of the potential impacts of the Project on Aboriginal heritage sites within the Subject Area, including the potential type of impact on each site (i.e. surface impacts, subsidence impacts or no impacts).

Table 22: Summary of Potential Impacts of the Project on Aboriginal Heritage Sites and Summary of Potential Harm

AHIMS ID	Site Name	Site Type	Scientific Significance	Location ¹	Impact Type	Type of Harm (Direct/Indirect/None) ¹	Degree of Harm (Total/Partial/None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value) ²
52-2-3204	Avon Dam IF1	Isolated Find	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-4468	Dendrobium ACHA AGG-1	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Total	Total Loss of Value
52-2-4467	Dendrobium ACHA AGG-2	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Partial	Total Loss of Value
52-2-4466	Dendrobium ACHA AGG-3	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Partial	Total Loss of Value
52-2-4465	Dendrobium ACHA AGG-4	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Partial	Total Loss of Value
52-2-1278	Wallandoola Site 39	Axe Grinding Groove	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1279	Wallandoola Site 38	Axe Grinding Groove	Moderate	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1452	East Cordeaux 33	Axe Grinding Groove	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1453	East Cordeaux 34	Axe Grinding Groove	Moderate	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1456	Tega Site 1	Axe Grinding Groove	Moderate	Area 6	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1460	Tega Site 6	Axe Grinding Groove	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1465	Tega Site 11	Axe Grinding Groove	Low	Area 6	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1466	Tega Site 12	Axe Grinding Groove	Low	Area 6	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1566	Donalds Castle Creek Site 5	Axe Grinding Groove	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1568	Donalds Castle Creek Site 7	Axe Grinding Groove	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)

AHIMS ID	Site Name	Site Type	Scientific Significance	Location ¹	Impact Type	Type of Harm (Direct/Indirect/None) ¹	Degree of Harm (Total/Partial/None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value) ²
52-2-1577	Donalds Castle Creek Site 16	Axe Grinding Groove	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1578	Donalds Castle Creek Site 17	Axe Grinding Groove	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1592	Donalds Castle Creek Site 31	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1729	Ricki Lee 1	Axe Grinding Groove	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1730	Ricki Lee 2	Axe Grinding Grooves	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1739	Ricki Lee 12	Axe Grinding Grooves	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1758	Upper Avon 54	Axe Grinding Grooves	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1779	Upper Avon 42	Axe Grinding Grooves	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1781	Upper Avon 44	Axe Grinding Groove	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-4469	Dendrobium ACHA Shelter-1	Shelter with Art	Low	Area 6	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
AHIMS number pending	Dendrobium ACHA Shelter-2	Shelter with Art	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1450	East Cordeaux 31	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1459	Tega Site 5	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1461	Tega Site 7	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1462	Tega Site 8	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)

AHIMS ID	Site Name	Site Type	Scientific Significance	Location ¹	Impact Type	Type of Harm (Direct/Indirect/None) ¹	Degree of Harm (Total/Partial/None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value) ²
52-2-1464	Tega Site 10	Shelter with Art	Low	Area 6	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1467	Tega Site 13	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1474	Tega Site 20	Shelter with Art	High	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1733	Ricki Lee 5	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1734	Ricki Lee 6	Shelter with Art	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1735	Ricki Lee 8	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1736	Ricki Lee 9	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1737	Ricki Lee 10	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1747	Upper Avon 53	Shelter with Art	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1752	Upper Avon 47	Shelter with Art	High	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1753	Upper Avon 48	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1755	Upper Avon 60	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1756	Upper Avon 51	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1759	Upper Avon 55	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1761	Upper Avon 46	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)

AHIMS ID	Site Name	Site Type	Scientific Significance	Location ¹	Impact Type	Type of Harm (Direct/Indirect/None) ¹	Degree of Harm (Total/Partial/None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value) ²
52-2-1780	Upper Avon 43	Shelter with Art	High	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1782	Upper Avon 45	Shelter with Art	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-3635	Metro Catchment-Art01	Shelter with Art	High	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-3730	Ricki Lee 11	Shelter with Art	High	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1757	Upper Avon 52	Shelter with Art	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-3955	M2D PAD 2	Shelter with Art and Deposit	Low	Area 5	Potential subsidence	Direct	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1775	Upper Avon 39	Shelter with Deposit	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1778	Upper Avon 41	Shelter with Deposit	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1451	East Cordeaux 32	Shelter with Art and Deposit	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1457	Tega Site 2	Shelter with Art and Deposit	Low	Area 6	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1754	Upper Avon 49	Shelter with Art and Deposit	High	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1776	Upper Avon 40	Shelter with Art and Deposit	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)
52-2-1784	Ricki Lee 7	Shelter with Art and Deposit	Low	Area 5	Potential subsidence	Indirect	Partial	Partial Loss of Value (aesthetic/visual)

¹ Sites located outside the predicted 20mm subsidence contour, with the exception of those located near or within valley bases for example axe grinding grooves are unlikely to experience direct or indirect impacts. Sites located near valley bases could potentially be affected by valley closure effects. Minor and isolated fracturing have been observed up to 400 m away from mining within the Southern Coalfield. The likelihood of the fracture to be coincidence with the sites located outside the Subject Area is considered to be very low. As a result, indirect harm is attributed in this case as it is an impact to the surrounding landscape as opposed to the actual Aboriginal cultural heritage site.

² The code does not provide definitions for these categories, however they are taken to mean:

Type of harm: Direct- the object will or may be subject to direct physical disturbance. Indirect- there may be secondary consequences from the activity, resulting in harm. None- neither the object nor its context will be altered.

Degree of harm: Total: the object(s) will be directly harmed in their entirety. Partial- some objects will be directly or indirectly harmed, however a portion of a site may remain unaffected. None- there will be no harm.

Consequence of harm: Total loss of value- no heritage values will remain subsequent to the harm. Partial loss of value- some heritage values will remain subsequent to the harm. No loss of value- there will be no harm, and no loss of value.

Although located in close proximity to Ventilation Shaft Site No. 5B, site Dendrobium ACHA AGG-1 would not be directly impacted as avoidance of this site is expected due to its location within an unnamed tributary of Donalds Castle Creek to the south of the ventilation shaft location.

12.4.2 Potential Harm

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) requires that both direct and indirect harm be considered. Generally, direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as a consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area.

The Project has the potential to harm Aboriginal objects and Aboriginal cultural values during both the development phase and the operational phase. During the development phase potential harm and impacts may result from the development of surface infrastructure (e.g. land clearing and ground disturbance for the establishment of transport corridors and facilities). During the operational phase of the Project potential harm and impacts may be derived from subsidence induced ground movements and may also be derived from any works associated with subsidence remediation or ancillary infrastructure such as goaf gas drainage or environmental monitoring locations.

As required by the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b), the likely impacts (and partial loss of value) to Aboriginal heritage sites as a result of the Project is presented in Table 22.

12.5 Potential Cumulative Impacts

The Project would cause a minor increase to the cumulative development impact on the Aboriginal cultural heritage of the region and local area. The Aboriginal heritage of the area has had limited impacts to it due to the area being used as a water catchment for the past 100 years. Sites that have been impacted within the catchment area have, for the large majority, been impacted by subsidence that is a result of longwall mining or by environmental processes. Within the Southern Coalfield, Sefton (2000) conducted a long term monitoring program that reviewed the effects of longwall mining to sandstone shelter sites over a ten year period. During her assessment Sefton monitored 52 Aboriginal sites; prior to, during and after longwall mining had been completed (Sefton 2000:15). The results of this study were:

- Five of the 52 sites had evidence of impacts that related to longwall extraction methods.
- Impacts associated with longwall mining can be grouped into four distinct categories:
 - cracking;
 - movement along existing joints and/or bedding planes;
 - changes to the water seepage patterns through the sandstone; and
 - blockfalls.
- Elements of shelters that were associated with the highest risk of impact were:
 - Size of the overhang, including the length of the ridgeline.
 - Wetness of the overhang.
 - Location in regards to the valley base.
 - Location of the shelter, in regards to the goaf.
 - Shelters formed through blockfall.
- During Sefton's monitoring program, there were no collapsed shelters identified.

- No shelters with an area of less than 50 cubic metres (m³) had been impacted due to subsidence.
- Not all shelters that were identified as being larger than 50 m³ had been impacted.
- Any impacts caused by subsidence were not observed until at least three months after the completion of extraction.
- ‘The over-riding factor which appears to be significant is overhang size, where large overhangs are at greater risk’ (Sefton 2000:38).

The *Impacts of Underground Coal Mining on Natural Features in the Southern Coal Field: Strategic Review* (NSW Department of Planning 2008) considered past and potential impacts of mine related subsidence on significant natural features within the Southern Coalfield. The objectives of the inquiry were to:

- Undertake a review of the impacts of longwall extraction within the Southern Coalfields significant natural features (rivers, significant streams, swamps and cliff lines), concentrating on risks to water flow, quality and ecosystems.
- Provide advice on best practise in regards to subsidence impacts, avoidance and/or minimising impacts on significant natural features; as well as the management, monitoring and remediation of any adverse effects.
- Report on the social and economic significance of the coal resources within the region.

In relation to Aboriginal heritage the summary of the report states that ‘Aboriginal heritage sites are most at risk of subsidence impacts where they are located in cliff lines and/or rock overhangs. The Panel was not made aware of any significant impacts having occurred on Aboriginal heritage features in the Southern Coalfields since the 1980s’ (NSW Department of Planning 2008: 2).

Impacts on natural features such as cliff lines, watercourses and valleys were described during the inquiry as having been associated with ‘non-conventional’ subsidence (NSW Department of Planning 2008: 82). The measures for predicting valley closure and upsidence were judged to be the most valuable when determining impacts on these landforms.

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) defines ecologically sustainable development and inter-generational equity as follows, “the principle of inter-generational equity holds that the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations”. When considered against the principles of inter-generational equity and ecologically sustainable development, the potential impacts of the Project can be considered relatively minor because they directly harm only a relatively small number of sites, one of moderate scientific value, one of high significance and the remaining being of low scientific value. There is no significant detrimental effect to quality or benefit that the Aboriginal history and archaeology of the Subject Area may provide to future generations. There is reciprocal cumulative growth of the understanding of the Subject Area’s history and prehistory which provides some amelioration of any adverse impacts, and which provides knowledge and information for future generations.

12.5.1 Potential Cumulative Impacts - Within the Southern Coalfield

Since the monitoring work completed by Sefton between 1990 and 2000, archaeological monitoring programs 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. The following discussion outlines the results of these monitoring programs in comparison to Sefton's original conclusions.

Aboriginal cultural heritage site monitoring programs have been developed and implemented across the Southern Coalfield in the past 17 years (Biosis Research 2008, 2009a, 2009b 2009c, 2011, 2013, 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, 2017a and 2017b and Sefton 2000, 2002a, 2002b, 2002c). The methodology of these programs is very similar to that outlined in Sefton (2000). Initial baseline recording is completed on those sites that are identified by subsidence consultants 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. Sandstone platform sites can be located within creek and river beds on large plateaus, often within or at the edge of swamps on platforms that make up shelter roofs. Stone artefact scatters, isolated artefacts and scarred trees, as outlined in Section 12.3 of this assessment, are often not monitored routinely as they are highly unlikely to be affected by subsidence, and hence the risk attributed to these site types is negligible.

At the completion of baseline recording, Aboriginal cultural heritage sites are often monitored a second time in line with the individual project's monitoring requirements, generally within 6 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 206 Aboriginal cultural heritage sites have been monitored since 1990 (Regal and Reeves 2017). The site types that have been monitored are outlined in Table 23 below.

Table 23: Aboriginal cultural heritage site types monitored within the Southern Coalfields

Site type	Number of type	Percentage
Sandstone shelter with art	114	51%
Sandstone shelter with deposit	27	12%
Sandstone shelter with art and deposit	25	20%
Single axe grinding groove	4	2%
Axe grinding grooves	15	6%
Engraving	1	0.5%
Engraving and axe grinding groove	1	0.5%
Sandstone shelter with art, deposit and axe grinding grooves	2	1%
Shelter with art and PAD	2	1%
Sandstone shelter with PAD	14	5%
Sandstone shelter with art, PAD and deposit	1	0.5%
Totals	206	100%

Of the 206 Aboriginal heritage sites monitored, 22 sites were identified as having impacts or changes that may be attributable to subsidence, environmental factors or a combination of both (Table 24). This number

equates to approximately 11% of all the Aboriginal cultural heritage sites monitored (Regal and Reeves 2017).

Table 24: Aboriginal sites within the Southern Coalfields observed to have subsidence related changes, during monitoring programs

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel or heritage value affected	Reference
52-2-0094	Flat Rock Creek 4	Sandstone shelter with art	Opening of existing bedding planes, along the roof/ rear wall and minor roof fall.	No	Kayandel Archaeological Services 2008
52-2-0106	Flat Rock Creek 10	Sandstone shelter with art	Cracks in rear wall, potential for altered seepage to impact art-mitigated with an artificial drip-line.	No	Kayandel Archaeological Services 2008
52-2-0089	Flat Rock Creek 11	Sandstone shelter with art	Exfoliation and block fall at rear wall.	No	Kayandel Archaeological Services 2008
52-2-0154	Flat Rock Creek 49	Sandstone shelter with art	Minor block fall from rear wall and ceiling.	No	Kayandel Archaeological Services 2008
52-2-0258	Flat Rock Creek 57	Sandstone platform with engraving and axe grinding grooves	Crack in sandstone platform.	No	Kayandel Archaeological Services 2008
52-2-0176	Flat Rock Creek 152	Sandstone shelter with art	Cracking and minor block fall at rear wall.	No	Sefton 2000 and Kayandel Archaeological Services 2008
52-2-1638	Browns Road Site 24	Sandstone shelter with art	Minor block fall at rear wall.	No	Sefton 2000
52-2-1625	Browns Road Site 10	Sandstone shelter with art	Cracking and minor blockfall at rear wall.	No	Sefton 2000
AHIMS number could not be confirmed	Wedderburn Road 1	Sandstone shelter with art	Cracking in floor and rear wall.	No	Sefton 2000
52-2-1300	Wedderburn Road 2	Sandstone Shelter with art	Opening of crack in back wall.	No	Sefton 2000
52-2-1162	Stokes Creek Site 67	Sandstone shelter with art	Opening of the bedding plane above the art and increased water seepage as a result.	No	Sefton 2000
52-2-2252	Dendrobium 4	Sandstone shelter with art	Opening of crack along the back wall.	No	Comur 2009

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel or heritage value affected	Reference
52-2-0195	Flat Rock Creek 34	Sandstone shelter with art	Horizontal cracking visible on the ceiling of the shelter. Cracking occurred over the most southern hand stencil on the back panel. Crack across hand stencil 40cm long. Crack along the roof of the shelter 1-2.5 m off ground, and 5 m long.	Yes ¹	Niche 2017b
52-2-3083	Flat Rock Creek 281	Sandstone shelter with art	Thin cracking adjacent to the hand stencil at the northern end of the shelter.	Yes ¹	Kayandel Archaeological Services 2012
52-2-3086	Flat Rock Creek 284	Sandstone shelter with art	Fractured a corner of a buttress-like formation on the rear wall.	No	Kayandel Archaeological Services 2012
52-2-2243	Georges River No. 2	Sandstone shelter with art	Thin vertical cracking in the shelter ceiling, adjacent to the art panel.	No	Niche 2013a
52-2-0396	Flat Rock Creek 15	Sandstone shelter with art	The large vertical fissure in the central back wall had increased in width (opened) and shifted laterally.	No	Niche 2013b
52-2-2244	Georges River No.3	Sandstone shelter with art and axe grinding grooves	Opening of the horizontal bedding plane. Cracking and exfoliation along the back wall.	No	Niche 2014
AHIMS number could not be confirmed	MET 1	Sandstone shelter with art	Vertical cracking and cracks along the roof.	No	Niche 2015a
52-2-0826	Flat Rock Creek 176	Sandstone shelter with art	Vertical cracking at the northern and southern ends of the shelter.	No	Niche 2015b
52-2-3077	Flat Rock Creek 275	Sandstone shelter with art	The horizontal bedding plane joins along the back of the shelter have been noted as opening, three hairline cracks have formed, running vertical from the bedding plane.	No	Niche 2016a
52-2-3486	Flat Rock Creek 301	Sandstone platform with axe grinding groove	A large crack was observed running east to west along the entire rock platform. Crack is	No	Niche 2017a

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel or heritage value affected	Reference
			approximately 3.08 m to the north of the grinding groove and is approximately 25 m long and continues past the rock platform.		

¹ The sites highlighted within Table 24 have experienced adverse consequences as a result of mining that are highlighted in their individual projects TARP. This means that the art panels at these sites have experienced cracking.

Twenty of the Aboriginal heritage sites in Table 24 sustained structural effects³ to either the sandstone shelter or the sandstone platform, eight of the sites sustained environmental effects, whilst the effects at two sites could not be attributed decisively as either subsidence or environmental.

Of the 22 sites identified as having impacts attributable to subsidence (Table 24), two are noted as having adverse consequences on heritage values as a result of underground mining. These adverse consequences were cracking that occurred across 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. The percentage of sites with impacts to art panels in this instance is approximately 1% of the 144 sites with art, assessed across the southern coalfield considerably less than the 10% originally predicted by Sefton in 2000. The remaining twenty sites have experienced subsidence related impacts to their structure (either the sandstone shelter or rock platform), which equates to approximately 10% of all Aboriginal sites monitored within the Southern Coalfield.

The smaller observed number of adverse consequences on heritage values compared to the predictions of Sefton (2000) could be an indicator of a number of things not originally considered in the study. Sefton's initial sample size was much less than the total number of Aboriginal heritage sites currently being monitored within the Southern Coalfield, as sandstone shelter sites with PAD and/or deposit as well as sandstone platforms with engravings and/or axe grinding grooves were not considered for monitoring due to the lack of predicted impacts to these site types.

Potential cumulative impacts to Aboriginal cultural heritage values as a result of the Project should consider the aforementioned monitoring programs in conjunction with the data provided for the Subject Area by MSEC (2018) (Section 12.3). There are 57 Aboriginal cultural heritage sites located within the Subject Area, 20 of which (nine sandstone shelter sites and eleven axe grinding groove sites) are located directly over longwalls. As a result, these sites would have the highest level of tilts and strains relating to subsidence, and therefore are more likely to experience subsidence impacts than sites not over the proposed longwalls (MSEC 2018:94). As 43 Aboriginal cultural heritage sites identified are within the angle of draw for the Subject Area, it is recommended that these sites would be added to future monitoring programs bringing the total number of sites monitored in the Southern Coalfield to 260.

³ In the case of Aboriginal Heritage Trigger Action Responses, for the purposes of End of Panel assessments within the Southern Coalfields structural effects are not constituted as harm, as it does not effect the art panel.

12.5.2 Potential Cumulative Impacts - Within the Dendrobium Mine Area

As demonstrated in Table 24, there has only been one Aboriginal site (Dendrobium 4 [AHIMS ID #52-2-2252]) impacted as a result of subsidence movements at Dendrobium Mine. Dendrobium 4 (AHIMS ID #52-2-2252) has had impacts recorded along the back wall and horizontal bedding planes of the sandstone shelter (Comur 2009). This movement did not affect the art located within the shelter, so is not classified as an adverse consequence to heritage values under the relevant Trigger Action Response Plan (TARP). Adding the sites within the current Subject Area, there would be a total of 98 sites monitored for the Dendrobium Mine.

13. Management and Mitigation Measures

13.1 Conservation Principles and Management Framework

The two founding principles behind the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011:12) are ecologically sustainable development and intergenerational equity. These principles hold that “the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations”.

The strong emphasis, as in the Burra Charter, is to quantify and understand the heritage values of a place, a site, or an object and exhaust avenues of avoiding harm to those values. If harm cannot be avoided then there must be consideration and implementation of strategies to minimise harm (OEH 2011:13).

It follows that the hierarchy for consideration to management strategies available for surface stone artefacts and subsurface stone artefacts and areas of archaeological potential, fall into four general categories, in order of preference from a conservation perspective:

- avoidance and *in-situ* conservation;
- partial avoidance and partial *in-situ* conservation (includes partial harm);
- harm caused with mitigating circumstances such as collection or salvage; and
- unmitigated harm.

The four general categories (described above) have been considered in the following subsections for direct impacts (e.g. surface disturbance) and indirect impacts (e.g. monitoring activities).

The management and mitigation measures have been prepared in consideration of comments received from the RAPs during the consultation process. These comments include those related to cultural considerations surrounding salvage works and the handling of artefactual materials, as well as the cultural significance of all sites. All comments received from the RAPs are considered in Section 4.

Where possible, harm would be avoided and sites would be retained *in situ*.

13.1.1 Detailed Design to Avoid Harm

During detailed design of proposed ventilation shaft site locations and the location of any ancillary infrastructure, it is recommended the proponent give consideration to the known Aboriginal heritage sites identified by this study. This process should include a consideration of whether or not surface infrastructure can be designed in a way that avoids harm, and if harm cannot be avoided that harm be caused to as few sites as possible, within existing design and operational constraints. Depending on the site type (e.g. artefact scatter or grinding groove) and scientific significance rating, further management measures such as archival recording and fencing may be undertaken prior to harm, in consultation with a suitably qualified archaeologist and representatives of the RAPs.

This approach is consistent with the OEH requirements of ecologically sustainable development and intergenerational equity.

13.1.2 Sites that are avoided via mitigation

Dendrobium ACHA AGG-1 falls within the creek bed of an unnamed tributary of Donalds Castle Creek. The site was determined to be of low scientific significance due to the site comprising of only a single grinding groove. This site is to the south of the proposed location of Ventilation Shaft Site No. 5B. This site should be fenced to mitigate the risk of indirect or accidental harm to the site.

13.1.3 Subsidence Monitoring

Monitoring prior to and after longwall mining should be implemented for Aboriginal heritage sites within the underground investigation area subject to impacts from mining induced subsidence. The subsidence monitoring program should be in accordance with the relevant approved Extraction Plan and AHMP. Monitoring should be undertaken by a suitably qualified archaeologist and representatives of the RAPs.

14. Recommendations

Based on the scientific significance of the Aboriginal heritage sites presented in Section 11, the impact assessment presented in Section 12 and the suggested management and mitigation measures outlined in Section 13, the following recommendations are made regarding the Aboriginal heritage sites within the Subject Area.

In addition, written comment provided on the draft ACHA report by RAPs (Section 4.3.2) has been considered in this assessment. Comments made by RAPs were primarily in relation to subsidence impacts on Aboriginal heritage sites, site monitoring processes and potential future access to sites by the Aboriginal community. These comments would also be considered during the development of the AHMP, where relevant.

It is recommended that an AHMP be developed for the Project that details and schedules (for the life of the Project) the mitigation and management measures presented in the report. The AHMP should be developed in consultation with the RAPs and relevant regulatory authorities.

The AHMP should include the following:

- Protocols for the involvement of the RAPs in cultural heritage works conducted under the AHMP. This protocol should focus on members of the RAPs identified during this ACHA's consultation process.
- A communications protocol that describes clear methods of communication, including expectations of suitable notification and response time, between the proponent and the RAPs.
- A protocol to allow for access to Aboriginal heritage sites as required by the AHMP (noting that access is also subject to the requirements of WaterNSW).
- Procedures to establish, maintain and update a GIS database of Aboriginal heritage sites identified within the Subject Area (i.e. the Project Sites Database).
- A protocol for the determination of the final location of ancillary infrastructure, including systematic survey of the relevant area(s) (in consultation with the RAPs) if the area has not already been surveyed.
- A subsidence monitoring program to be implemented progressively over the life of the Project. The subsidence monitoring program should include monitoring of all Aboriginal sandstone shelter sites and grinding groove sites located within the angle of draw of the Project. The program should include (but not be limited to) the following:
 - A schedule for undertaking the subsidence monitoring at the nominated sites.
 - Appropriately detailed baseline and archival site recordings, including high resolution digital photographs.
 - An impact TARP specific to each of the sites being monitored.
- A protocol for the discovery and management of human remains, including stop work provisions and notification protocols.
- Procedures for the management and reporting of previously unknown Aboriginal heritage sites or items that may be identified during the life of the Project.
- Protocols for heritage awareness training to be incorporated into the mine site inductions for both employees and sub-contractors who may be conducting works that have the potential to impact on any

Aboriginal heritage sites. Consideration should be given to involving the RAPs in the development and presentation of the cultural awareness training.

- A regular review process for the AHMP.
- AHIMS Site cards to be submitted for newly recorded sites.
- Copies of the final report should be made available to each RAP, the Department of Planning and Environment and the Office of Environment and Heritage.

Glossary

Term	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.
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.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Archaeological deposit	A layer of soil material containing archaeological remains.
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.
Archaeological site	A site with material evidence of past Aboriginal or non-Aboriginal activity in which material evidence (artefacts) of past activity is preserved.
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	<ol style="list-style-type: none"> 1. A group of stone artefacts found in close association with one another. 2. Any group of items designated for analysis - without any assumptions of chronological or spatial relatedness.
Avoidance	A management strategy which protects Aboriginal sites within an impact area by avoiding them totally in development.
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
Development	The operations involved in preparing a mine for extraction, including cutting roadways and headings. Also includes tunnelling, sinking, crosscutting, drifting, and raising.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Exploration	The work done to prove or establish the extent of the coal resource.
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Harm	With regard to Aboriginal objects this has the same meaning as the NSW <i>National Parks and Wildlife Act 1974</i> .
AHMP	Aboriginal Heritage Management Plan
IPHG	Illawarra Prehistory Group

Term	Definition
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 find	A single artefact found in an isolated context.
Landform	Any one of the various features that make up the surface of the earth.
Management plans	Conservation plans which identify short and long term management strategies for all known sites recorded within a (usually approved) Subject area.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
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.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	A place where past human activity is identifiable.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.

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Appendix 1: Aboriginal Community Consultation

Not included in this version.

Appendix 2: Aboriginal Community Consultation Log

Not included in this version.







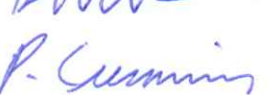
Appendix 3: Dendrobium Mine - Coal for Steelmaking: Plan for the Future - Aboriginal Cultural Heritage Assessment: Proposed Methodology

Removed on request of the Registered Aboriginal Parties.

Appendix 4: Dendrobium Next Domain methodology information session attendance and minutes

#3109 Dendrobium Mine- Plan for the Future

Attendance sheet – Methodology Meeting 6 March 2017

Name	Representing	Date	Time on	Sign On	Lunch break	Time off	Sign Off
Glenda Chalke	CBNTCWC	6-3-17	9.00	G. Chalke			
Paul Boyd	DIDGENGUNAWAL	6-3-17	9.00				
PHILIP KHAN	K.Y.W.G.	6-3-17	9.00				
BASIL SMITH	GOOBAM	6-3-17	9.00				
WENDY SMITH	Gulagar	6-3-17	9.00	Wendy Smith			
Jack Bell	Cullendulla	6-3-17	9.00	J. Bell			
Keeley Bell	Murrumarang	6-3-17	9.00	K Bell			
Richard Dutton	Bairnsriga	6-3-17	9.00	R Dutton			
William Moran	B.I.C	6-3-17	9.00				
Wiggy Duder	B.I.C	6-3-17	9.00				
Kayla Williams	W.P.G.E.C	6-3-17	9.00				
Paul Cummins	W.P.G.E.C	6-3-17	9.00				
Paul Cummins	W.P.G.E.C	6-3-17	9.00	P. Cummins			

Meeting: Cordeaux Colliery

Dendrobium Area 5 and Area 6 Cultural Heritage Assessment Methodology Meeting

6 March 2017

Present:

Gary Brassington – South 32 Illawarra Coal
Matt Richardson – Niche Environment and Heritage
Renée Regal – Niche Environment and Heritage
Glenda Chalker- Cubbitch Barta Native Title Claimants
Paul Boyd- Didge Ngunawal
Philip Khan- KYWG
Basil Smith- Goobah
Wendy Smith- Gulagar
Jake Bell- Cullendulla
Keeden Bell- Murramarang
Richard Dutton- Biaminiga
William Moran- B.I.C
Luigi Budn- B.I.C
Kayla Williamson- WPGEC
Paul Cummins WPGEC

Notes

1. Renée (RR)– intro herself and Sam Richards
2. Gary Brassington (GB) – Intro self, South 32 and the project
 - a. History of South 32 /project introduction and background – Presentation
 - b. Q – is this longwall – A yes
 - c. Q – in previous mining areas – have the creeks dried up? A – major creeks have not been mined beneath but some minor creeks mined beneath have seen some impacts
 - d. Q – we don't get the opportunity to see areas that have been mined beneath – it's a restricted area. Seen social media – lots of subsidence in the areas – affected the creeks in the area – “we are here today to rubber stamp the mine – are we actually here to identify the sites on country today?” A – not today – that is the purpose of the field work and then monitoring program will monitor the impacts to sites etc. during and post mining.
 - e. Q - Who monitors the sites? A – Consultant will continue to survey and consult with the communities registered for this project. That is the same as the previous projects also – Registered groups.
 - f. What about the safety of the dam? A – no mining under the dam itself. Roadways go under the dam but they don't subside.
 - g. Q – what is going on with 3C? A – Approved in 2008 but studies since then – have shown that the area can't be mined next.
 - h. Are there major creeks in Area 5? A – no don't want major creek impacts. Between 2000 approval and now – changes to mining approach. Illawarra Coal had approval to mine under Wongawilli creek but chose not to.
3. RR – presentation on project
 - a. Intention is to get to all sites in and next to the project (red) boundary (Area 5 and 6)
 - b. See methodology for proposed works – detailed description of project to full extent as per methodology
 - c. Have till **8th of March** – to provide any feedback, must provide insurances
 - d. Q – will Aboriginal People be included in mining rehabilitation? How many Aboriginal people are involved in employment here for the long term. A – there

- are several Aboriginal people who work with Illawarra Coal. GB Explained several opportunities for your people to get into the business including annual trade intake, Graduate program as well.
- e. Does South 32 have a Reconciliation Action Plan (RAP)? A – not that we are aware of
 - f. The mine is cashing in on resources that are under the ground that are Indigenous resources. Can anything happen here today to encourage employment for young people? A – please put comments in the consultation responses, which will be reviewed by S32 Management and Government.
 - g. Vent shaft sites – will they be walked over? A – yes
 - h. Should be taking pictures of those areas – ground and sandstone outcrops – will be taking photos of outcrops etc. A – weekly assessment of mining area are undertaken, including records of the impacts which are collated and included in public reports for the sites.
 - i. Stage 3 – seeking information from all registered groups re information on cultural heritage sites/values – now, any time during project, call anytime but written information is best.
 - j. Survey Methodology
 - i. Targeting all sites in the mining areas
 - ii. Many sites already known / identified by Illawarra Pre-history Group.
 - iii. Surveying tributaries not previously surveyed (creeklines with no site located)
 - iv. Will target specific landscape features (slopes/creeks etc.)
 - v. Colour of maps – need to consider colour blind people
 - k. RR really wants lots of consultation on particularly high significance
 - l. Note – this is the way that Aboriginal People recorded history – want to find out what is in the sites – if the opportunity arises – must investigate further. A – please comment on this in the consultation
 - m. Do the lines around the areas (red lines on Area 5 and Area 6) include a buffer zone? A – without knowing the mine plan – difficult to know – we should probably extend an appropriate distance beyond the identified study area
 - n. Comment – that some sites can be affected beyond limit of mining. A – agree – this buffer will be included
 - o. Vent shaft sites – area surveyed is greater than needed – to allow for flexibility
 - p. Overhangs – what happens if they collapse? A – hasn't happened yet – but this will be addressed in the management plan.
 - q. Who is doing the survey? A – Niche Environment and Heritage
 - r. Project Safety
 - i. Tool box talk every morning at 8:00 am at Cordeaux Dam carpark, if the gate is locked just wait as RR has a key and will let you in.
 - ii. Rain can affect access – must have contact for each group
 - iii. All people to carry water and food for themselves – at least 3 litres per day – please bring a back pack
 - iv. We will have first aid kits in bags and cars
 - v. Communications – RR will cover this
 - vi. PPE – must be worn – hiking boots / not joggers – critical for ankle support
 - vii. No knives – **no smoking**
 - viii. Sunglasses if wrap around
 - ix. Safety glasses
 - x. Hard hats – please bring and must be worn in shelters
 - xi. Zero drug and alcohol policy
 - xii. Respect must be observed – offending team members will be asked to leave site

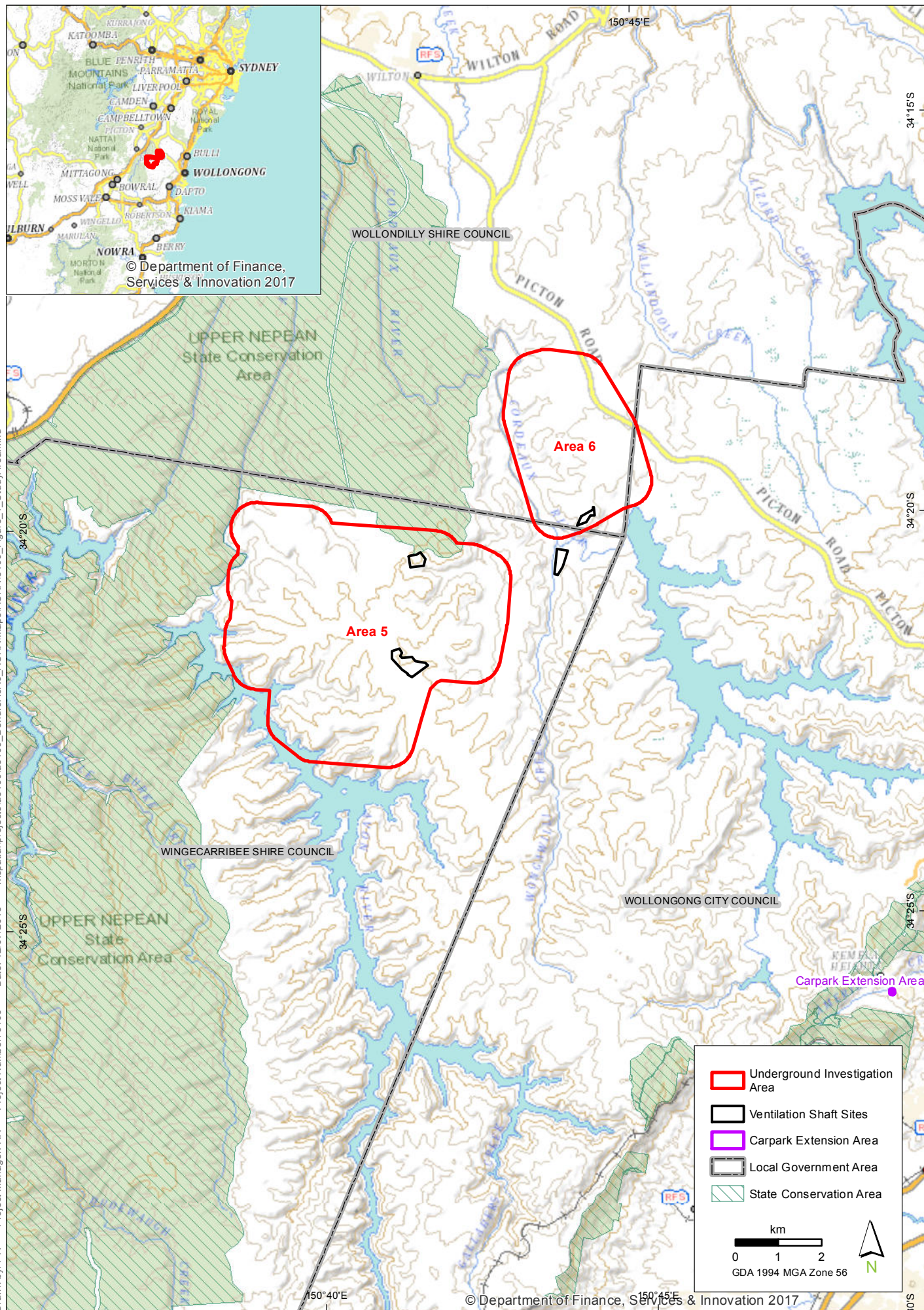
- xiii. Stay together
 - xiv. Really tough in the field – must be physically fit – please be aware of that when selecting field team
 - s. If not done – please send through insurances
 - t. Q – although targeting AHIM sites – will other sites be surveyed? A – yes
 - u. Roster- 3 RAP groups per day on site – insurances – by Wednesday – Friday Roster will go out. Can only take one person on site per group –if you would like to bring an extra person –please let us know days in advance so we can try and accommodate. Payment will only be made for one RAP per day.
 - v. Q If RAPS not here – can they be excluded from the survey? No. Consultation is being carried out in accordance with the consultation Guidelines as written by OEH.
 - w. Who is Illawarra Pre-history Group? Are they Aboriginal people? Illawarra Pre-history group does include an Aboriginal Man (Glenda stated this). Basil noted that Carryl Sefton is very accurate – and very good.
 - x. How often will the groups go out post this project ? A – will be determined by this consultation process
 - y. Basil pointed out – will be asking his team to survey for creek lines (grinding groves) and shelter sites.
 - z. Payment details discussed – as per slide
 - i. Full day is start at 8 and leave site at 4
 - ii. Rain days – if postponed – will be rescheduled
 - iii. If less than 4 hours – will pay a half day – anything over that will pay full day. Half day is 12:00.
 - iv. Heat days – over 35 degrees – will assess and consider options
 - v. Total Fire Bans – catchment closed
 - aa. Q – what is grouting? A – some cracking – can be remediated by grout – in the past a concrete based product – at Metropolitan Colliery, Helensburgh they have used PUR (two chemicals). Grout not required often – most major streams not impacted – one stream will be grouted – awaiting management plan government approval. IC has grouted Mahneys Hole. Metropolitan Colliery, Helensburgh – longest running grouting program.
 - bb. Q – existing approvals – there has been mining since 2005? Have you been extracting coal all that time? A – Yes. From that – appears that mining in this area will likely be ongoing for 20 years. Q – how do we get an “access road” for kids to get Jobs? A – report will be passed on to management and also to Government. Glenda – noted that three generations of Glenda’s family have worked in mines. Glenda noted that there has been a downturn in the coal mining industry generally – will have lots of people looking for jobs out there. GB noted IC has put off people recently but young people onboarding program has still continued.
 - cc. Young people from groups need to be notified of this – if they are involved in the survey program – how can be they told about this. GB – will check on requirements.
 - dd. Will Illawarra Coal adopt the same plan as Metrop? A – if that is something that you like then please include recommendations in your comments.
 - ee. Will that include all people here or just consultants? A – that’s for the management plan.
4. Close – GB – thank you – great meeting and constructive – enjoy yourself in the catchment – truly appreciate your input.

Appendix 5: Aboriginal Heritage Site Information

Removed on request of the Registered Aboriginal Parties.

Appendix 6 Supporting Figures

Drawn by: PR Project Manager: RR Date: 12/07/2018 Project Number: 3109 T:\spatial\projects\3100\3109_DendroA546_ACHAI\Map\ACHAI3109_Figure_1_StudyArea.mxd

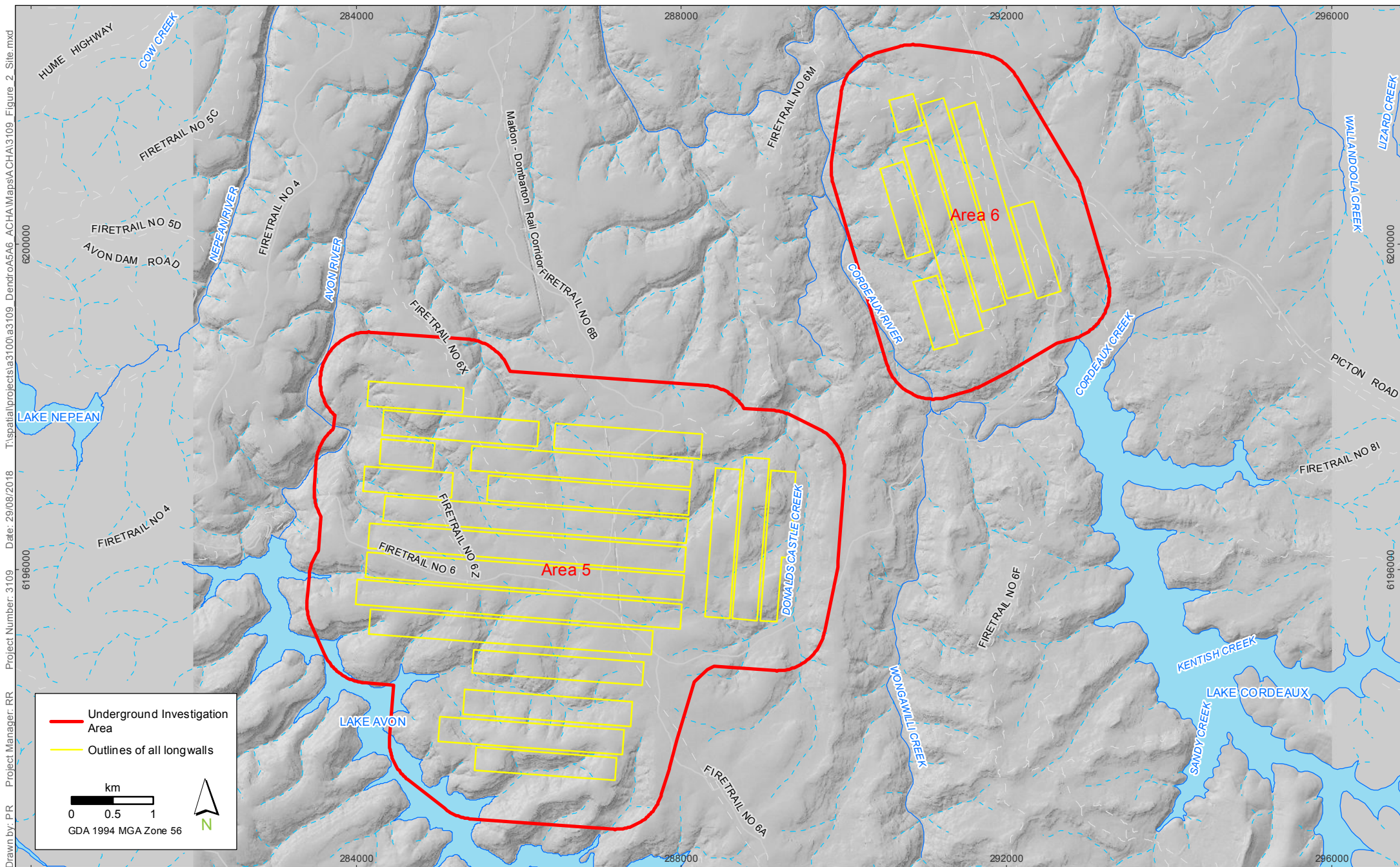


Regional Project Location

Dendrobium Aboriginal Cultural Heritage Assessment

Source: Illawarra Coal and Niche

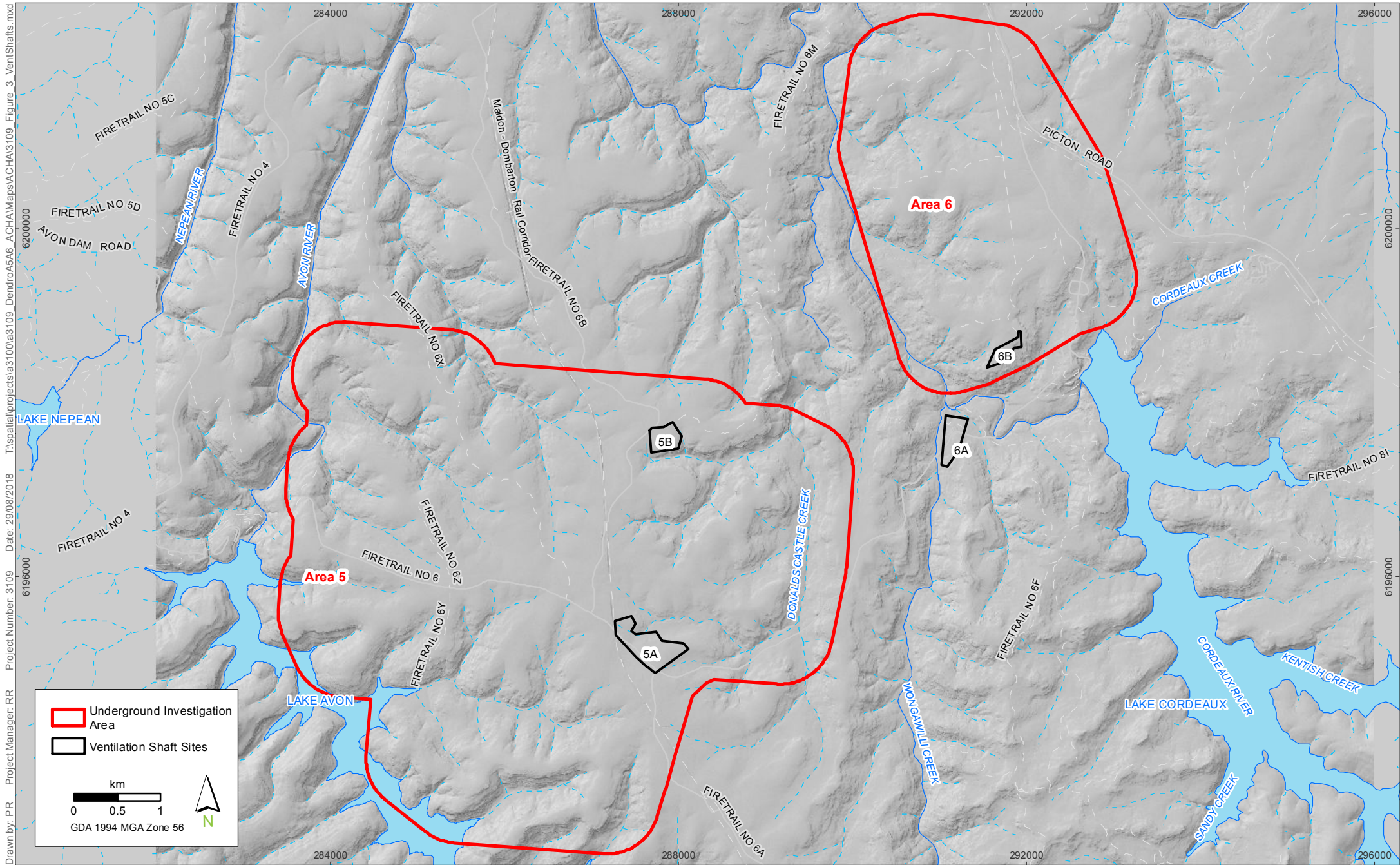
FIGURE 1



Project Layout - Underground Investigation Dendrobium Area 5 and Area 6

Dendrobium Aboriginal Cultural Heritage Assessment

FIGURE 2



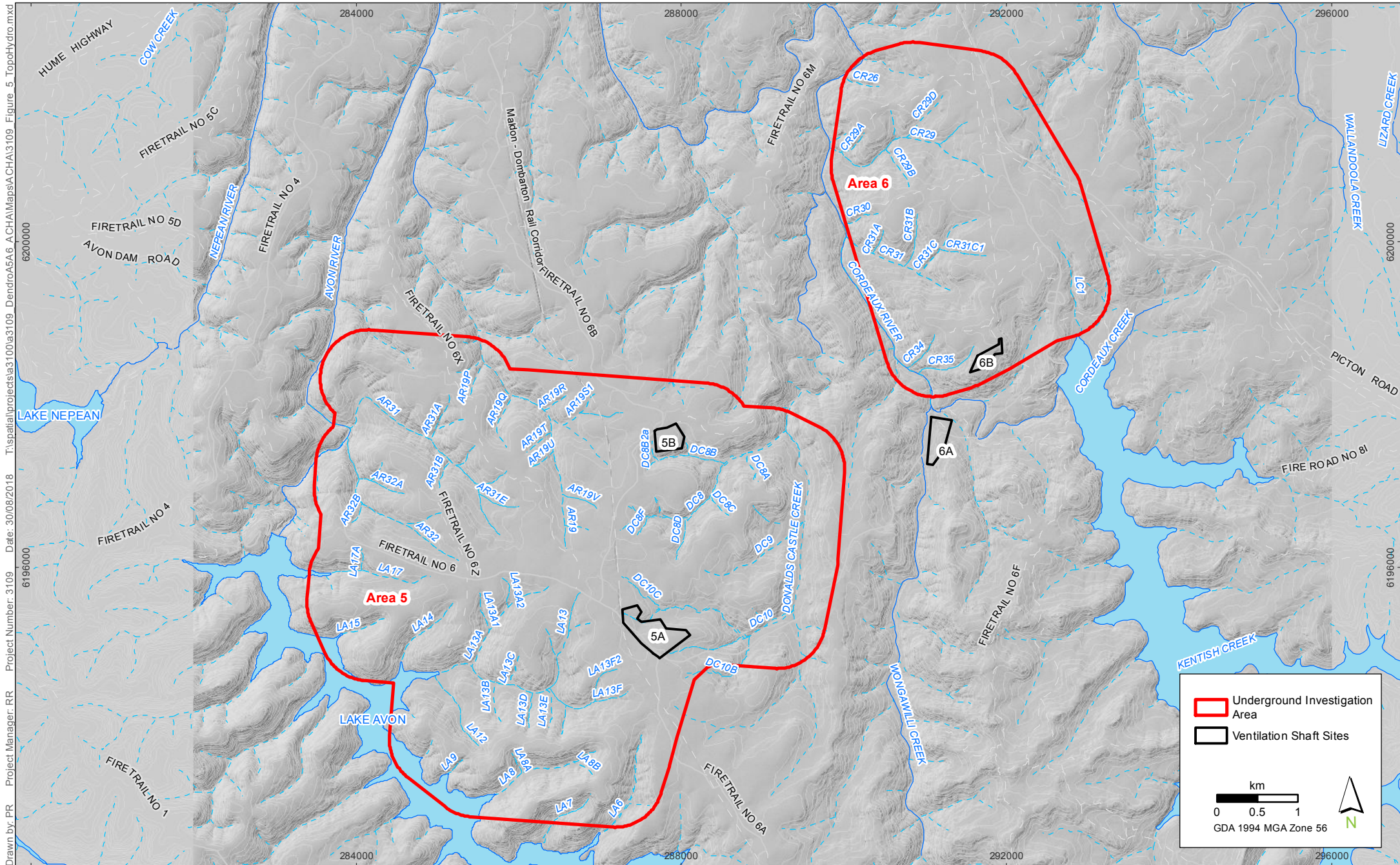
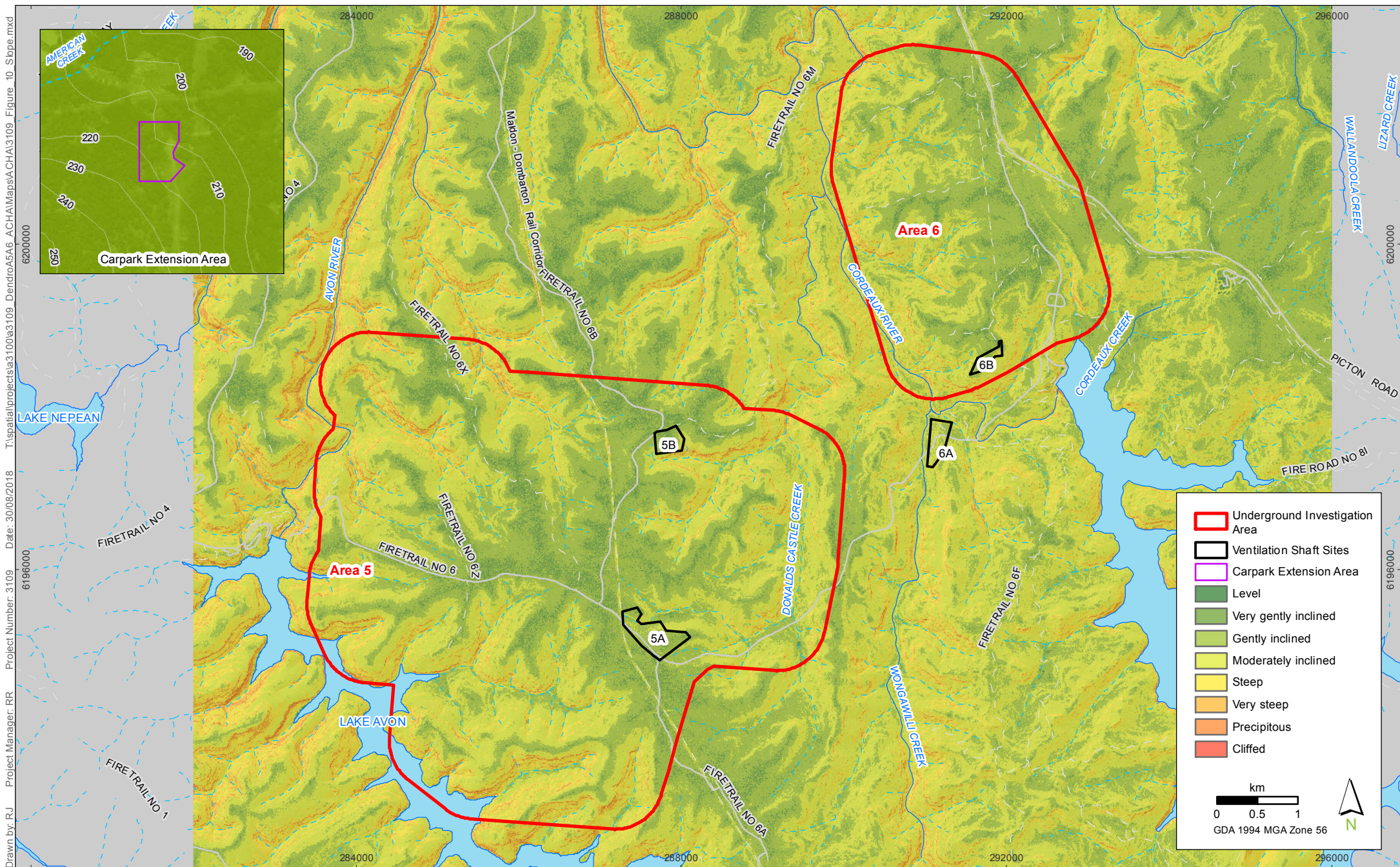


Figure 7: Aboriginal Heritage Information Management System Site Records within Close Proximity to Area 5 and Area 6

Removed on request of the Registered Aboriginal Parties.

Figure 8: Aboriginal Heritage Information Management System Site Records within Close Proximity to the Dendrobium Pit Top Carpark Extension

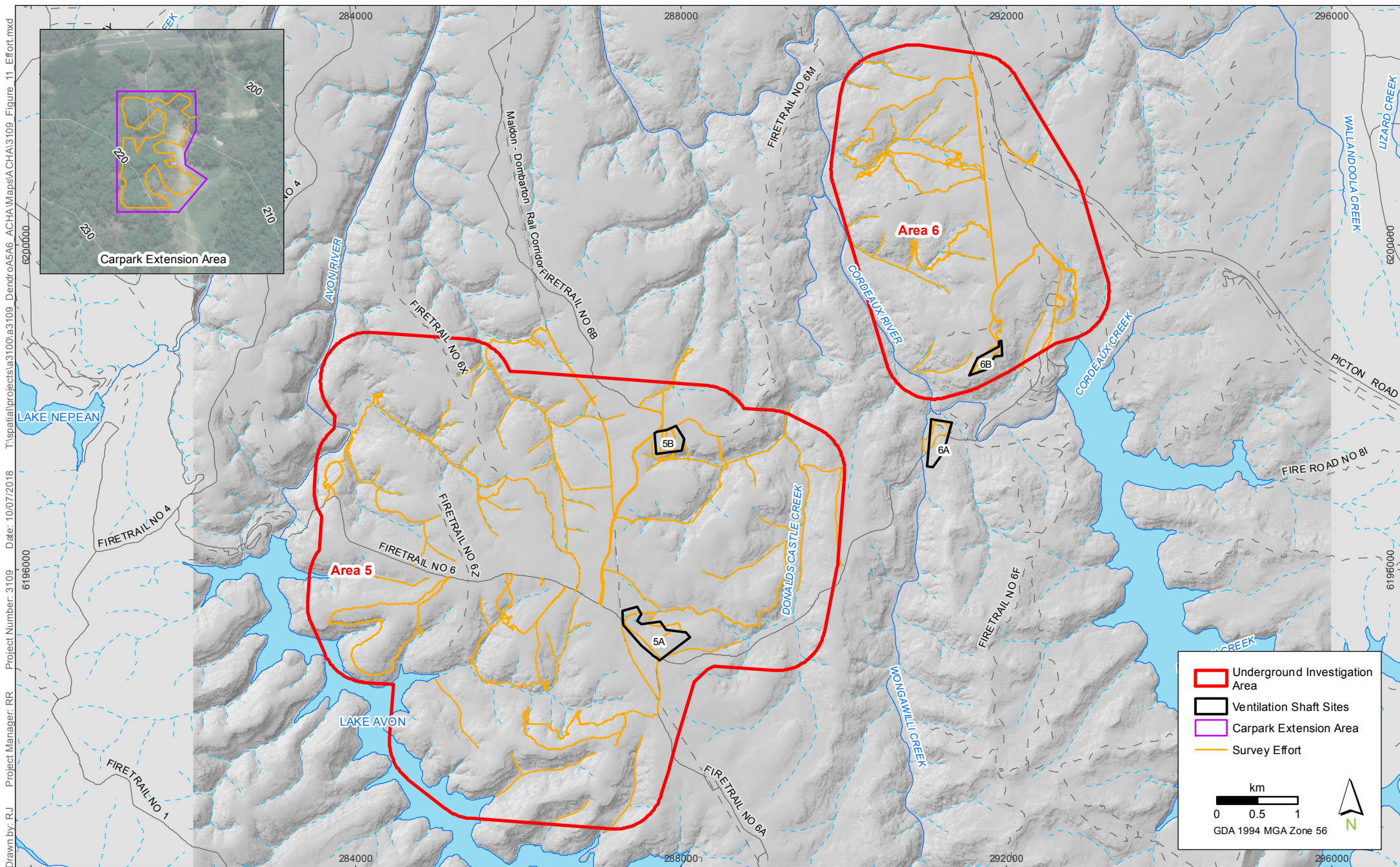
Removed on request of the Registered Aboriginal Parties.



Sampling Strategy - Slope Categories

Dendrobium Aboriginal Cultural Heritage Assessment

FIGURE 10



Survey Coverage

Dendrobium Aboriginal Cultural Heritage Assessment

FIGURE 11

Figure 12: Confirmed Aboriginal Heritage Information Management System Records

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Figure 13: Newly Recorded Aboriginal Cultural Heritage Sites

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Appendix 7 AHIMS search results

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Appendix 8: MSEC Subsidence Assessment Extract

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