APPENDIX 10

Aboriginal Cultural Heritage and Archaeological Assessment

Austar Coal Mine Pty Ltd

Aboriginal Cultural Heritage and Archaeological Assessment: Stage 3 Modification, Austar Coal Mine Project

September 2011

Umwelt
Environmental Consultants

Aboriginal Cultural Heritage and Archaeological Assessment: Stage 3 Modification, Austar Coal Mine Project

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Austar Coal Mine Pty Ltd

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Report No.	2274/R60/V6/FINAL	Date:	September 2011

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Acknowledgement

Umwelt would like to acknowledge the Traditional Custodians of the Quorrobolong Valley – the Wonnarua people – and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

Umwelt would also like to acknowledge the post-contact experiences of Aboriginal people who have attachment to the Quorrobolong Valley.

We pay our respect to the elders – past, present and future – for they hold the memories, traditions, culture and hopes of Aboriginal people in the area.

Summary

Austar Coal Mine Pty Ltd (Austar) operates the Austar Coal Mine south of Abernethy and Kitchener in the lower Hunter Valley of NSW (refer to **Figure 1.1**). The mine is an aggregate of the former Ellalong, Pelton, Cessnock No.1 and Bellbird South Collieries, with mining activities within the Consolidated Mining Lease 2 (CML 2) dating to 1916.

Development consent for Stage 1 of the Austar Coal Mine project was obtained in 1996, with consent for Stage 2 of the project obtained in June 2008. Consent for Stage 3 of the Austar Coal Mine Project was obtained in September 2009 under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act); but since that time, a modification to the Stage 3 project has been proposed, consisting of a reorientation of longwall panels (refer **Section 2.2**). Consent for the Stage 3 Modification project is required under the EP&A Act, as a 75W Modification approval application.

The proposed Stage 3 Modification Area is within the Country recognised as belonging to the Wonnarua People and lies within the Mindaribba Local Aboriginal Land Council (MLALC) boundaries.

Umwelt (Australia) Pty Limited (Umwelt) prepared the Environmental Assessment (EA) for Stage 3 of the Austar Coal Mine Project (Umwelt 2008a) and has been engaged to prepare the EA for the 75W Modification application. This Aboriginal Cultural Heritage and Archaeological Assessment is undertaken as part of the EA with the aim of identifying and managing any potential Aboriginal archaeological impacts resulting from the modified Project. Since the 2008 assessment many of the properties not previously available for survey had since become available enabling an expansion of the total effective survey coverage from 6 per cent to approximately 52.5 per cent of the 1210 hectare area of potential surface impact.

Aboriginal Stakeholder Involvement

The following Aboriginal stakeholders registered an interest in the Stage 3 project during the 2008 Environmental Assessment, and were involved in archaeological survey undertaken for the Project: Aboriginal Native Title Consultants; Giwiirr Consultants; Hunter Valley Cultural Consultants; Hunter Valley Cultural Surveying; Lower Hunter Wonnarua Council; Lower Wonnarua Tribal Consultancy Pty Ltd; Mingga Consultants; Culturally Aware; Wonn 1 Consulting; Mindaribba Local Aboriginal Land Council; Upper Hunter Heritage Consultants; Wattaka Wonnarua Cultural Consultants Service; Wonnarua Culture Heritage; Wanaruah Custodians and Yarrawalk. In addition to the above groups Yinarr Cultural Services submitted an expression of interest late in the project, attended meetings and was provided the draft of this report for comment.

Archaeological Survey and Assessment

The primary aim of the Aboriginal Cultural Heritage and Archaeological Assessment was to identify any visible surface archaeological materials or potential archaeological deposits (PADs) within the proposed Stage 3 Modification Area. Further, the survey aimed to document sufficient information on identified sites to inform the archaeological significance assessment. This is fundamental in determining appropriate management strategies for archaeological sites in the Stage 3 Modification Area. A survey strategy was developed in a workshop held with Registered Aboriginal Parties at Austar Coal mine on 15 February 2011.

Predictive Model

Predictive modelling indicates which types of archaeological sites are likely to be found in an area and specifies their likely distribution, content and integrity. The following site types were predicted to occur after a review of the archaeological and landscape context, ethnohistoric information and land use history:

- **artefact scatters** and **isolated finds** (the dominant site types within the local region identified in all landform contexts);
- **scarred trees** (have been previously recorded in the region and can occur in all landform contexts retaining mature, native vegetation);
- **PADs** located in areas where erosion has not acted to uncover archaeological material. Most likely to be located in slightly elevated areas (lower slopes or terraces) associated with more reliable water sources; and
- **grinding groove sites** (occur in the lower Hunter Valley in sandstone geological areas, such as those found within the north of the proposed Stage 3 Modification Area).

Archaeological Survey

Survey was conducted over seven days between 28 February and 8 March, 2011. Austar does not own the land in the proposed Stage 3 Modification Area and survey was undertaken on properties where landowners provided access and on crown land in the Werakata Conservation Area. Survey located 13 previously unrecorded archaeological sites comprising four isolated finds, four artefact scatters, four PADs and one potential scarred tree. Registered Aboriginal Parties involved in the survey identified that all sites were of cultural significance and the PAD (ACM29) and the potential scarred tree (ACM21) were of high cultural significance.

The potential for burial sites and ceremonial sites in the Quorrobolong Valley was also examined after an earlier report (Needham 1981) placed them in the general area of Quorrobolong Creek. Primary sources were contacted to establish the veracity of this report and indicated the sites referred to were located to the south-east of the proposed Stage 3 Modification Area near Wallis Creek. Furthermore, the potential for skeletal remains to survive in the area was considered to be low as the soil is acidic, subject to wetting and drying cycles and disturbed by historic land use practices.

Archaeological Significance Assessment

The 13 newly recorded sites brought the number of sites known within the Stage 3 Modification Area to 23 (including four PADs). All 23 sites were subject to an archaeological significance assessment/reassessment. An additional 11 sites have been identified as a part of previous surveys in the area surrounding the proposed Stage 3 Modification Area. All sites located within and immediately surrounding the Stage 3 Modification Area have been included in the archaeological significance assessment.

Of the 29 **artefact scatters** and **isolated finds** recorded in assessments that covered both the approved Stage 3 Project Area and proposed Stage 3 Modification Area, 26 sites (ACM1-5, ACM6-8, ACM11-13, ACM15-17, ACM18-20, ACM22-24, ACM27 and 28, ACM31-34) are assessed as having low archaeological significance. Three **artefact scatters** and **isolated finds** recorded (ACM9, ACM10 and ACM14) are assessed as having low to moderate archaeological significance. The **grinding groove** site (ACM6) is assessed as having low to moderate archaeological significance. The potential **scarred tree** (ACM21) to

be verified by an arboriculturalist is assessed as having low to moderate archaeological significance.

Four **Potential Archaeological Deposits** (ACM25, ACM26, ACM29, ACM30) associated with Cony and Sandy Creek were nominated in areas assessed as likely to have subsurface archaeological deposits. The assessment of these areas as PADs was based on their position in the landscape (elevated area close to a creekline), and as they had soil profiles that retained the potential for at least spatial integrity. As the PADs have not yet been investigated or their content and integrity established, it is not possible to determine their archaeological significance.

Cony Creek and Sandy Creek (and surrounding lower hillslopes and flats) were identified to be areas of archaeological potential by both Registered Aboriginal Party Representatives and archaeologists.

Impact Assessment

Potential impacts from subsidence due to the proposed Stage 3 Modification were assessed by Mining Subsidence Engineering Consultants (MSEC). MSEC (2011) state that artefact scatter and isolated find sites may be affected by cracking of the soil, but that this is likely to be isolated and as minor cracking is rarely seen in areas where mining is more than 400 metres deep. MSEC (2011) further states that if cracks occur, they are likely to be small and dispersed due to the presence of soil. These small cracks will be partially closed by following subsidence or subsequently filled in as a result of soil movement. Such minor cracking of soil may also affect areas of archaeological potential along Cony and Sandy Creek.

MSEC (2011) states that the proposed Stage 3 Modification will result in a reduction in total subsidence impact at the grinding groove site identified in the 2008 survey and documented in Umwelt (2008b), although some potential for fracturing of bedrock still remains.

Impacts to sites and PADs by future exploration drilling and minor infrastructure (if required) could not be assessed as the locations for these works are not yet known. Management strategies for future surface disturbance works have been identified as a part of the assessment.

Flooding and Drainage Impacts

Subsidence relating to longwall mining may result in flooding and drainage impacts in the proposed Stage 3 Modification Area. Flooding and drainage impacts as a result of the Stage 3 Modification have been assessed by Umwelt 2011a. Artefact scatters ACM28, ACM32, ACM10 and ACM9 are located within 25 metres of Cony Creek (fourth order stream) on the stream bank or on the lower hillslopes. As described in Umwelt 2011a, the average in-channel grade of Cony Creek and Sandy Creek is expected to remain at 0.4 per cent to 0.5 per cent indicating that no significant changes in overall stream power or erosive potential along these reaches is expected. The potential to increase erosion of the landform in the vicinity of the artefact scatters on Cony Creek is expected to be minimal.

Management Strategies

As described in Umwelt (2008b), Austar and Aboriginal stakeholders agreed upon an offset strategy for potential impacts from the Stage 3 mining on the grinding groove. This offset was a monetary contribution of $100,000 to an Aboriginal project or program (to be decided by Aboriginal stakeholders). While the predicted subsidence impacts on the grinding groove as a result of the proposed Stage 3 Modification have decreased considerably compared with the Stage 3 mine plan as approved, Austar remains committed to the provision of a

monetary contribution as an offset for the grinding groove. Austar agreed to make the contribution when all necessary government approvals for the Stage 3 project were obtained. Aboriginal stakeholders have requested that no engineering works be conducted at the grinding groove site (Umwelt 2008b).

Other recommendations made by this report and Umwelt (2008b), as discussed between Umwelt and Registered Aboriginal Parties, include:

- that an Aboriginal Cultural Heritage Management Plan (ACHMP) be prepared for the Austar Coal Mine to outline all Aboriginal heritage management strategies for the project, responsibilities of all parties and the timeframe for required heritage works;

- that no Aboriginal archaeological site be visited, or have remediation works undertaken, without Registered Aboriginal Party representatives in attendance;

- that known sites on accessible properties are included in a monitoring program. This will involve recording each site before and after subsidence to identify any impacts. This will be done by an archaeologist and Registered Aboriginal Party representatives;

- that if any future surface works are needed on properties that have not been previously inspected, or that may affect a known site or area, an archaeologist and Registered Aboriginal Party representatives will inspect the area and provide advice on any Aboriginal heritage works needed;

- that if any artefacts are recovered as a result of future works, they will be stored in a Keeping Place to be provided by Austar Coal Mine within the Stage 3 surface infrastructure site following recording and analysis;

- that Registered Aboriginal Party representatives (and an archaeologist if requested by the Registered Aboriginal Parties) provide relevant Austar personnel with a cultural heritage awareness training session;

- that if any additional sites are found within the Stage 3 Modification Area, these will be inspected by an archaeologist and Registered Aboriginal Party representatives to assess the site and decide on how it should be managed; and

- that if any human or possible human skeletal remains are found during surface works, that works cease immediately to allow for forensic assessment and management.

Recommendations made by Registered Aboriginal Parties during the review process include:

- that any borehole and seismic works that are to be done are to require participation from Registered Aboriginal Parties; and

- that any areas identified of archaeological potential or where sites are potentially going to be destroyed will need an Aboriginal Heritage Impact Permit (AHIP).

No other recommendations or comments were received during the review process.

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APPENDICES

1.0 Introduction

Austar Coal Mine Pty Ltd (Austar) operates the Austar Coal Mine south of Abernethy and Kitchener in the lower Hunter Valley of NSW (refer to **Figure 1.1**). The mine is an aggregate of the former Ellalong, Pelton, Cessnock No.1 and Bellbird South Collieries, with mining activities within the Consolidated Mining Lease 2 (CML2) dating to 1916.

Development consent for Stage 1 of the Austar Coal Mine project was obtained in 1996, with consent for Stage 2 of the project obtained in June 2008. Consent for Stage 3 of the Austar Coal Mine Project was obtained in September 2009 as Project Approval 08_0111 under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The current project is a proposed change to the longwall layout of Stage 3. This modification will include removal of longwall A6, and extraction of coal in longwalls A7 to A19, which are a reorientation of longwalls A7 to A17 shown in **Figure 1.2**. The location of the main headings is proposed to be moved to the west and the width of chain pillars is also proposed to be increased to reduce roadway failure risk and in turn subsidence impact risks. The proposed Stage 3 Modification will remain entirely within CML2 and existing lease extension application areas MLA 322 and MLA 333 and involves a change to the Stage 3 mine plan only, with no proposed changes to underground mining method, total approved rate or quantity of extraction, or associated surface infrastructure. Consent for the modification to the Stage 3 project is sought under Part 3A of the EP&A Act, as a 75W Modification.

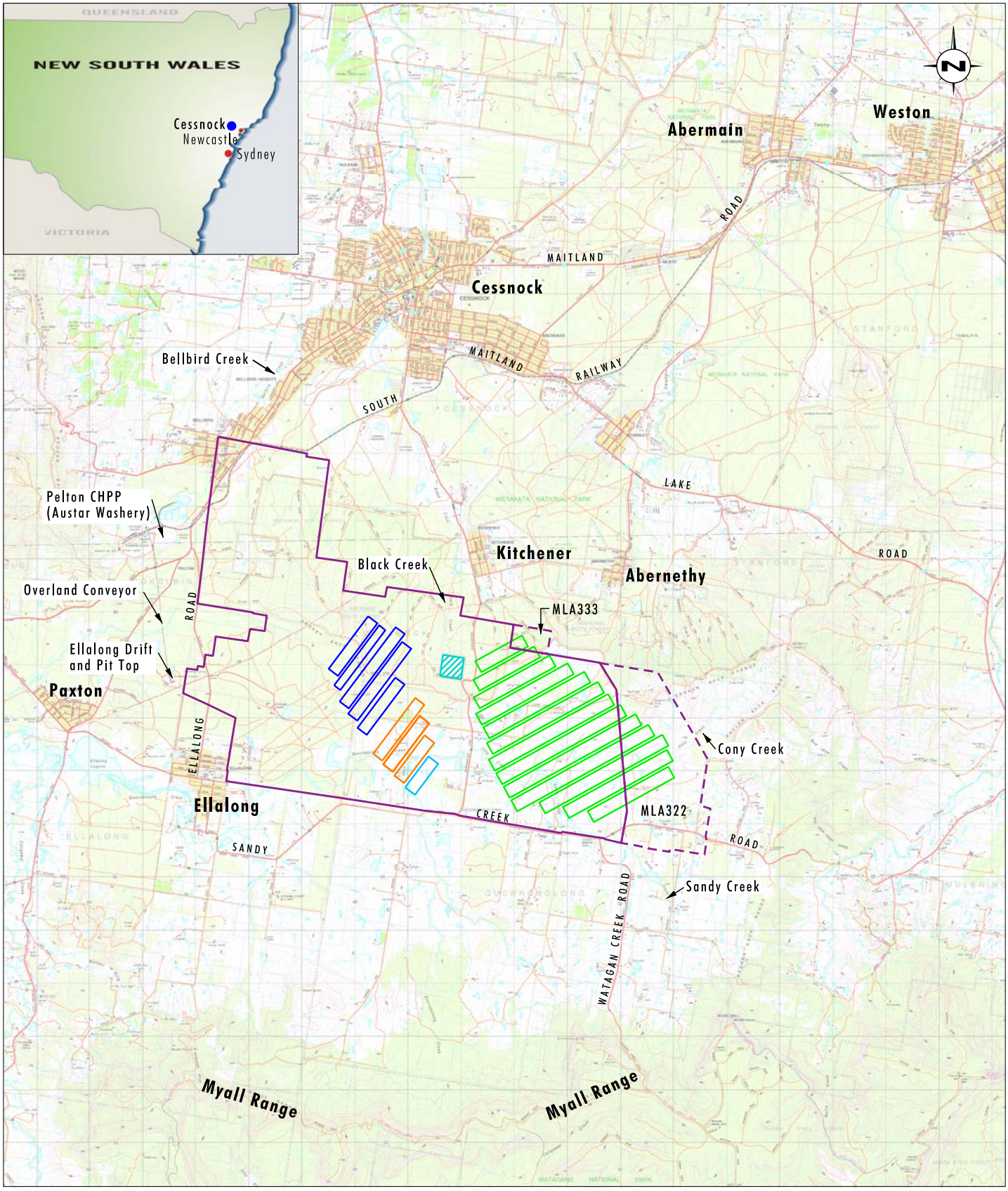
Umwelt (Australia) Pty Limited (Umwelt) prepared the Environmental Assessment (EA) for Stage 3 of the Austar Coal Mine Project (Umwelt 2008a) and has been engaged to prepare the EA for the 75W Modification application. The proposed Stage 3 Modification Area, which is the subject of this assessment is the land area within the 20 mm subsidence contour shown on **Figure 1.2**.

1.1 Registered Aboriginal Party Consultation and Participation

The proposed Stage 3 Modification Area is within the Country recognised as belonging to the Wonnarua People and lies within the Mindaribba Local Aboriginal Land Council (MLALC) boundaries. Fifteen Aboriginal parties had previously registered an interest in consultation for the Austar project under the *Department of Environment Climate Change (DECC) Interim Community Consultation Requirements for Applicants* (2005). As consultation had been ongoing with the 15 Registered Aboriginal Parties since 2008 the Department of Planning and Infrastructure notified Austar on 2 September 2010 that there was no requirement for a new notification process. Consultation therefore continued with the same Registered Aboriginal Parties.

Registered Aboriginal Party consultation and participation in this current Aboriginal Cultural Heritage and Archaeological Assessment has involved:

- the keeping of a Registered Aboriginal Party consultation log (refer to **Appendix A**);
- a project inception meeting;
- a survey strategy workshop in which Registered Aboriginal Party representatives provided input into the development of field survey methods – specifically requesting a 100 per cent survey of all accessible properties;
- participation in seven days of field survey;



Source: Topo Maps: LPI NSW, Longwall Layout: Austar Coal Mine

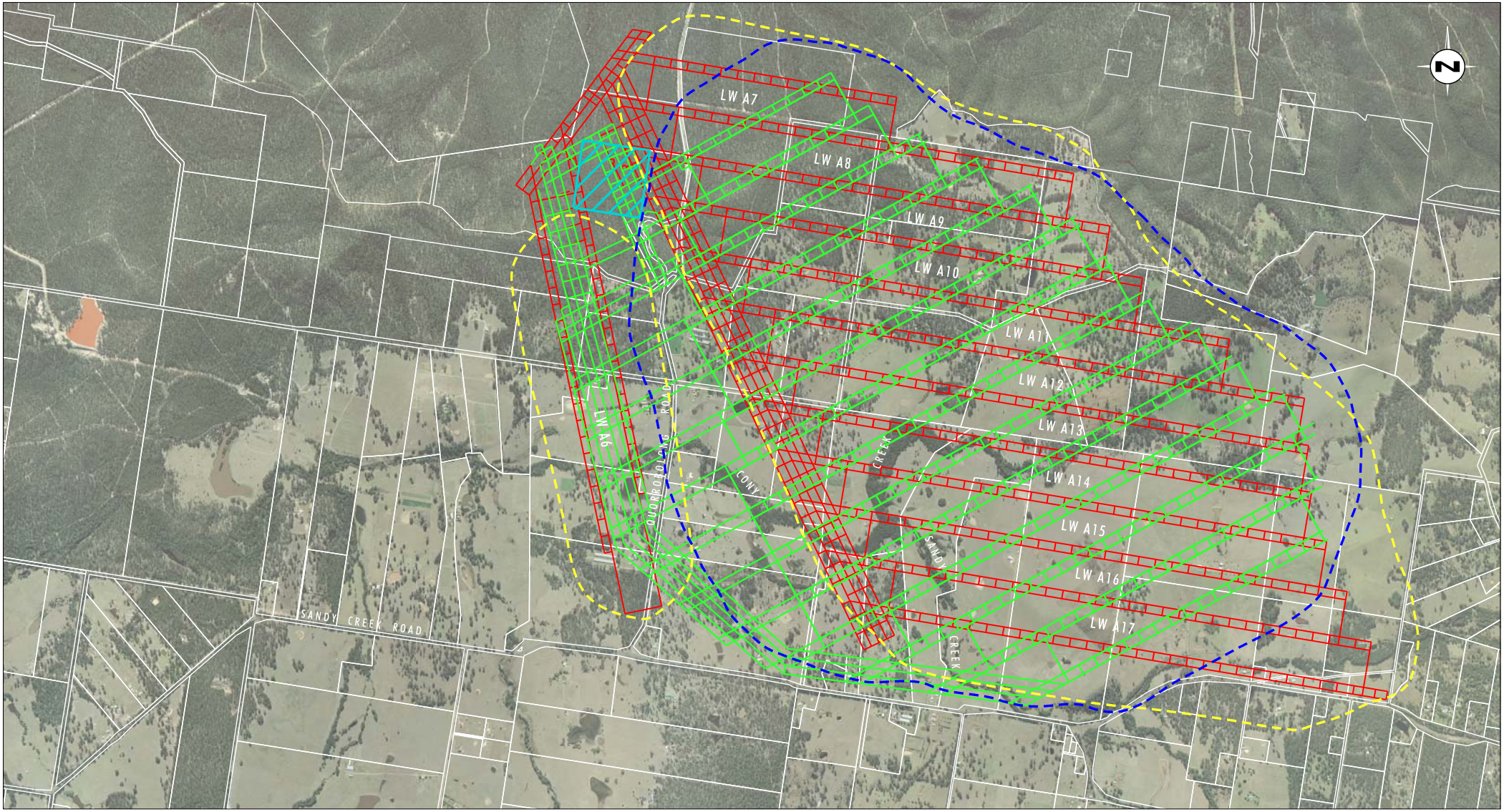
0 1.0 2.0 4km
1:100 000

Legend

- Layout for Stage 1 Longwall Panels
- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Proposed Stage 3 Modification Longwall Panels
- Approved Surface Infrastructure Site
- Consolidated Mining Lease (CML) 2
- Pending Mining Lease Application Areas

FIGURE 1.1

Austar Mine Complex
Locality Plan



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006, Subsidence Contours: MSEC

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1:32 000

Legend

- Conceptual Layout for Stage 3 Longwall Panels as Approved
- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Conceptual Layout as Approved (Stage 3 Area)
- 20mm Subsidence Contour for Proposed Stage 3 Modification (Stage 3 Modification Area)
- Approved Surface Infrastructure Site

FIGURE 1.2

Stage 3 Project and Stage 3 Modification Area

- a review of site card information in order to obtain information relevant to the cultural values of the sites and potential archaeological deposits (PADs) located and their management;
- a review of the draft Aboriginal Cultural Heritage and Archaeological Assessment report; and
- provision of input into the Aboriginal Cultural Heritage and Archaeological Assessment report.

The 15 Registered Aboriginal Parties included:

- Aboriginal Native Title Consultants (ANTC);
- Giwiirr Consultants (GC);
- Hunter Valley Cultural Consultants (HVCC);
- Hunter Valley Cultural Surveying (HVCS);
- Lower Hunter Wonnarua Council (LHWC);
- Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC);
- Mingga Consultants (MC);
- Culturally Aware (CA);
- Wonn 1 Consulting (W1C);
- Mindaribba Local Aboriginal Land Council (MLALC);
- Upper Hunter Heritage Consultants (UHHC);
- Wattaka Wonnarua Cultural Consultants Service (WWCCS);
- Wonnarua Culture Heritage (WCH);
- Wanaruah Custodians (WC); and
- Yarrawalk (Y).

In addition to the above groups Yinarr Cultural Services (YCS) submitted an expression of interest late in the project, attended meetings and was provided the draft of this report for comment.

1.2 Native Title

A search of the National Native Title Tribunal's (NNTT's) National Native Title Register, Register of Native Title Claims, Unregistered Claimant Applications and Register of Indigenous Land Use Agreements was undertaken on 29 April 2011. The search parameters were specified as the Cessnock Local Government Area. Results of the search were received from the NNTT on 4 May 2011.

There are no Native Title claims registered for the area incorporating the Stage 3 Modification Area or the broader Cessnock Area.

1.3 Relevant Legislation

This Aboriginal Cultural Heritage and Archaeological Assessment was undertaken as part of the EA with the aim of identifying and managing any potential impacts to Aboriginal archaeological objects and values resulting from the modified Project.

This Aboriginal Cultural Heritage and Archaeological Assessment has been conducted in compliance with relevant Planning policies and guidelines, specifically the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (2010) and the Part 3A assessment guideline *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2004b).

In the period between the 2008 and 2011 surveys new regulations under the *National Parks and Wildlife Act 1974* have been introduced through the *National Parks and Wildlife Amendment Act 2010* and the Assessment is also compliant with the National Parks & Wildlife Regulation 2009.

1.4 Contents of this Report

This report consists of the following sections:

Section 2 describes the Austar Coal Mine project, spanning history of the project, existing infrastructure and operations and the proposed modification to Stage 3 of the Project.

Section 3 provides the assessment context, reviewing available literature on the environment of the proposed Stage 3 Modification Area, ethnohistoric sources, land use history and previous archaeological research; with the implications of this context for the Aboriginal Cultural Heritage and Archaeological Assessment of the 75W modification area discussed throughout.

Section 4 presents the archaeological predictive model developed for the proposed Stage 3 Modification Area, specifying likely site types, site content, site distribution and site integrity.

Section 5 details the aims, objectives, methods and results of the archaeological survey, including survey coverage, landform and archaeological site classification, known sites inspected and additional sites recorded. This section also identifies areas of potential archaeological deposit (PAD) recorded and evaluates survey results against the predictive model developed in **Section 4**. It also provides a discussion of the results of all surveys undertaken in the broader Stage 3 Assessment Area. The likely Aboriginal archaeological values of properties that were not accessible are also discussed.

Section 6 provides an analysis of the archaeological sites and PADs identified and presents the evaluation of their archaeological significance as assessed against established criteria.

Section 7 provides a heritage impact assessment archaeological sites and areas of archaeological potential identified during the 2008 and 2011 surveys.

Section 8 defines key factors influencing the management of Aboriginal objects for the Project, the management options available and presents management recommendations

developed for Aboriginal archaeological site types and potential archaeological deposits identified within the proposed Stage 3 Modification Area.

Section 9 lists reports and publications referred to in the text.

1.5 Contributors to the Assessment

Andrew Roberts (Senior Archaeologist, Umwelt) undertook the Aboriginal community consultation and archaeological survey and assessment and prepared this technical report. Gary Mulhearn (Environmental Coordinator, Austar Coal Mine Pty Ltd) also undertook Aboriginal community and landowner consultation and assisted with survey preparation. Kirwan Williams (Archaeologist, Umwelt) assisted in the archaeological survey and report preparation. Jan Wilson (Manager, Cultural Heritage) provided strategic direction for the project and the quality review of draft and final reports. Peter Jamieson (Director) and Catherine Pepper (Associate) managed the preparation of the Umwelt EA report, including the Aboriginal Cultural Heritage and Archaeological Assessment component and Andy Goodwin (Social and Environmental Analyst) assisted with report writing and production.

2.0 Austar Coal Mine Project

2.1 History of Austar Coal Mine

Underground coal mining commenced at the Pelton Colliery in 1916. In 1960/1961, the Pelton Coal Handling and Preparation Plant (CHPP) was constructed. In 1975, development consent for the Ellalong Colliery was granted and the mine was officially opened in July 1979. The development approved in the 1975 development consent envisaged that coal from the Ellalong Colliery would be transported by conveyor from the Ellalong Drift and Pit Top to the Pelton CHPP (refer to **Figure 2.1**).

In early 1994, high gas levels were encountered in the southern part of the Ellalong Colliery. In 1996, the Minister for Urban Affairs and Planning granted development approval to extend the Ellalong Colliery into the Bellbird South area to allow development in an area not affected by high levels of coal seam gas. The 1996 consent (DA29/95) permits mining in Consolidated Mining Lease 2 (CML2) with a production rate of up to 3 million tonnes of coal per annum (Mtpa) by conventional retreat longwall mining. The approved extraction height ranged from 3.5 to 4.5 metres. The consent also allows for the handling, processing and transport of coal to the Port of Newcastle via road and rail.

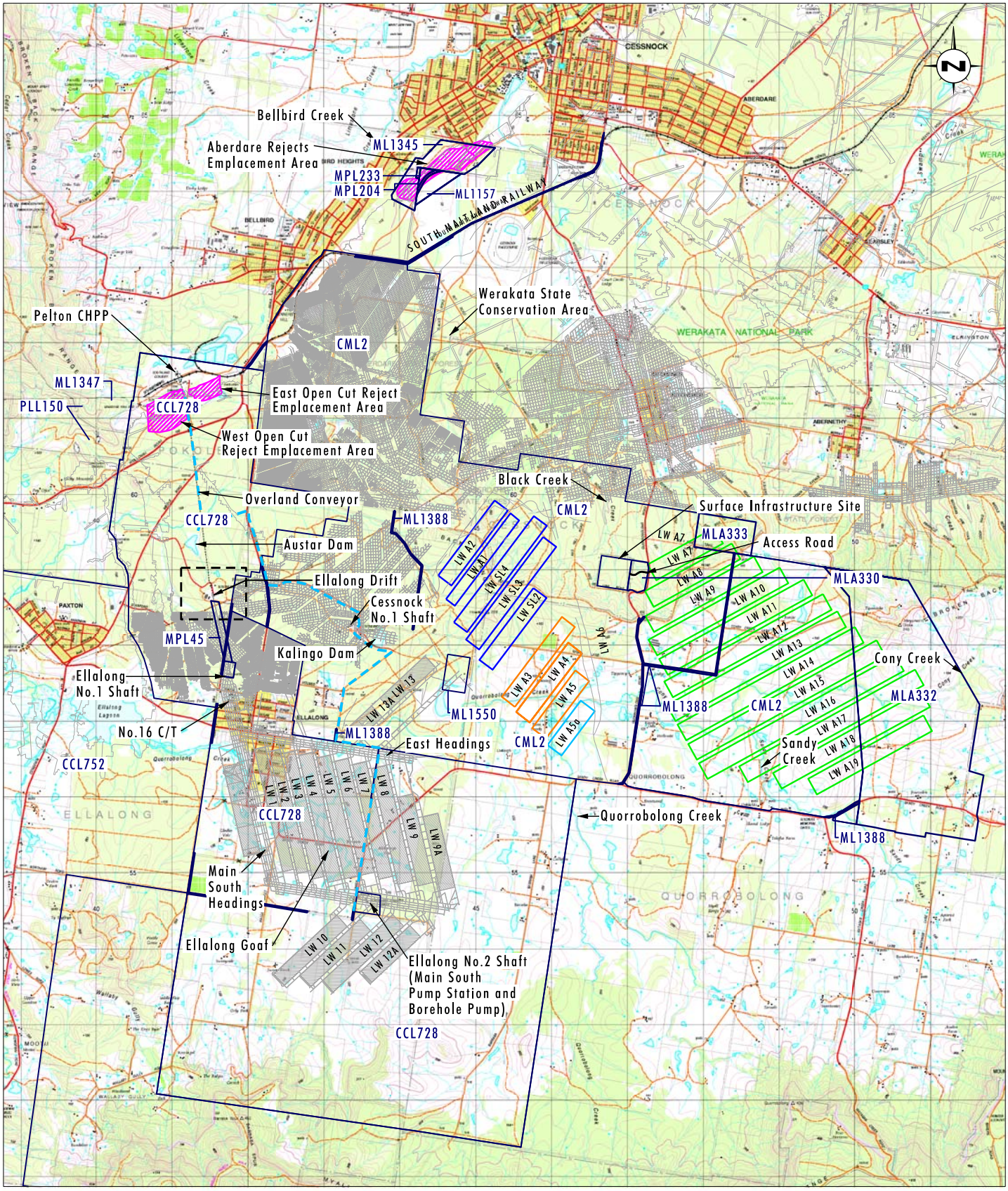
In 1998, Southland Coal Pty Limited acquired the Ellalong and Pelton Collieries and amalgamated them with Bellbird South. Ellalong, Pelton and Bellbird South Collieries became known as the Southland Colliery, which operated until 2003 when fire broke out in the underground workings. Subsequently, the mine went into receivership and operations were placed on care and maintenance.

In December 2004, YanCoal Australia purchased the Southland Coal assets and changed the name of the mine to the Austar Coal Mine. Mining was recommenced under the 1996 Minister's Consent in reconfigured Stages, 1, 2 and 3. The extent of previous and current workings within what is now known as the Austar Coal Mine is shown on **Figure 2.1**.

Stage 1 approval was obtained in September 2006, and this allowed a modification of the 1996 Minister's Consent to allow for the extraction of coal by longwall top coal caving (LTCC) method. A further section 96 Modification (Stage 2) was approved by the Minister of Planning in 2008 to allow LTCC extraction of Longwall panels A3 to A5 in Stage 2.

Presently, coal is being extracted from the area subject to the 1996 Minister's Consent. Coal is bought to the surface at the Ellalong Drift and Pit Top, conveyed to the Pelton CHPP, processed and handled at the Pelton CHPP and railed to the Port of Newcastle via Pelton Branch Line and South Maitland Railway. Key activities approved under the 1996 consent (DA29/95) include:

- mining of up to three million tonnes (Mt) of coal per annum;
- transfer of the coal by underground conveyor to the surface;
- washing and preparation of coal;
- stockpiling of raw and washed coal;
- reject emplacement; and
- transport of product coal by rail (98 per cent) to the Port of Newcastle and up to 60,000 tonnes annually by road to markets that are not currently practical to service using rail.



Source: Topo Maps: LPI NSW, Longwall Layouts: Austar Coal Mine

0 1 2 3km
1:70 000

Legend

- Layout for Stage 1 Longwall Panels
- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Proposed Stage 3 Modification Longwall Panels
- Reject Emplacement Areas
- Old Workings
- Mining Leases
- Water Pipeline

FIGURE 2.1

Austar Mine Complex

File Name (A4): R60_V1/2274_931.dgn

2.2 Stage 3 Project Approval

A new project approval was granted by the Minister for Planning in September 2009, enabling the extraction of up to 3.6 million tonnes of run of mine (ROM) coal annually for 21 years using LTCC technology in the Stage 3 area. It also involved the construction and operation of a new Surface Infrastructure Site and access road south-west of Kitchener (refer to **Figure 1.2**). Construction of the Surface Infrastructure Site commenced in December 2009 and will take approximately 36 months to complete. Longwall mining in the Stage 3 area is scheduled to commence in 2013. Austar proposed to use existing infrastructure and facilities to handle, process and transport coal from Longwalls A6 to A17. Modification to the approved Stage 3 Project is now being sought under section 75W in Part 3A of the EP&A Act.

Umwelt prepared the EA for the Stage 3 Project and prepared an Aboriginal Cultural Heritage Assessment as part of the EA (Umwelt 2008b). The 2008 survey and assessment was undertaken to precede the development of a Aboriginal Cultural Heritage Management Plan (ACHMP) with assistance of Registered Aboriginal Parties with the aim of identifying and managing any potential Aboriginal cultural heritage impacts resulting from the planned works.

2.3 Proposed Stage 3 Modification

To enable more efficient and safer extraction of coal from the Stage 3 area, Austar seeks approval to modify Project Approval 08_0111 to allow the longwalls to be reoriented. This modification will include removal of longwall A6, and extraction of coal in longwalls A7 to A19, which are a reorientation of longwalls A7 to A17. A comparison between the longwall layouts of the Approved Stage 3 and Stage 3 Modification is provided in **Figure 1.2**. The location of the main headings is proposed to be moved to the west and the width of chain pillars is also proposed to be increased to reduce roadway failure risk and in turn subsidence impact risks (refer to **Figure 1.2**). The proposed Stage 3 Modification will remain entirely within CML2 and existing lease extension application areas MLA 322 and MLA 333 and involves a change to the Stage 3 mine plan only, with no proposed changes to underground mining method, total approved rate or quantity of extraction, or associated surface infrastructure.

As Project Approval 08_0111 was granted under Part 3A of the EP&A Act, Austar seeks approval for the modification under section 75W of the EP&A Act. Section 75W allows for the modification of approvals granted by the Minister under Part 3A. This Aboriginal Cultural Heritage and Archaeological Assessment will accompany the EA in the modification application to the NSW Minister for Planning and has been prepared in accordance with the Environmental Assessment Requirements (EARs).

As shown in **Figure 1.2**, the area of surface impact will be generally within the envelope of that previously approved for the majority of the underground mining area. Surface impacts are proposed to be decreased in the west of the approved Stage 3 area via the removal of Longwall A6, decreased in the south-east and north-west by reorientation of longwall panels, and increased for a section of land between the approved Longwall A6 and the western extent of approved Longwalls A7 to A17.

3.0 Assessment Context

Review of environmental, ethnohistoric, historic, and archaeological literature is essential to the assessment process, as it informs our understanding of past Aboriginal occupation, land use, archaeological site patterning, site survival and the potential for detection of extant archaeological sites.

The aims, objectives and methods of the Aboriginal Cultural Heritage and Archaeological Assessment were developed in consultation with Registered Aboriginal Parties (refer to **Section 1.2**) as required in the *National Parks & Wildlife Amendment Act 2010.*

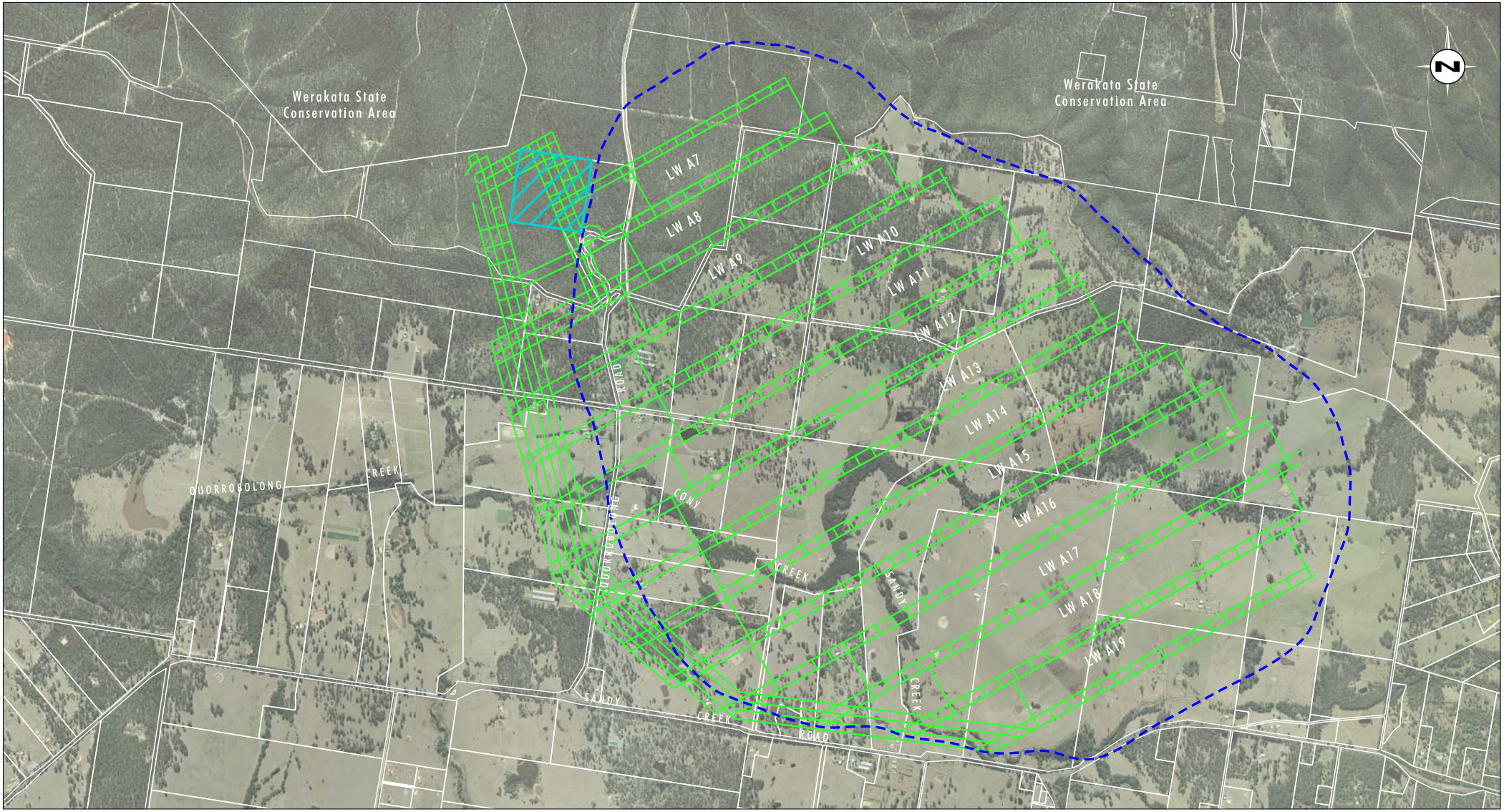
Throughout this assessment the area within the 20 mm subsidence contour for the Stage 3 longwall panels as approved is referred to as the 'Stage 3 area'. The area within the 20 mm subsidence contour for the proposed Stage 3 Modification longwall panels is referred to as the 'proposed Stage 3 Modification Area' (refer to **Figure 3.1**).

3.1 Known Aboriginal Archaeological Sites

A search of the Department of Environment Climate Change and Water (DECCW) Aboriginal Heritage Information Management System (AHIMS) database undertaken on 23 June 2010 identified 117 Aboriginal archaeological sites within (AMG coordinates E338975-356405 N6349220-6371090) an area of 21.87 kilometres (north-south) by 12.43 kilometres (east-west). This area encompasses the Myall Range to the south, Congewai Creek to the east, Middle Creek to the north and the Broken Back Range to the west (refer to **Figure 3.2**). **Table 3.1** lists all sites located within the AHIMS search area. Please note that the grid coordinates for the sites have not been listed at the request of the Registered Aboriginal Parties who do not want the specific site locations identified. **Appendix B** contains the AHIMS results (**Appendix B** is for restricted viewing and will not be part of the document provided for public exhibition).

Table 3.1– Known Aboriginal Archaeological Sites within AHIMS Search Area

Site ID	Site Name	Site Type
37-6-0041	Conjewai Creek	Shelter with art, Rock Engraving, Artefact scatter, Grinding groove
37-6-0042	Conjewai Creek	Shelter with deposit
37-6-0084	Mootai	Shelter with Art, Shelter with Deposit
37-6-0101	Conjewai Creek	Shelter with Art
37-6-0114	Quorrobolong	Modified tree
37-6-0422	Quorrobolong	Artefact scatter, isolated find
37-6-0472	Rocky Creek	Grinding grooves.
37-6-0473	Catch-a-Bay Swamp	Aboriginal Ceremonial and dreaming
37-6-0686	Cessnock Landfill 1	Artefact scatter, isolated find
37-6-0716	RCK 1	Artefact scatter, isolated find
37-6-0717	RCK 2	Artefact scatter, isolated find
37-6-0718	HL 1	Artefact scatter, isolated find
37-6-0719	ML 1	Artefact scatter, isolated find
37-6-0731	TL 3	Artefact scatter, isolated find
37-6-0732	TL 2	Artefact scatter, isolated find
37-6-0733	TL 1	Artefact scatter, isolated find
37-6-0737	TL 4	Artefact scatter, isolated find



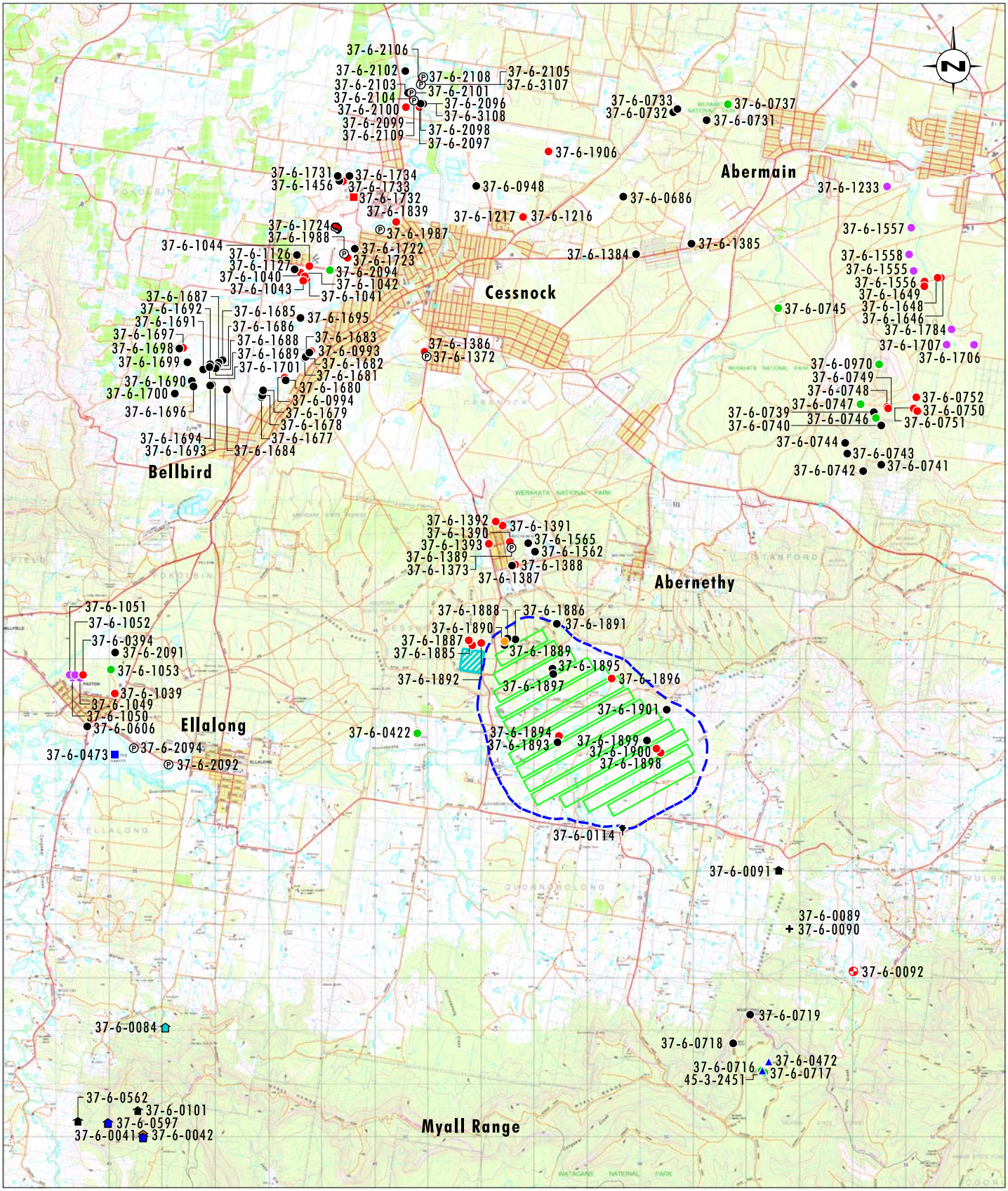
Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification (Stage 3 Modification Area)
- Approved Surface Infrastructure Site

FIGURE 3.1

75W Modification Area



Source: Geology: Mineral Resources 2003, Longwall Layout: Austar Coal Mine

0 1.0 2.0 4km
1:100 000

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Surface Infrastructure Site
- Axe Grinding Groove
- Carved Tree
- Isolated Find
- Isolated Find with PAD
- Isolated Find and Grinding Groove
- Natural Mythological (Ritual)
- Artefact Scatter and PAD
- Artefact Scatter
- Open Camp Site
- PAD
- Shelter with Art
- Shelter with Art and Deposit
- Shelter with Deposit
- Shelter with Axe Grinding Groove, Rock Engraving and Art
- Burial/s
- Bora/Ceremonial
- Unidentified Site Type

FIGURE 3.2

AHIMS Sites (Regional)

File Name (A4): R60_V1/2274_967.dgn

Table 3.1– Known Aboriginal Archaeological Sites within AHIMS Search Area (cont)

Site ID	Site Name	Site Type
37-6-0948	c-if-1	Artefact scatter, isolated find
37-6-0993	BBAS1	Artefact scatter, isolated find
37-6-0994	BBAS2	Artefact scatter, isolated find
37-6-1039	Paxton 5	Artefact scatter, isolated find
37-6-1040	Mt View 1	Artefact scatter, isolated find
37-6-1041	Mt View 2	Artefact scatter, isolated find
37-6-1042	Mt View 3	Artefact scatter, isolated find
37-6-1043	Mt View 4	Artefact scatter, isolated find
37-6-1044	Mt View 5	Artefact scatter, isolated find
37-6-1126	Mt View IF2	Artefact scatter, isolated find
37-6-1127	Mt View IF3	Artefact scatter, isolated find
37-6-1216	Cessnock 2	Artefact scatter, isolated find
37-6-1217	Cessnock 1	Artefact scatter, isolated find
37-6-1372	Kitchener PAD 1	Potential Archaeological Deposit
37-6-1373	Kitchener PAD 2	Potential Archaeological Deposit
37-6-1384	Neath 1	Isolated find
37-6-1385	Neath 2	Isolated find
37-6-1386	HH 1	Artefact scatter, isolated find
37-6-1387	KS 1	Isolated find
37-6-1388	KS 2	Artefact scatter, isolated find
37-6-1389	KS 3	Artefact scatter, isolated find
37-6-1390	KS 4	Artefact scatter, isolated find
37-6-1391	KS 5	Artefact scatter, isolated find
37-6-1392	KS 6	Artefact scatter, isolated find
37-6-1393	KS 7	Artefact scatter, isolated find
37-6-1456	Kerlew 1	Isolated find
37-6-1562	Kitchener Sub-Division (KSD2)	Isolated find
37-6-1565	Kitchener Sub-Division (KSD1)	Isolated find
37-6-1677	NB1	Isolated find
37-6-1678	NB2	Isolated find
37-6-1679	NB3	Isolated find
37-6-1680	NB 4	Isolated find
37-6-1681	NB 5	Isolated find
37-6-1682	NB 6	Isolated find
37-6-1683	NB 7	Isolated find
37-6-1684	NB 8	Isolated find
37-6-1685	NB 9	Isolated find
37-6-1686	NB 10	Artefact scatter
37-6-1687	NB 11	Isolated find
37-6-1688	NB 12	Isolated find
37-6-1689	NB 13	Isolated find
37-6-1690	NB 14	Isolated find
37-6-1691	NB 15	Isolated find

Table 3.1– Known Aboriginal Archaeological Sites within AHIMS Search Area (cont)

Site ID	Site Name	Site Type
37-6-1692	NB 16	Isolated find
37-6-1693	NB 17	Isolated find
37-6-1694	NB 18	Isolated find
37-6-1695	NB 19	Isolated find
37-6-1696	NB 20	Isolated find
37-6-1697	NB 21	Artefact scatter
37-6-1698	NB 22	Isolated find
37-6-1699	NB 23	Isolated find
37-6-1700	NB 24	Isolated find
37-6-1701	NB 25	Isolated find
37-6-1722	OGC 5	Isolated find
37-6-1723	OGC 6	Artefact scatter
37-6-1724	OGC 7	Artefact scatter; Potential Archaeological Deposit
37-6-1731	OGC 1	Isolated find
37-6-1732	OGC 2	Isolated find; Potential Archaeological Deposit
37-6-1733	OGC 3	Artefact scatter
37-6-1734	OGC 4	Isolated find
37-6-1839	AR1	Artefact scatter
37-6-1885	ACM1 (Quorrobolong)	Artefact scatter
37-6-1886	ACM3 (Quorrobolong)	Isolated find
37-6-1887	ACM2 (Quorrobolong)	Artefact scatter
37-6-1888	ACM4 (Quorrobolong)	Isolated find
37-6-1889	ACM5 (Quorrobolong)	Isolated find
37-6-1890	ACM6 (Quorrobolong)	Isolated find, Grinding groove
37-6-1891	ACM7 (Quorrobolong)	Isolated find
37-6-1892	ACM8 (Quorrobolong)	Artefact scatter
37-6-1893	ACM9 (Quorrobolong)	Isolated find
37-6-1894	ACM10 (Quorrobolong)	Artefact scatter
37-6-1895	ACM11 (Quorrobolong)	Isolated find
37-6-1896	ACM12 (Quorrobolong)	Artefact scatter
37-6-1897	ACM13 (Quorrobolong)	Isolated find
37-6-1898	ACM14 (Quorrobolong)	Artefact scatter
37-6-1899	ACM15 (Quorrobolong)	Isolated find
37-6-1900	ACM16 (Quorrobolong)	Artefact scatter
37-6-1901	ACM17 (Quorrobolong)	Isolated find
37-6-1906	Hunter TEC Ironbark Lane 1	Artefact scatter
37-6-1987	OGC PAD 2	Potential Archaeological Deposit
37-6-1988	OCG PAD 1	Potential Archaeological Deposit
37-6-2091	Paxton North IF1	Isolated find
37-6-2092	Paxton PAD 2	Potential Archaeological Deposit
37-6-2094	Paxton PAD 1	Potential Archaeological Deposit
37-6-2096	SPC 1	Isolated find

Table 3.1– Known Aboriginal Archaeological Sites within AHIMS Search Area (cont)

Site ID	Site Name	Site Type
37-6-2097	SPC 2	Artefact scatter
37-6-2098	SPC 3	Isolated find
37-6-2099	SPC 4	Artefact scatter
37-6-2100	SPC 5	Artefact scatter
37-6-2101	St Philips PAD 1	Potential Archaeological Deposit
37-6-2102	SPC 6	Isolated find
37-6-2103	SPC 7	Isolated find
37-6-2104	SPC 8	Artefact scatter
37-6-2105	SPC 9	Artefact scatter
37-6-2106	SPC 10	Artefact scatter
37-6-2107	St Philips PAD 2	Potential Archaeological Deposit
37-6-2108	St Philips PAD 3	Potential Archaeological Deposit
37-6-2109	St Philips PAD 4	Potential Archaeological Deposit
37-6-2718	Kitchener Isolated Find 1	Isolated find
45-3-2451	RCK 3	Grinding grooves

Table 3.2 summarises the sites found in the search area by site type. The most common Aboriginal site types within the AHIMS search area are isolated finds and artefact scatters (101 in total), followed by PADs (12 including 2 PADs associated with surface material).

Table 3.2 –Summary of AHIMS Registered Sites within Search Area

Site Type	Number of Sites
Isolated find	47
Artefact scatter/Isolated artefact	32
Artefact scatter	19
Potential Archaeological Deposit	10
Axe Grinding Grooves	2
Shelter with Art, axe grinding grooves, engraving and artefact scatter	1
Scarred Trees	1
Aboriginal Ceremonial and Dreaming	1
Artefact scatter/Art	1
Artefact scatter/Potential Archaeological Deposit	1
Isolated find/Potential Archaeological Deposit	1
Axe Grinding Grooves/Isolated find	1
Total	**117**

3.1.1 Site Definitions

These site types – and other known site types that occur in the broader Lower Hunter Valley region – are defined below.

- **Open Camp Sites/Artefact Scatters.** An open camp site or artefact scatter refers to areas in the open landscape that contain two or more stone artefacts – pieces of stone

modified for or by human use – generally located within 100 metres of each other. Stone artefacts are robust and preserve well in the archaeological record when other forms of evidence of Aboriginal occupation are lost due to preservation biases (wooden implements, food remains do not preserve well). Artefact scatters may result from the activities of a single person or a group of people. They may reflect a single occupation episode, or multiple episodes of occupation of a single place. The vast majority of stone artefacts were tools used in day to day activities, however, some were used in special rituals/ceremonies that were non-secular in nature (that is, ceremonial axes, tjuringa [engraved or decorated stones] or stone knives used in cicatrisation).

- **Isolated Finds.** The site type described as an 'isolated find' or 'isolated artefact' consists of a single stone artefact, which may represent lost or discarded artefacts, but may also be the surface expression of a larger scatter of artefacts in a subsurface context.

- **Scarred Trees.** Aboriginal people often removed the bark and sometimes heartwood from the trunks of trees to make toe holds (to aid in climbing to extract honey or possums from tree hollows), bowls, shields, spearthrowers, coolamons, canoes and/or for roofing material for shelters. The bark removal leaves scars on the tree trunk which indicates the Aboriginal use of an area.

- **Carved Trees.** Other trees were carved with designs, which were used to mark ceremonial grounds and burials (Etheridge 1918:84; McBryde 1974:126). Designs were often carved on the wood of the trunk exposed by the removal of the bark, and designs could include geometric or linear patterns or animal representations.

- **Rockshelter Sites.** The term 'rockshelter site' refers to rockshelters or overhangs that contain evidence such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces). Some rockshelter sites also contain rock art (painted or drawn), engravings and/or grinding grooves.

- **Engraving Site.** The term 'engraving site' refers to places where Aboriginal people have incised (using techniques such as pecking or abrasion) some form of motif into rock. The engravings may be on a rock outcrop, rock slab, boulder, cliff-face, rock overhang, or in a cave or rockshelter. Engraving sites are not necessarily located in sheltered positions, but are most often located on softer rock types (like sandstone).

- **Grinding Grooves.** Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, stone chisels or fire hardened wooden spear points. Grinding grooves are commonly located on sandstone ledges that outcrop in creek and river beds, as the availability of water enhances the speed with which grinding proceeds. Less commonly, grinding grooves are located on rock surfaces away from water such as in rockshelters and on stone types other than sandstone.

- **Grinding Bowls.** Grinding bowls are rounded depressions on rock surfaces that have been manufactured by the grinding of ochre, seeds, nuts and other plant resources. Grinding bowls are commonly located on sandstone ledges that outcrop in creek and river beds, as water is often added during the grinding process to form a paste. Less commonly, grinding bowls are located on rock surfaces away from water such as in rockshelter sites and on stone types other than sandstone.

- **Waterholes/Wells.** These are generally natural rock waterholes that contain water used for drinking or for special ritual purposes.

- **Pot Holes.** Pot holes are deep (arm's length), steep sided, generally rounded depressions located on sandstone ledges that outcrop in creek and river beds. The pot

holes are generally natural depressions that have been enlarged and deepened by grinding. Pot holes often have grinding grooves radiating from them; or may have a rock placed over them to keep the water safe from animals and clear of debris.

- **Stone Arrangements.** Stone arrangements are locations where Aboriginal people deliberately positioned stones to form shapes or patterns, ranging from simple stone mounds to complex circles and pathways.

- **Stone Quarries.** Stone quarries are places where Aboriginal people have sourced raw material for the manufacture of tools. Quarries may be cobble beds in rivers or on beaches, or they may be rock outcrops. When outcrops are exploited the quarrying activity may take the form of the flaking of rock from the outcrop, or scree from below the outcrop may be used instead. In some areas the stone may be dug from beneath the earth as Aboriginal stone knappers often preferred rock which had not been dried out by exposure to the elements (Tindale 1965: 140; Jones and White 1988:61-62).

- **Ochre Quarries.** Ochre quarries are places where Aboriginal people sourced ochre (hydrated iron oxides and iron hydroxides - Whitten and Brooks 1972:269) which they used for body decoration, implement decoration and rock art.

- **Ceremonial Grounds.** In the Hunter region the main type of ceremonial ground recorded was the Bora. Bora grounds generally consisted of two earthen rings or two rings outlined with stones. The Bora ground was used during male initiation ceremonies (Fife 1995), and historic literature suggests that access to the smaller of the two rings was restricted to initiated males and the male initiates.

- **Contact Sites.** These are places where Aboriginal people lived in the period following European settlement. They are often documented in historical literature as being places of a shared history of interaction between Aboriginal people and non-Aboriginal people, and could be reflected by archaeological objects such as flaked glass artefacts.

- **Burial Sites.** Burial sites can be classified as pre- or post-contact. Pre-contact burial sites refer to Aboriginal skeletal material dating to a time before white settlement. The skeletal material may be buried, covered by rocks, interred in a cave/rockshelter/under a ledge, in a tree hollow, or exposed on a platform in a tree. Burial sites are generally believed to be non-secular in nature by contemporary Aboriginal people. Post-contact burial sites refer to burials/interments that have taken place since European settlement and that are not located in a recognised cemetery and are not documented. If they are documented then they are considered Aboriginal historic sites and not Aboriginal archaeological sites.

3.1.2 Known Aboriginal Archaeological Sites within the Proposed Stage 3 Modification Area

Of the 117 registered Aboriginal archaeological sites identified by the AHIMS site register search, 14 are located within the Stage 3 Modification Area (ACM3 to 6 and ACM8 to 17). A further three sites (ACM1, ACM2 and ACM 7) were assessed in the 2008 Aboriginal Cultural Heritage Assessment as a component of the Stage 3 EA (Umwelt 2008b), but are outside the Stage 3 Modification Area. All of these sites are listed in **Table 3.3** and illustrated on **Figure 3.2**.

Table 3.3 – Aboriginal Archaeological Sites Registered within the Stage 3 Area and Proposed Stage 3 Modification Area

AHIMS #	Site Name	Site Type	Area Where Registered
37-6-1885	ACM1 (Quorrobolong)	Isolated find	Stage 3 Area
37-6-1887	ACM2 (Quorrobolong)	Isolated find	Stage 3 Area
37-6-1886	ACM3 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1888	ACM4 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1889	ACM5 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1890	ACM6 (Quorrobolong)	Grinding groove and Isolated find	Proposed Stage 3 Modification Area
37-6-1891	ACM7 (Quorrobolong)	Isolated find	Stage 3 Area
37-6-1892	ACM8 (Quorrobolong)	Artefact scatter	Proposed Stage 3 Modification Area
37-6-1893	ACM9 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1894	ACM10 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1895	ACM11 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1896	ACM12 (Quorrobolong)	Artefact scatter	Proposed Stage 3 Modification Area
37-6-1897	ACM13 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1898	ACM14 (Quorrobolong)	Artefact scatter	Proposed Stage 3 Modification Area
37-6-1899	ACM15 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1900	ACM16 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area
37-6-1901	ACM17 (Quorrobolong)	Isolated find	Proposed Stage 3 Modification Area

In addition to the sites listed in **Table 3.3**, five Aboriginal archaeological sites have been recorded within the broader CML2 lease area managed by Austar. Three of these are not yet registered on the AHIMS sites database as site cards have only recently been submitted to the Office of Environment and Heritage[1] (OEH). These sites are listed in **Table 3.4**.

Table 3.4 - Archaeological Sites known to occur within the CML2 Lease

AHIMS #	Site Name	Site Type
na	ACM18	Artefact scatter
na	ACM19	Isolated find
na	ACM20	Isolated find
37-6-0422	Quorrobolong	Artefact scatter
37-6-0114	Quorrobolong	Carved tree

[1] Formerly NPWS, DEC, DECC and DECCW

Of the above site locations, one – Quorrobolong (#37-6-0114), a carved tree – is positioned approximately 100 metres to the south of the proposed Stage 3 Modification Area (**Figure 3.2**). This site was registered by D Bell in 1980, but the site cards note that the site was first reported by B T McCarthy in 1959. The tree is described as destroyed on the AHIMS site card. No other information is provided on the site card.

3.2 Previous Archaeological Research

3.2.1 Previous Archaeological Assessments within the Broader Cessnock and Lower Hunter Area

The Cessnock area has been subject to extensive archaeological investigation since the 1970s (Stedinger Associates 2003, 2005, Rich 1995, Moore 1970, Kuskie 1994, 2002, Koettig 1986, 1987, Hiscock & Attenbrow 2004, Gay 1999, Foley 1981, ERM 2003, 2004, Effenberger & Baker 1996, Dean-Jones & Mitchell 1993, Brayshaw 1981 & 1982, Besant 2002a, 2002b, Baker 1994, Appleton 1993, SCARP 2009). Archaeological research in the area has predominantly consisted of surveys, with only a few excavations providing information on the subsurface deposits of the region.

Appendix C summarises prior archaeological assessments in the Cessnock and area and Lower Hunter Valley which has identified that former occupation sites (camp sites evidenced by artefact scatters and isolated finds) are the most common site type, and that these sites can occur in all landform contexts. However, studies have also identified that both site and artefact density increase with proximity to creek lines, and that sites are most commonly found within 50 metres of permanent or semi-permanent streams.

Small artefact scatters and isolated finds may also be found in areas of elevation and low gradient such as along spur crests that are not necessarily closely associated with reliable water (McCardle 2006).

Archaeological excavation in the Cessnock area (ERM 2003, Stedinger Associates 2005) has identified subsurface deposits in areas containing few or no surface artefacts. One site identified through excavation alone – Mount View 8 – contained 3777 artefacts.

Artefact assemblages recorded within the broader Lower Hunter region have been found to generally consist of flakes, broken flakes, retouched flakes, flaked pieces and cores. The dominant raw material is generally indurated mudstone and silcrete with porcellanite, silicified sandstone, hornfels, basalt, quartz, quartzite and chert commonly making up a minor component of the larger assemblages.

There is a paucity of Pleistocene age sites in the broader Hunter Valley context. Based on the age of the upper (A unit) soils and the presence of backed artefacts, the majority of sites are considered to date from the mid to late Holocene (between 6000 to 5000 years ago) to the present. However, Aboriginal occupation of the Hunter Valley undoubtedly occurred prior to the Holocene, with a small number of late Pleistocene dates reported from Glennies Creek, Lemington and Warkworth West (Koettig 1986, Kuskie 2000, AMBS 2002, ERM 2004:15, SCARP 2009).

3.2.2 Previous Archaeological Assessments within the Proposed Stage 3 Modification Area

Umwelt has undertaken a number of surveys in the proposed Stage 3 Modification Area and the results of these recent assessments are summarised below.

3.2.2.1 Aboriginal Heritage Assessment Austar Coal Mine (Umwelt 2008b)

Umwelt (2008b) conducted an archaeological survey of the Stage 3 Area of Austar Coal Mine (refer to **Figure 3.3**). Based on a review of ethnohistoric, environmental and archaeological literature for the local area, a predictive model was developed for archaeological site distribution, content and integrity that predicted:

- small artefact scatters and isolated finds were likely to occur;
- artefact sites will be generally in low-gradient landscape areas in association with creek lines or on spur crests and ridge crests that offer broad outlooks;
- larger artefact scatters may occur along Cony and Sandy Creeks;
- silcrete and mudstone were predicted to be the most common raw materials;
- scarred trees may occur where mature trees survive; and
- grinding grooves may occur where suitable sandstone outcrops in the creek lines.

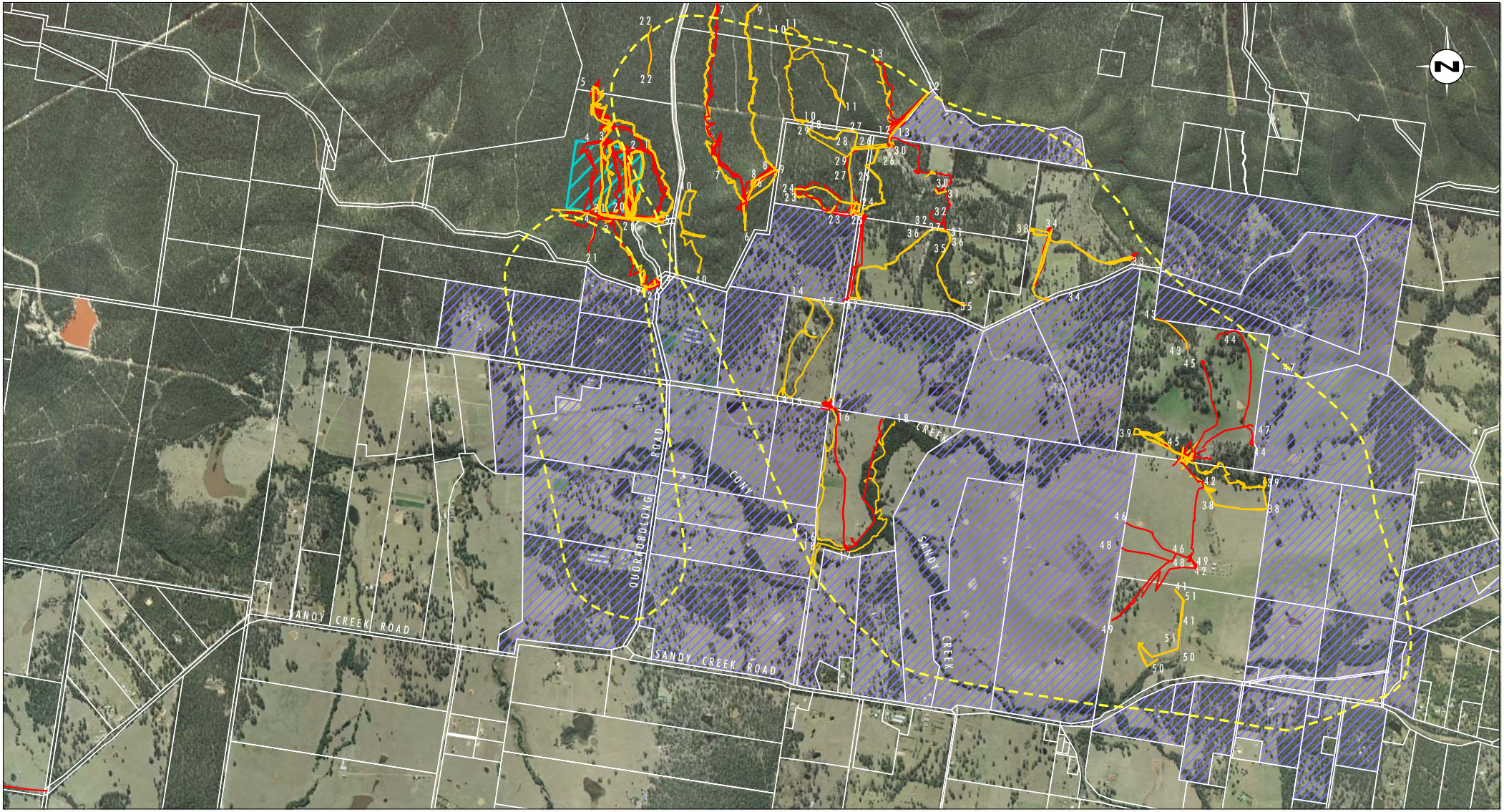
Surveys concentrated on creek lines, spur crests and ridge crests with broad outlooks where the predictive model suggested sites would be located (refer to **Figure 3.3**). More intensive surveys were undertaken on the proposed Surface Infrastructure Site near Quorrobolong Road. During survey, 17 archaeological sites were recorded, including 9 isolated finds, 7 artefact scatters and 1 grinding groove site. Site and artefact densities were generally low, with only one site known to contain more than 6 artefacts (ACM14 which contained 24 artefacts). Most sites were assessed to be of low archaeological significance, three were of low to moderate archaeological significance, and the grinding groove was assessed to be of moderate archaeological significance.

The 2008 survey identified four artefact scatters along Cony Creek and also an area with archaeological potential on terraces to the north-east of its confluence with Sandy Creek. It is furthermore noted that areas of Sandy Creek also appear from aerial photography to contain palaeo-channels that could contain older archaeological deposits within abandoned creek terraces.

The 2008 Aboriginal Cultural Heritage Assessment (Umwelt 2008b) identified the former presence of a carved tree to the south of the proposed Stage 3 Modification Area (NPWS #37-6-0114). However, this tree is noted on the site card to be no longer extant. Carved trees are very rare site types and it is highly unlikely that further carved trees will be located within the proposed Stage 3 Modification Area.

The single grinding groove recorded during the 2008 survey in the Werakata State Conservation Area (SCA) was associated with an isolated find. The grinding groove was also associated with a number of pot holes that had worn into the sandstone platform on which it occurred. This site had been previously disturbed by historic blasting and was of low integrity. The presence of a grinding groove site within the proposed Stage 3 Modification Area reflects the sandstone geology of the Broken Back Range, which forms the northern wall of the Quorrobolong Valley within the north of the proposed Stage 3 Modification Area. Similar sandstone outcrops were not observed in the creek systems of Cony and Sandy Creeks within the valley floor or across the proposed Stage 3 Modification Area during the Stage 3 survey (Umwelt 2008b).

The literature review undertaken for the Stage 3 Aboriginal Cultural Heritage Assessment (Umwelt 2008b) identified one documented bora ground within the Quorrobolong Valley



Source: Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.5km
1:32 000

Legend

- 20mm Subsidence Contour
- Approved Surface Infrastructure Site
- Inaccessible Properties
- JT Tracks
- KM Tracks

FIGURE 3.3

2008 Archaeological Survey Transects

File Name (A4): R60_V1/2274_968.dgn

(Reynolds in Needham 1981). Further interviews with this informant in 2011 has indicated the bora site is not in the proposed Stage 3 Modification Area but is likely the same site indicated in a review of AHIMS data and positioned approximately 2.6 kilometres south-west of the proposed Stage 3 Modification Area, on low-lying land no more than 150 metres from Wallis Creek (Umwelt 2008b; Fig 5.6; Reynolds pers. comm. 12 April 2011). Needham (1981:36 from Haslam pers. comm.) described the Quorrobolong ceremonial site as a small ring with an apparent corridor leading away from it. This is consistent with descriptions of bora sites in south-east Australia, which generally consist of two mounded rings – one between 25 to 30 metres in diameter, and the second approximately 10 to 12 metres in diameter – which are connected by a path (Bowdler 1999). Most bora sites have also been found in association with carved trees.

Needham (1981:38.) also identified two burial sites in the Quorrobolong Valley from the same source and these were discussed in the Umwelt 2008 Aboriginal Cultural Heritage Assessment. In 2011 Umwelt was able to contact Mr Reynolds and determined these were located near the Wallis Creek bora (mentioned above) 3.5 kilometres distant from the proposed Stage 3 Modification Area. Both are described as being under a tree or trees, and one is described as being a raised earth rectangular plot. This is consistent with some historical descriptions of burials in the Hunter Valley, with some early observers (such as Breton 1833:203-204) observing the deceased being covered with mounds of earth (instead of being placed in a hole) in the centre of a circle approximately thirty feet in diameter cleared of vegetation. Breton further notes that the trees for some distance were carved with figures representing kangaroos, emus, possums and weapons, some of which extended twenty feet above ground.

3.2.2.2 Due Diligence Inspections (Umwelt and MLALC 2010a, 2010b)

Umwelt and MLALC also conducted two due diligence inspections in 2010, the first of which was for a temporary water pipeline to the Austar Surface Infrastructure Site through a 400 metre section of Werakata SCA. This inspection began on the crest of a spur of the Broken Back Range and proceeded downslope in a northerly direction. Depth of soil in all landforms covered from the upper to the lower slopes was perceived to be shallow (Umwelt 2010a) and no artefacts or PADs were located.

The second due diligence inspection consisted of the survey of two proposed routes for a 33 kV electricity feeder from Kitchener township to Austar's Surface Infrastructure Site. This inspection was carried out entirely within the low undulating terrain which surrounds Kitchener township. A single isolated find (a mudstone flake; NPWS #37-6-1392) was identified as a result of this inspection (Umwelt 2010b) in a disturbed context near a fence and road alignment to the north of Kitchener.

3.2.2.3 Archaeological Due Diligence Inspections of Seismic lines and Borehole locations near Kitchener, NSW (Umwelt and MLALC 2011b)

In February 2011, Umwelt and MLALC were commissioned by Austar to undertake archaeological due diligence inspection of previously unsurveyed sections of four proposed seismic lines and borehole locations within the Werakata SCA approximately 2 kilometres south of the township of Kitchener and to the north of Austar's Surface Infrastructure Site. This survey located three archaeological sites (ACM18, 19 and 20) assessed to be of low significance in an area of second and third order streams with low to moderate archaeological potential.

3.3 Implications of Previous Archaeological Assessments

Archaeological research in the Central Lowlands of the Hunter Valley (refer to **Appendix C** for details) has identified that:

- there are unlikely to be Pleistocene age sites in the proposed Stage 3 Modification Area. Any site located is likely to date to the mid to late Holocene (between 6000 to 5000 years ago and the present);
- sites may be present in all landform contexts;
- artefact scatters and isolated finds will be the dominant site type;
- site density and complexity will increase closer to permanent water and wetlands, probably due to increased biodiversity. More complex sites could therefore occur within 50 metres of major watercourses and wetlands, on terraces, flats or lower slopes;
- sandstone archaeological sites such as grinding grooves or rockshelter sites do occur in areas of suitable geology;
- scarred or carved (modified) trees would only occur in areas where mature, native vegetation survives;
- artefact assemblages generally consist of flakes, broken flakes, retouched flakes, flaked pieces and cores;
- dominant raw materials are generally indurated mudstone and silcrete with porcellanite, silicified sandstone, hornfels, basalt, quartz, quartzite and chert commonly making up a minor component of the assemblages; and
- longer term Aboriginal occupation results in the discard of more cultural material, making these areas more obvious archaeologically than areas subject to transient use, where few artefacts are discarded.

Archaeological research in the Cessnock region (in particular ERM 2003, McCardle 2004, Stedinger Associates 2005) has identified that:

- similar patterns of site occurrence, distribution, content and integrity occur as they do in the wider Hunter Valley;
- a low level of archaeological research has been undertaken consisting primarily of small surveys with only one survey evaluating an area of greater than 20 hectares before the Austar Coal Mine Stage 3 Aboriginal Cultural Heritage Assessment (Umwelt 2008b) which assessed an area of 552 hectares;
- surveys have generally identified a small number of sites with low artefact numbers, the majority having less than three artefacts;
- two archaeological investigations have provided information on the subsurface deposits of the region (ERM 2003, Stedinger Associates 2005) identifying subsurface deposits in areas containing few or no surface artefacts. One site identified through excavation – Mount View 8 – contained 3777 artefacts indicating the surface distribution of artefacts may not reflect subsurface archaeology;

- it has been possible to identify broad associations between intra and inter site features including artefact heat treatment and knapping (Stedinger Associates 2005) even though site stratigraphy may be disturbed so as to obscure finer resolution of chronological relationships; and

- silcrete and mudstone – the dominant stone types utilised for artefact manufacture in the Hunter Valley (ERM 2004) and in the Kitchener area (McCardle 2004) cannot be sourced locally. The closest known source of both these raw materials is from cobble beds in the Hunter River approximately 20 kilometres away (Umwelt 2008b).

Archaeological research in the proposed Stage 3 Modification Area (Umwelt 2008b, 2010a, 2010b and 2011) has identified that:

- similar patterns of site occurrence, distribution, content and integrity occur as they do in the wider Hunter Valley and local region;

- the majority of recorded sites in the proposed Stage 3 Modification Area have been impacted by ground disturbance from historic land-use practices making it highly unlikely that soil profiles in the area retain stratigraphic integrity although it is possible that some spatial integrity survives in areas that have retained relatively deep A2 soil horizons;

- sites in areas subject to past and present cultivation and contour ploughing, such as along the fourth and fifth order streams of Cony Creek and hillslopes near Sandy Creek are expected to be of low integrity as ploughing will have acted to redistribute any artefactual material that may have existed in these areas both spatially and stratigraphically. Where cultivation is undertaken on flood plains and terraces (not of recent origin) and lower slopes (i.e. in soil profiles of some depth), sites may survive with some integrity beneath the plough zone;

- modified trees are expected to be rare due to vegetation clearance over much of the area and the loss of mature trees that were alive during pre-contact times through historic firewood cutting, natural decay, bushfire and/or insect activity;

- small artefact scatters and isolated finds were predicted to occur;

- artefact sites will be generally in low-gradient landscape areas in association with creek lines or on spur crests and ridge crests that offer broad outlooks;

- larger artefact scatters may occur along Cony and Sandy Creeks;

- silcrete and mudstone were predicted to be the most common raw materials used for artefact manufacture; and

- grinding grooves may occur on suitable sandstone outcrops in the creek lines.

3.4 Environmental Context

The proposed Stage 3 Modification Area is located in the Quorrobolong Valley, between Broken Back Ridge and the Myall Range; approximately 1.5 kilometres south of the towns of Kitchener and Abernethy (refer to **Figure 3.2**). This area lies within the Central Lowlands of the Hunter Valley, one of the nine sub-regions of the Hunter Valley defined by the CSIRO (Story 1963) and is part of the larger Sydney Basin Bioregion defined by NPWS (2007) that covers more than 3,000,000 hectares and contains significant portions of the Hunter, Hawkesbury-Nepean and Shoalhaven River systems.

3.4.1 Geology

The Austar Coal Mine is located in the South Maitland Coalfield of the Maitland Group, with coal sourced from the Greta seam at depths of approximately 400 to 750 metres. Throughout the Maitland Group, marine sandstones and siltstones occur, extending from the coal measures to the ground surface (HLA 1995). Three geological units occur within the proposed Stage 3 Modification Area, as illustrated on **Figure 3.4.** The Branxton Formation covers the majority of the proposed Stage 3 Modification Area, with linear belts of Fenestella Shale in the north and undifferentiated alluvium along Cony and Sandy Creeks.

- Branxton Formation: this Early Permian formation is composed of sandstone, siltstone, conglomerate and a small amount of basalt. It is the dominant geological unit and is found widely throughout the slopes and ridges of the Quorrobolong Valley. Most previously recorded Aboriginal archaeological sites located in the proposed Stage 3 Modification Area were located in this dominant geological unit.

- Fenestella Shale: occurs in a narrow band, no greater than 380 metres in width, in the northern part of the proposed Stage 3 Modification Area. The landscape containing the Fenestella Shale is within the Werakata SCA and consists of steep slopes with intermittent gullies. Fenestella Shale consists of, siltstone, claystone and minor fine grained sandstone.

- Undifferentiated alluvium: defines the Cony Creek and Sandy Creek alignment within the Stage 3 Modification Area. This unit contains sand, silt, clay and gravel; some residual and colluvial deposits, including channel, levee, lacustrine, floodplain and swamp deposits. Alluvium may include some higher level Tertiary terraces.

3.4.1.1 Archaeological Implications of Geology

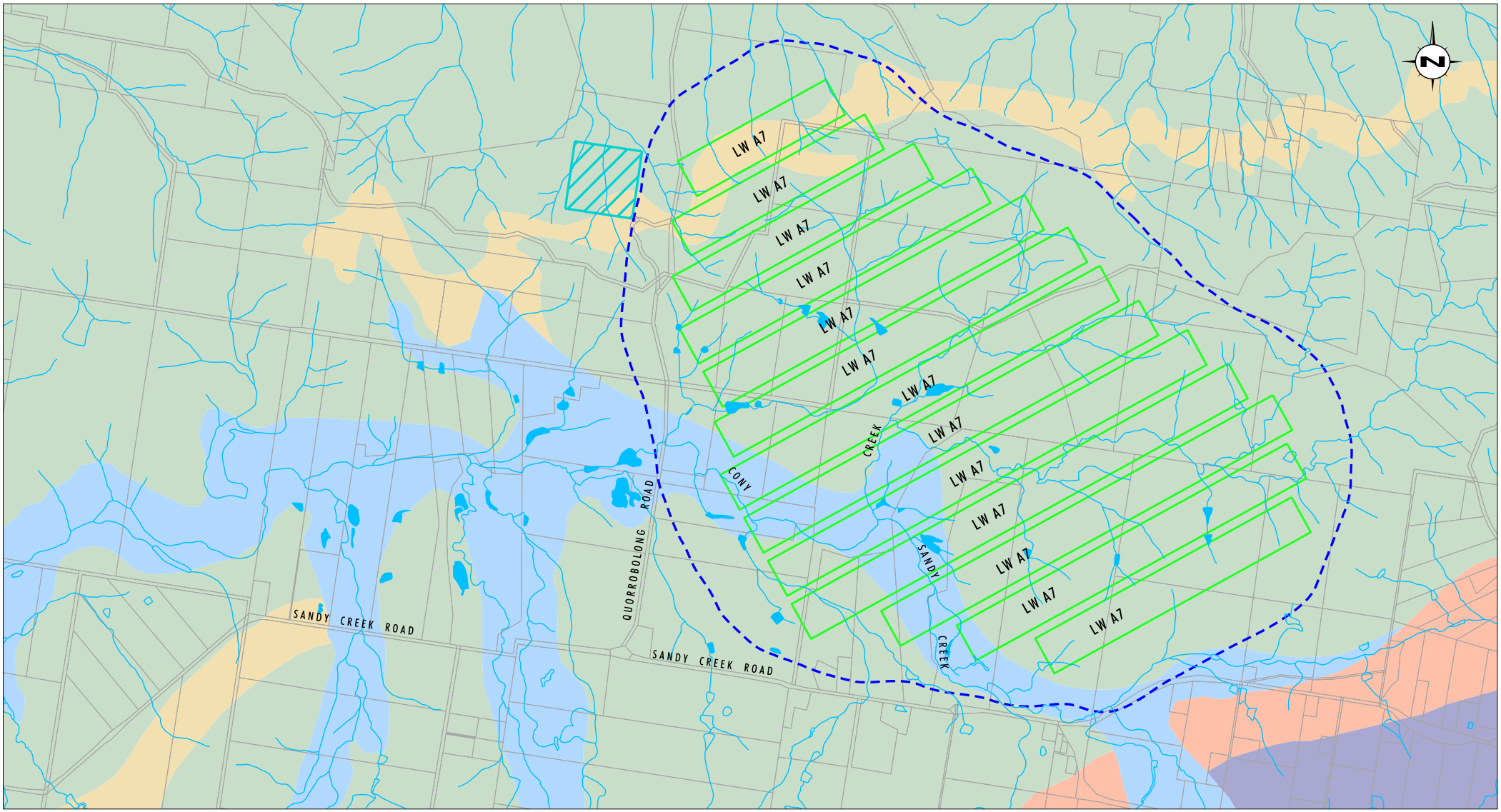
Conglomerates within the above geological units may contain raw materials suitable for stone artefact manufacture, such as quartz and quartzite and these may have migrated into alluviums within the valley floor. Raw materials suitable for stone artefact manufacture may therefore have been opportunistically sourced and utilised within the entire proposed Stage 3 Modification Area.

A significant portion of the proposed Stage 3 Modification Area is contained within sandstone geological units, excluding the undifferentiated alluvium associated with Sandy and Cony Creeks. Surface outcrops of sandstone however have been found during prior survey (Umwelt 2008b) to be limited to the far northern extent of the proposed Stage 3 Modification Area, specifically within the Branxton Formation. In this area sandstone has been found to outcrop as platforms in creeklines, but not as clifflines with the potential for rockshelters. Therefore, sandstone archaeological site types such as axe grinding grooves and engravings may be found in the Branxton Formation particularly in the Werakata SCA in the far north of the proposed Stage 3 Modification Area.

Sources of ochre are not known within the proposed Stage 3 Modification Area, so ochre quarry sites are considered highly unlikely to occur.

3.4.2 Soils

Three soil landscapes occur within the proposed Stage 3 Modification Area: the Quarrabolong Soil Landscape, the Aberdare Soil Landscape and the Branxton Soil Landscape. As illustrated on **Figure 3.5**, the Quorrobolong and Aberdare Soil Landscapes occupy most of the proposed Stage 3 Modification Area. The Quarrabolong Soil Landscape



Source: Cadastre: LPI NSW, Geology: Mineral Resources 2003, Longwall Layout: Austar Coal Mine

0 0.5 1 1.5km
1:32 000

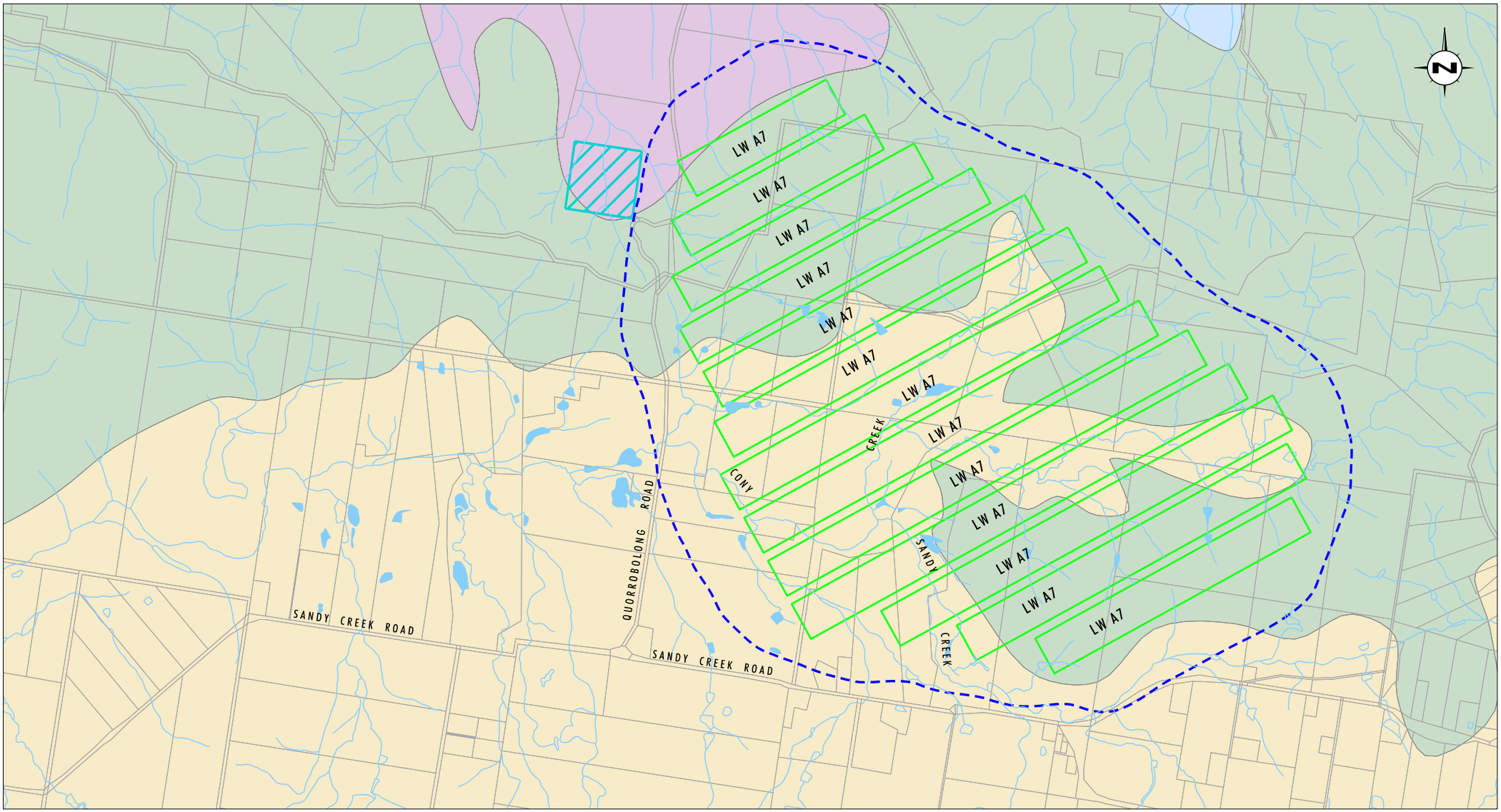
Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Approved Surface Infrastructure Site
- Branxton Formation (Conglomerate, sandstone, siltstone)
- Fenestella Shale (Conglomerate, sandstone, siltstone)
- Undifferentiated alluvial deposits; sand, silt, clay and gravel; some residual and colluvial deposits. Includes some channel, levee, lacustrine, floodplain and swamp deposits. May include some higher level Tertiary terraces
- Mulbring Siltstone (Siltstone, claystone, minor fine-grained sandstone)
- Muree Sandstone (Fine to coarse-grained sandstone, conglomerate, minor clay)
- Drainage Line

FIGURE 3.4

Geological Map

File Name (A4): R60_V1/2274_969.dgn



Source: Cadastre: LPI NSW, Soils: Department of Natural Resources 2005, Longwall Layout: Austar Coal Mine

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Approved Surface Infrastructure Site
- Quorrobolong Soil Landscape
- Aberdare Soil Landscape
- Neath Soil Landscape
- Branxton Soil Landscape
- Drainage Line

FIGURE 3.5

Soil Landscape Map

defines the creek lines and associated landforms (flats and lower slopes) of the Cony and Sandy Creek systems. The Aberdare Soil Landscape extends along the crests and mid to upper slopes of the proposed Stage 3 Modification Area to the south of the Werakata SCA. The Branxton Soil Landscape occurs only in the far northern section of the proposed Stage 3 Modification Area, within the Werakata SCA. The key characteristics of each soil landscape are summarised in **Table 3.5**.

Table 3.5 – Soil Landscape Descriptions (from Kovac and Lawrie 1991)

	Quarrabolong Soil Landscape	**Aberdare Soil Landscape**	**Branxton Soil Landscape**
Terrain	Undulating lowlands south of Cessnock. Elevation 40-20 m. Slopes average 3-6%. Drainage lines common.	Rolling low hills to the south and south-east of Cessnock. Elevation 80-265 m. Slopes average 12-15%.	Undulating rises to low hills and many small creek flats. Elevation 50-80 m. Slopes average 3-5%.
Vegetation	Dry sclerophyll forest of gums, ironbark and stringybark including blood redwood and blackbutt. Much has been cleared for grazing on improved and unimproved pastures.	Woodland community of spotted gum, brown stringybark and some box. Some timber cleared, most retained for forestry.	Mainly cleared for grazing, with native pastures. Some uncleared bushland, mainly spotted gum, red ironbark, narrow-leaved red ironbark and swamp oak in drainage lines.
General Soil Profile	Prairie soils on lower slopes and in drainage lines, with Wiesenboden in some locations. Yellow podzolic soils and soloths on higher slopes (possibly on lower slopes), with brown soloths on some crests.	Yellow (orange) podzolic soils on mid-upper hillslopes. Red and brown podzolic soils on steeper slopes. Some alluvial sands in drainage lines.	Yellow podzolic soils on mid-slopes and red podzolics on crests. Yellow soloths on lower slopes and in drainage lines. Alluvial sands in some creeks with siliceous sands. Some acid topsoil problems encountered within area.
Soil Erosion	Stream bank erosion along many creeklines. Minor sheet and rill erosion on slopes.	Minor to moderate sheet and rill erosion on slopes. Some gullying in drainage lines. Moderate to high erodibility of topsoil.	Tunnel and gully erosion in yellow soloths due to high dispersibility. Little erosion of alluvial soils and siliceous sands.

As outlined above, the topsoil of most units is moderately erodible, and the subsoil of yellow soloths (which occur on slopes) is moderately to highly erodible. Tunnel and gully erosion is likely in yellow soloth soils due to high dispersibility. Topsoil pH ranges between 5.5 and 6.5, and acid topsoil problems are encountered throughout the area (Kovac and Lawrie 1991:109). Salt scalds may also occur in yellow soloth soils.

The development of stone layers between topsoils (A horizon) and subsoils (B horizon) is a common feature of duplex profiles, such as those found within the proposed Stage 3 Modification Area, resulting from rain wash and bioturbation processes. These actions can result in the thickening of the topsoil and burial of larger fragments at the level where bioturbation agents usually cease operating (Dean-Jones and Mitchell 1993:43). In general, stones larger than the diameter of burrowing agents will 'sink' through the soil over time, creating an artificial layer of archaeological material that originally was deposited throughout the A horizon. The one major exception to this trend is stone movement towards the surface resulting from tree fall. Dean-Jones and Mitchell (1993:67) also found that surface layers of duplex soils (A horizons) may be quite young, and are more likely to be about 200 to 3000 years old rather than 3000 to 20,000 years old.

Archaeological Implications of Soils

The landscape and soils of the study area place a number of limitations on archaeological research and analysis:

- duplex soils occur throughout the proposed Stage 3 Modification Area, and surface layers of duplex soils (A horizons) may be quite young, and are more likely to be about 200-3000 years old rather than 3000-20,000 years old (Dean-Jones and Mitchell 1993:67). Artefacts recorded in surface deposits are therefore likely to be of mid to late Holocene in age;

- geomorphic and archaeological studies (such as Dean-Jones 1993) have demonstrated that the development of stone layers between A and B horizons as a result of downward movement of stone in the soil profile is a common feature of duplex soils as a result of rain splash and bioturbation. Stone artefacts are therefore most likely to be buried in the soil profile at the base of the A2 soil horizon/top of the B clay horizon, rather than occur on the surface unless the basal A2 soil horizon is exposed. The downward movement of artefacts indicates that open sites can be predicted to have limited stratigraphic integrity;

- soils of the proposed Stage 3 Modification Area are dominantly classified as highly dispersible and erodible and are highly susceptible to sheet and gully erosion. This is particularly relevant for the steep slopes of the Broken Back Range, where slopes of up to 30 per cent experience high levels of sheetwash and erosion. In these areas, post-depositional movement of stone artefacts is likely to occur, with artefacts moved to lower landform contexts. In the valley lowlands, post-depositional movement of artefacts is likely to be less, given the gentler slope and possibility of soil aggradation;

- the floodplains of Cony and Sandy Creeks are aggrading soil landscapes, so there is potential for artefacts to be found in subsurface deposits, although geomorphic processes and agricultural activities suggest that the stratigraphic and spatial integrity of such deposits may be limited; and

- the soil pH throughout the proposed Stage 3 Modification Area varies from acidic to slightly acidic (pH 5 to 6.5). Those areas with neutral soils (pH 7) will have greater potential for the preservation of organic materials, including bone, than those of an acidic nature. Given this, the potential for organic and skeletal material to survive within the proposed Stage 3 Modification Area is low.

3.4.3 Landforms and Creek Systems

The topography of the proposed Stage 3 Modification Area comprises three main morphological units: the Broken Back Range; alluvial flats and associated creeks; and the intervening spurs and associated slopes.

The northern and eastern portions of the Stage 3 mining area lie within the Broken Back Range, a major landform extending from west of Pokolbin to Mulbring, reaching a height of 240 metres above sea level (m ASL) within the proposed Stage 3 Modification Area.

The majority of the central and southern portions of the proposed Stage 3 Modification Area are classified as undulating hill slope, which extend from the Broken Back Range to the alluvial landforms of the Cony and Sandy Creek systems. These hill slopes average in gradient between one and five per cent, but extend up to 18 per cent in the eastern slopes of the Broken Back Range and in the southern crest near Sandy Creek Road. Hill slopes are up to 500 metres wide, and elevation in this unit ranges between 130 and 200 m ASL within the proposed Stage 3 Modification Area.

Cony Creek and Sandy Creek are the major creeklines within the proposed Stage 3 Modification Area, with the confluence of the two situated in the central section of the area (refer to **Figure 3.6**). From this confluence, Cony Creek flows into Quorrobolong Creek and then Ellalong Lagoon 7 kilometres to the west of the proposed Stage 3 Modification Area.

The main channel of Cony Creek within the proposed Stage 3 Modification Area is approximately 2 metres wide, with steep banks up to 2 metres in height. Where the understorey vegetation is sparse and where grazing occurs along the creek line, there is considerable erosion of the banks. There is generally very low flow within Cony Creek, however several small to moderate-sized chains of ponds were present, at the time of the both the 2008 and the current survey.

Numerous tributaries of the Cony Creek and Sandy Creek systems occur within the proposed Stage 3 Modification Area. The combined length of these streams equal approximately 53 kilometres, and occur as first order (20.5 kilometres), second order (10.5 kilometres), third order (5.2 kilometres), fourth order streams (6.3 kilometres) and fifth order streams (1.8 kilometres). First and second order streams do not have associated alluvial flats, but alluvial flats and floodplains do occur along sections of third, fourth and fifth order streams. Flats of up to 500 metres in width extend from both Cony and Sandy Creeks. The majority of all creeks within the proposed Stage 3 Modification Area have been dammed at least once along their length.

Black Creek flows to the north-west and is outside of the proposed Stage 3 Modification Area, passing through the location of the approved surface infrastructure site. This creek line is ephemeral, and at the time of the 2008 survey, there was very little water in its channel (Umwelt 2008b). However, there is evidence of high flows in the past, and there were several small pools of standing water (Umwelt 2008b) in the second and third order streams.

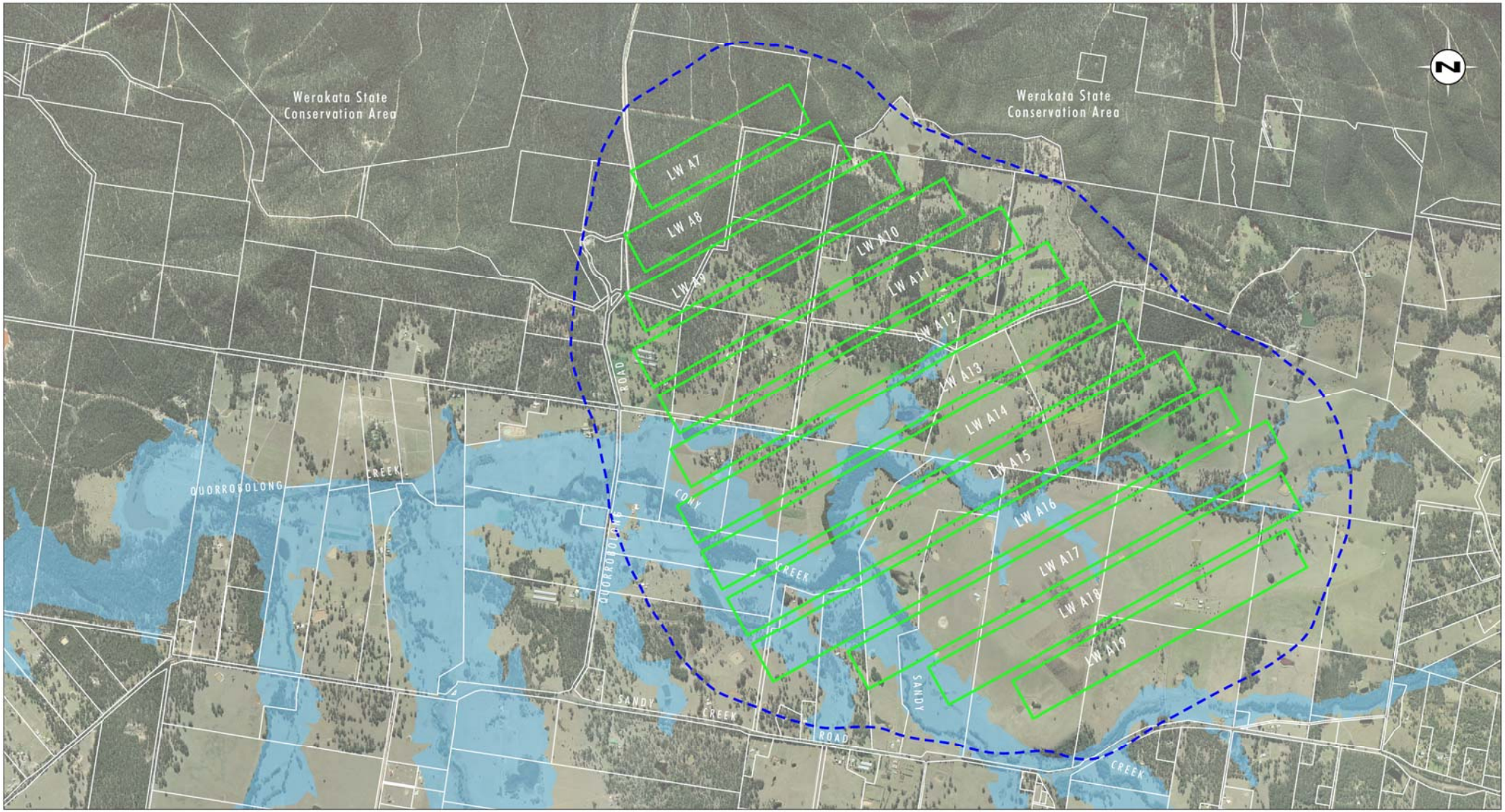
Figure 3.6 illustrates the extent of flooding of creek systems within the proposed Stage 3 Modification Area during the 100 year average recurrence interval (ARI) flood event over the existing (i.e. pre-Stage 2 mining) landform. As illustrated, the alignment of Sandy Creek and the alignment of Cony Creek west of the Sandy Creek confluence can experience significant flooding, with the 100 year ARI extending approximately 200 metres from Sandy Creek and approximately 400 metres from Cony Creek. It can be expected that in times of heavy prolonged rainfall that these low-lying areas would remain waterlogged for period of time.

3.4.3.1 Archaeological implications of Landforms and Creek Systems

Higher landforms such as spurs and ridge crests offer broad outlooks over the landscape, particularly in the Broken Back Range to the north. Broad crests of low gradient are suitable for transient use as travel routes and also for short term camp sites.

The steep slopes adjoining crests in the Broken Back Range are not suitable as Aboriginal camp site locations due to their gradient and their use was most probably limited to transient hunting and gathering therefore the potential for deposition of archaeological materials is limited. Further, if artefacts were discarded in these areas of steeper gradient some downslope movement of artefactual material could be expected.

The proposed Stage 3 Modification Area has numerous watercourses of relevance as previous archaeological investigations have strongly correlated availability of water and Aboriginal camp locations. Low-gradient landforms (such as flats and lower slopes) surrounding these watercourses would provide suitable camping locations, particularly when associated with creek confluences. However, the majority of watercourses are ephemeral, so would periodically but not permanently provide sufficient fresh water to support temporary campsites. Cony Creek and higher order sections of Sandy Creek would have provided the more permanent water sources (as they do today), and therefore areas associated with



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.5km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- 100 Year Flood Level

FIGURE 3.6

100 year ARI Storm: Flood Extent for Pre Stage 2 Mining Landform

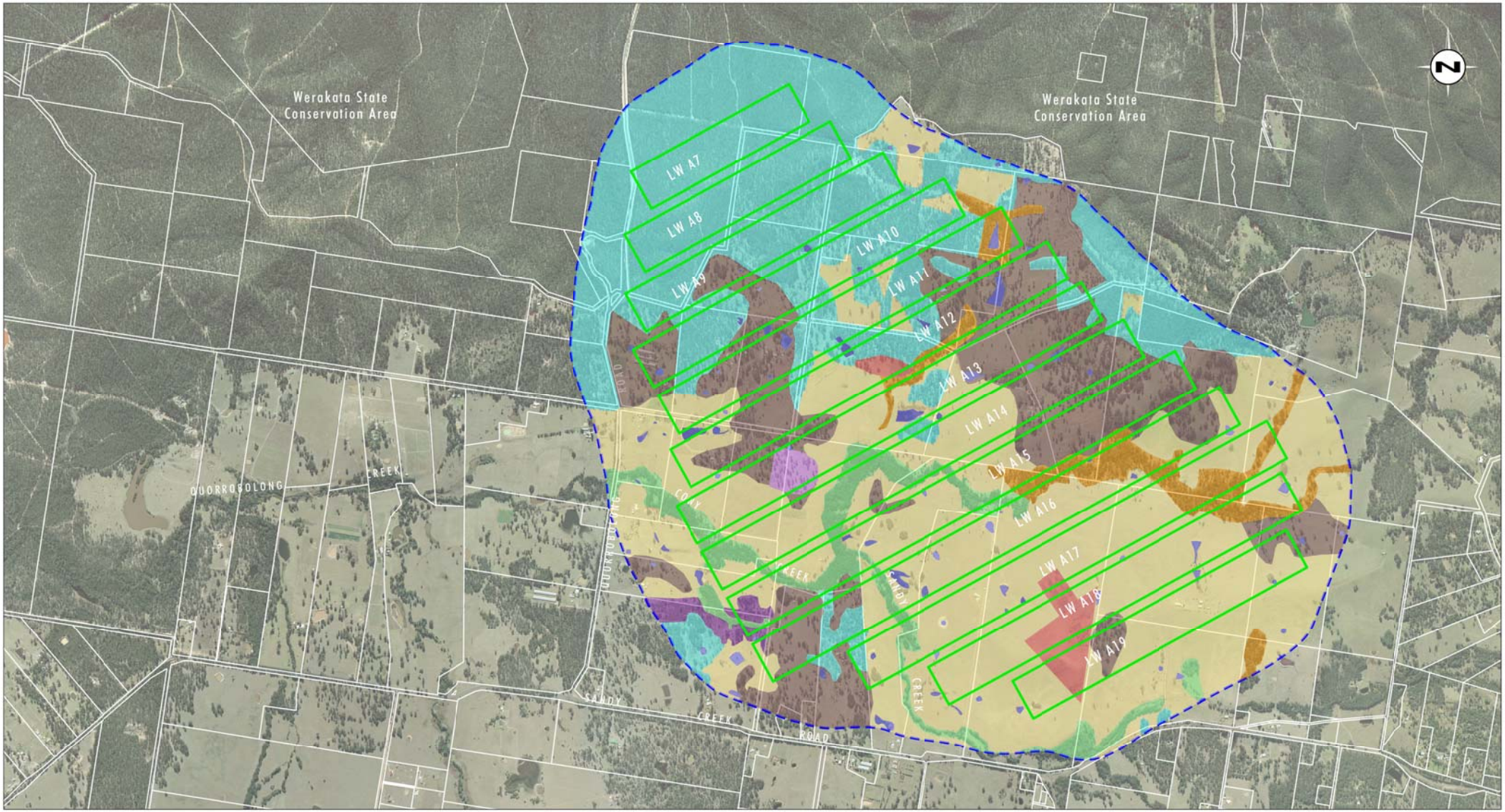
these creeklines may have been more intensively used, resulting in higher site and artefact densities. Natural ponds within these ephemeral creek systems retain water in drier times, thereby forming focal points for camping, and through attracting local fauna, may have provided a focus for hunting.

Sandy Creek and the eastern section of Cony Creek (to the east of its junction with Sandy Creek) contain areas classified as floodplain and swamps (wetlands). Wetland areas are characterised by increased biodiversity, and are likely to have been subject to more intensive and frequent use than other landscape areas. This increased use is expected to be reflected in the archaeological record of the surrounding landforms including creek terraces and low gradient slopes that provide dry camp locations. Flooding of landforms along Cony and Sandy Creeks may have acted to bury sites in alluvial deposits or affected the spatial integrity of archaeological sites, or destroyed archaeological sites by creek channel migration.

The eastern reaches of Cony Creek are less than two kilometres from the watershed of the easterly flowing Cockle Creek catchment that flows into Lake Macquarie. Cony Creek provides a natural corridor from the coast to Congewoi Creek and the Wollombi Brook from where access is gained to the Central Hunter Valley in the north-west and the Mangrove Creek catchment to the south. Archaeological site patterning and content may reflect the transient use of these creeklines as pathways.

3.4.4 Flora and Fauna

The landscape of the proposed Stage 3 Modification Area is diverse, ranging from gently undulating alluvial landforms to the steep slopes of the Broken Back Range within a few kilometres. Ecological assessments of the Stage 3 Project area (Umwelt 2008c, Umwelt in prep.) identified that although much of the proposed Stage 3 Modification Area is dominated by open grassland (Derived Grassland or Derived Grassland with scattered canopy trees) a further five vegetation communities are contained within the proposed Stage 3 Modification Area, including Lower Hunter Spotted Gum – Ironbark Forest, Riparian Red Gum Forest, Swamp Oak Riparian Forest, Regeneration and Woollybutt Open Forest Remnant. The distribution of the vegetation communities in the proposed Stage 3 Modification Area is illustrated in **Figure 3.7**. Within these communities, a total of 299 flora species were recorded during recent fieldwork, of which 257 are native. Fifty-eight species are known to have an Aboriginal use in Australia's south-east (Umwelt 2008b: 5.5-5.7). **Table 3.6** lists those flora species within the proposed Stage 3 Modification Area that have a known Aboriginal use in Australia's south-east, from review of ethnohistoric literature and from discussions with Aboriginal stakeholders.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

0 0.5 1 1.35km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Cultivated
- Dam
- Derived Grassland / Pasture
- Derived Grassland with Scattered Canopy Trees
- Regeneration
- Riparian Red Gum Forest
- Lower Hunter Spotted Gum Ironbark Forest
- Swamp Oak Riparian Forest
- Woollybutt Open Forest Remnant

FIGURE 3.7

Vegetation Communities

File Name (A4): R60_V1/2274_976.dgn

Table 3.6 - Flora Species and Known Aboriginal Use

Scientific Name	Name	Known Aboriginal Use	Reference
Acacia binervata	Two-veined hickory	Food and economic plant	Australian National Botanic Gardens Education Services 2000
Acacia deanei subsp. *deanei*	Green wattle, Deane's wattle	Food, economic and medicine plant	Gott 1995
Acacia decurrens	Black wattle	Food, economic and medicine plant	Gott 1995
Acacia falcata	Sickle wattle	Food, economic and medicine plant	Gott 1995
Acacia floribunda	White sally	Food, economic and medicine plant	Gott 1995
Acacia implexa	Hickory wattle	Food, economic and medicine plant	Gott 1995
Acacia linifolia	White wattle	Food, economic and medicine plant	Gott 1995
Acacia longifolia var. *longifolia*	Sydney golden wattle	Food, economic and medicine plant	Gott 1995
Acacia longissima	Narrow-leafed wattle	Food, economic and medicine plant	Gott 1995
Acacia parvipinnula	Silver-stemmed wattle	Food, economic and medicine plant	Gott 1995
Acacia terminalis subsp. *longiaxialis*	Sunshine wattle	Food, economic and medicine plant	Gott 1995
Acacia ulicifolia	Prickly moses	Food, economic and medicine plant	Gott 1995
Acianthus pusillus	Gnat orchid	Food plant	Flood 1980:94
Acrotriche divaricata	Ground berry	Food plant	Steenbeeke, 2001
Allocasuarina littoralis	Black sheoak	Food and economic plant	Australian National Botanic Gardens 2007
Allocasuarina torulosa	Forest oak	Food and economic plant	Australian National Botanic Gardens 2007
Carex appressa	Tall sedge	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Carex inversa	Knob sedge	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Amyema guadichaudii	Paper-bark mistletoe	Food and medicinal plant	Flood 1980:94, Zola and Gott 1992:54
Angophora bakeri	Narrow-leafed apple	Economic plant	MacDonald and Davidson 1998

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Angophora floribunda	Rough-barked apple	Economic plant	MacDonald and Davidson 1998
Astroloma humifusum	Native cranberry	Food plant	Flood 1980:96
Backhousia myrtifolia	Grey myrtle	Food, economic and medicine plant	Gott 1995
Banksia spinulosa var. *collina*	Hairpin banksia	Food and economic plant	Australian National Botanic Gardens 2007
Billardiera scandens var. *scandens*	Apple berry	Food plant	Flood 1980:95
Brachychiton populneus subsp. *populneus*	Kurrajong	Food and economic plant	Low 1989: 27; MacDonald and Davidson 1998; Zola & Gott 1992:36
Bulbine bulbosa	Bulbine lily	Food plant	Flood 1980:94. Zola and Gott 1992:43
Bursaria spinosa var. *spinosa*	Blackthorn	Food and economic plant	Flood 1980:95, Gott 1995
Caladenia carnea	Pink fingers	Food plant	Zola and Gott 1992:44
Caladenia catenata	White caladenia	Food plant	Zola and Gott 1992:44
Calochylus paludosus	Red beard orchid	Food plant	Zola and Gott 1992:44
Callistemon linearis	Narrow-leaved bottlebrush	Food plant	Australian National Botanic Gardens Education Services 2000
Casuarina glauca	Swamp oak	Food and economic plant	Australian National Botanic Gardens 2007
Cayratia clematidea	Slender grape	Food plant	Low 1989: 64
Clematis glycinoides	Headache vine	Food, economic and medicine plant	Zola and Gott 1992:47, Gott 1995, Fraser & McJannett, 1993
Cissus antarctica	Water vine	Food plant	Low 1989: 64
Clerodendron tomentosum	Hairy clerodendron	Food plant	Steenbeeke, 2001
Corymbia eximia	Yellow bloodwood	Economic plant	MacDonald and Davidson 1998
Corymbia maculata	Spotted gum	Economic plant	MacDonald and Davidson 1998
Dianella caerulea	Blue flax-lily	Food and Economic Plant	Low 1989: 8
Dianella longifolia var. *longifolia*	Blueberry lily	Food plant	Australian National Botanic Gardens 2007
Dianella longifolia var. *stenophylla*	Blueberry lily	Food plant	Australian National Botanic Gardens 2007
Dioscorea transversa	Native yam	Food plant	Botanic Gardens Trust 2007
Diuris aurea	Donkey orchid	Food plant	Gott 1995
Diuris dendrobioides	Wedge diuris	Food plant	Gott 1995

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Dodonaea triquetra	Large-leaf hop bush	Food plant	Gott 1995
Einadia hastata	Berry saltbush	Food plant	Low 1989: 129
Einadia nutans subsp. *linifolia*	Climbing saltbush	Food plant	Low 1989: 129
Einadia trigonos subsp. *trigonos*	Fishweed	Food plant	Low 1989: 129
Elaeocarpus obovatus	Hard quandong	Economic plant	Australian National Botanic Gardens Education Services 2000
Eragrostis leptostachya	Paddock lovegrass	Food plant	MacDonald and Davidson 1998
Eremophila debilis	Amulla	Food plant	MacDonald and Davidson 1998
Eleocharis gracilis	sedge	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Eucalyptus. acmenoides	White mahogany	Economic plant	MacDonald and Davidson 1998
Eucalyptus. amplifolia subsp. *amplifolia*	Cabbage gum	Economic plant	MacDonald and Davidson 1998
Eucalypt canaliculata	Large-fruited grey gum	Economic plant	MacDonald and Davidson 1998
Eucalyptus crebra	Narrow-leaved ironbark	Economic plant	pers. comm. various Aboriginal people from the Dubbo Region (2000) and from AHIMS site card review
Eucalyptus eugenioides	Thin-leaf stringybark	Economic plant	MacDonald and Davidson 1998
Eucalyptus fibrosa	Red ironbark	Economic Plant	MacDonald and Davidson 1998
Eucalyptus globoidea	White stringybark	Economic plant	MacDonald and Davidson 1998
Eucalyptus longifolia	Woollybutt	Economic plant	MacDonald and Davidson 1998
Eucalyptus moluccana	Grey box	Economic plant	MacDonald and Davidson 1998
Eucalyptus piperita	Sydney peppermint	Economic plant	MacDonald and Davidson 1998
		Medicine plant	Australian National Botanic Gardens Education Services 2000
Eucalyptus punctata	Grey gum	Economic plant	MacDonald and Davidson 1998
Eucalyptus racemosa	Narrow-leaf scribbly gum	Economic plant	MacDonald and Davidson 1998
Eucalyptus resinifera	Red mahogany	Economic plant	MacDonald and Davidson 1998
Eucalyptus tereticornis	Forest red gum	Economic plant	MacDonald and Davidson 1998

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Eucalyptus umbra	Broad-leafed white mahogany	Economic plant	MacDonald and Davidson 1998
Eustrephus latifolius	Wombat berry	Food plant	MacDonald and Davidson 1998
Exocarpos cupressiformis	Native cherry	Food and economic plant	Brayshaw 1986:74-75. Zola and Gott 1992:48
		Medicinal plant	Watson 2007
Exocarpos strictus	Dwarf cherry	Food plant	Gott 1995
Fimbristylis laterale	Common fringe sedge	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Gahnia aspera	Rough saw-sedge	Food and economic plant	Low 1989:105; Zola & Gott 1992:60
Geitenoplesium cymosum	Scrambling lily	Food plant	Steenbeeke, 2001
Geranium solanderi var. *solanderi*	Native geranium	Food and medicinal plant	Flood 1980:95. Zola & Gott 1992:47, 56
Glossodia major	Waxlip orchid	Food plant	Gott 1995
Glossodia minor	Small waxlip orchid	Food plant	Gott 1995
Glycine clandestina	Twining glycine	Food plant	Low 1989: 100
Glycine latifolia	Glycine	Food plant	Low 1989: 100
Glycine microphylla	Small-leaf glycine	Food plant	Low 1989: 100
Glycine tabacina	Variable glycine	Food plant	Low 1989: 100
Grevillea montana	Mountain grevillea	Food plant	Low 1989: 171
Grevillea sericia subsp. *sericia*	Pink spider flower	Food plant	Low 1989: 171
Hakea dactyloides	Broad-leafed hakea	Food plant	Low 1989: 171
Hakea sericia	Needlebush	Food plant	Low 1989: 171
Hardenbergia violacea	False sarsaparilla	Food plant	Cribb & Cribb 1986:207
Kunzea parviflora	Violet kunzea	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Hovea linearis	Narrow-leaf hovea	Food plant	Flood 1980:95
Indigofera australis	Australian indigo	Economic plant	Australian National Botanic Gardens 2007
Jacksonia scoparia	Dogwood	Food plant	Steenbeeke, 2001
Juncus usitatus	Common rush	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Kennedya rubicunda	Running postman	Food plant	Low 1989:44
Lepidium bonariense	Cut-leaf peppercress	Food plant	Low 1989:143

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Lepidosperma laterale	Sedge	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
Leptomeria acida	Native current	Food and medicinal plant	Low 1989:105;
Leptospermum parvifolium	Small-leaf tea-tree	Food, economic and medicine plant	Gott 1995
Leptospermum polygalifolium subsp. *cismontanum*	Lemon-scented tea-tree	Food, economic and medicine plant	Gott 1995
Leptospermum trinervium	paperbark tea-tree	Food, economic and medicine plant	Gott 1995
Lissanthe strigosa	Peach heath	Food plant	Low 1989: 42
Lomandra confertifolia	Mat-rush	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
Lomandra filiformis subsp. *filiformis*	Wattle mat-rush	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
Lomandra longifolia	Spiny-headed mat-rush	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
Lomandra multiflora subsp. *multiflora*	Many-flowered mat rush	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
Lomandra obliqua	Fish-bones	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
Lyperanthus suaveolans	Brown beaks	Food plant	Gott 1995
Macrozamia communis	Burrawang	Food plant	MacDonald and Davidson 1998
Macrozamia flexuosa	Macrozamia nuts/seeds	Food plant	Brayshaw 1986:74-75
Marsilea mutica	Nardoo	Food plant	Flood 1980. Cribb & Cribb 1986 83
Maytenus silvestris	Narrow-leafed orangebark	Medicinal plant	Steenbeeke, 2001
Melaleuca decora	Ball honeymyrtle	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Melaleuca linariifolia	Snow in summer	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Melaleuca nodosa	Ball honeymyrtle	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Melaleuca seiberi	Seibers' paperbark	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Melaleuca styphelioides	Prickly-leafed tea-tree	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Melaleuca thymifolia	Thyme honeymyrtle	Food, economic and medicine plant	ERM 2004:34. Royal Botanic Gardens 2007. Australian National Botanic Gardens Education Services 2000
Melichrus urceolatus	Urn heath	Food plant	Low 1989: 172,173
Ottelia ovalifolia	Swamp lily	Medicinal plant	NSW Department of Education and Training 2007
Pandorea pandorana subsp. *pandorana*	Wonga wonga vine	Economic Plant	Cunningham et al. 1992: 602
Panicum simile	Two colour panic	Food plant	MacDonald and Davidson 1998
Persoonia linearis	Narrow-leaved geebung	Food plant	Low 1989: 43-44
Pimelea linifolia var. *linifolia*	Riceflower	Economic plant	Australian National Botanic Gardens 2007
Plantago debilis	Common plantain	Medicinal plant	Low 1989: 133
Pteridium esculentum	Bracken fern	Food plant	Gott 1995
Pterostylis nutans	Nodding greenhood	Food plant	Gott 1995
Ranunculus inundatus	River buttercup	Food, economic and medicine plant	Zola and Gott 1992:47, Gott 1995, Fraser & McJannett, 1993
Rubus parvifolius	Native raspberry	Food plant	Flood 1980:95
Rumex brownii	Swamp dock	Food plant	Low 1989: 28, 30, 153-154
Styphelia triflora	Pink five-corners	Food plant	Low 1989: 43
Syncarpia glomulifera subsp. *glomulifera*	Turpentine	Economic plant	MacDonald and Davidson 1998
Themeda australis	Kangaroo grass	Food and medicinal plant	Greenway 1910:16 MacDonald and Davidson 1998 Zola & Gott 1992:58
Triglochin procerum	Water ribbons	Food plant	Zola & Gott 1992: 12
Typha orientalis	Broad-leaved cumbungi	Food plant	Gott 2007
Wahlenbergia gracilis	Australian bluebell	Food plant	Fraser and McJannett 1993:65

Table 3.6 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Wahlenbergia stricta	Tall bluebell	Food plant	Fraser and McJannett 1993:65
Xanthorrhoea sp.	Grass tree	Food and economic plant	MacDonald and Davidson 1998

The vegetation within the proposed Stage 3 Modification Area is dominated by open grassland and pastures, with much of the area being logged in the past for grazing, which continues to be the dominant land use.

Umwelt (in prep) has also identified 123 fauna species within the proposed Stage 3 Modification Area during survey work in winter and spring of 2007 and more recently in September 2010. **Table 3.7** lists those native species within the proposed Stage 3 Modification Area that have a possible Aboriginal use or known significance to Wonnarua people, from review of ethnohistoric literature and from discussions with Aboriginal stakeholders.

Table 3.7 - Fauna Species and Known Aboriginal Use

Biological Name	Common Name
Acanthiza chrysorrhoa	Yellow-rumped thornbill
Acanthiza lineata	Striated thornbill
Acanthiza nana	Yellow thornbill
Acanthiza pusilla	Brown thornbill
Acanthorhynchus tenuirostris	Eastern thornbill
Acrobates pygmaeus	Feathertail glider
Amphibolurus muricatus	Jacky lizard
Anas gracilis	Grey teal
Anas superciliosa	Pacific black duck
Anthochaera carunculata	Red wattle bird
Cacatua galeria	Sulphur-crested cockatoo
Cacatua rosiecapilla	Galah
Cacatua tenuirostris	Long-billed corella
Calyptorhyncus funereus	Yellow-tailed black cockatoo
Chelodina longicollis	Snake-necked turtle
Chenonetta jubata	Australian wood duck
Cygnus atratus	Black swan
Egretta novaehollandiae	White-faced heron
Emydura macquarii	Macquarie turtle
Entomyzon cyanotus	Blue-faced honeyeater
Fulica atra	Eurasian coot
Gallinula tenebrosa	Dusky moorhen
Glossopsitta concinna	Musk lorikeet
Leucosarcia melanoleuca	Wonga pigeon
Macropus giganteus	Eastern grey kangaroo
Macropus robustus	Common wallaroo
Macropus rufogriseus	Red-necked wallaby
Merops ornatus	Rainbow bee-eater

Table 3.7 - Fauna Species and Known Aboriginal Use (cont)

Biological Name	Common Name
Ocyphaps lophotes	Crested pigeon
Pelicanus conspicillatus	Australian pelican
Petaurus breviceps	Sugar glider
Petaurus norfolcensis	Squirrel glider
Phalacrocorax melanoleucos	Little pied cormorant
Phalacrocorax sulcirostris	Little black cormorant
Philemon corniculatus	Noisy friarbird
Phraps chalcoptera	Common bronzewing
Physignathus lesueurii	Eastern water dragon
Platelea flavipes	Yellow-billed spoonbill
Platycercus eximius	Eastern rosella
Pogona barbata	Bearded dragon
Porphyrio porphyrio	Purple swamphen
Psephotus haemotonotus	Red-rumped parrot
Pseudechis porphyriacus	Red-bellied black snake
Scythrops novaehollandiae	Channel-billed cuckoo
Tachybaptus novaehollandiae	Australasian grebe
Threskiornis molucca	Straw-necked ibis
Trichoglossus haemotodus	Rainbow lorikeet
Trichoglossus chlorolepidotus	Scaly-breasted lorikeet
Trichosurus vulpecula	Common brushtail possum
Vanellus miles	Masked lapwing
Vombatus ursinus	Common wombat
Wallabia bicolor	Swamp wallaby
Aquila audax	Wedge-tailed eagle

Umwelt (2008c) also discusses the aquatic resources of the proposed Stage 3 Modification Area, noting that sampling failed to identify any freshwater vertebrates along Cony Creek and Black Creek although the potential for some to occur (such as the introduced mosquito fish) was noted. Sandy Creek was not inspected due to lack of access, but Umwelt (2008c) noted that it is likely to support a diversity of freshwater fish and macro-invertebrate taxa.

A variety of animals hunted and plants utilised in the past (as food, economic resources and medicine) occur within this well watered area suggesting this was an important resource zone for Wonnarua People. Areas with higher diversity of flora and fauna resources are likely to have been subject to more intensive and/or repeated use. Furthermore the existence of chains of ponds suggests that Cony Creek and Sandy Creek would have provided a base for wider resource exploitation of surrounding landscape areas. Ellalong Lagoon to the west would apparently provide the key aquatic habitat and a permanent source of water, making it a likely regional focus for long term occupation.

3.4.4.1 Archaeological implications of Flora and Fauna

A wide range of flora and fauna species known to have been used by Aboriginal people are located in the proposed Stage 3 Modification Area and this diversity could be expected to have attracted Aboriginal hunter-gatherers and to have resulted in the presence of archaeological material discarded in camp sites used when exploiting these resources.

As noted above, however, skeletal and organic materials are unlikely to be preserved within the soils of the proposed Stage 3 Modification Area due to the slightly acidic to acidic pH values of the soils. The harder parts of the skeleton and in particular the teeth of terrestrial vertebrate prey species generally have the greatest likelihood of survival. The valley floor however retains many wetland soil profiles and which could be suitable for palaeo-environmental analysis.

3.4.5 Land Use History

Table 3.8 presents a chronological overview of the development of the Central Lowlands of the Hunter Valley, with specific reference to the Cessnock LGA.

Table 3.8 - Timeline of Local and Regional History

Date	Historical Development	Reference
1819	First recorded journey into the Wollombi Valley, by John Howe.	Needham 1981:67
1820	The Hunter Valley was opened for free settlement.	Heritage Office & DUAP, 1996
1821	First land grant in the Cessnock area, with Benjamin Blackburn receiving 400 acres near Kurri Kurri.	Parkes et al. 1979:23
1822 to 1823	A route (roughly in alignment with the present Old Bulga Road) from Windsor was found by Benjamin Singleton, John Howe and others which made possible the overland movement of stock from the Cumberland Plain to the Hunter Valley.	Crago 1979:38
1822 to 1826	Henry Dangar conducted a detailed survey of the lower Hunter between 1822 and 1826.	Brayshaw 1984:1.2
1826	'Cessnock' estate established on 2560 acres of land by John Campbell.	Parkes et al. 1979:24
1826-1836	Great North Road built by convict labour. Line between Wollombi and Maitland built by 1831.	
1830s	Australia's first soldiers settlement was established at Wollombi, with discharged members of the NSW regiments receiving (from 1830) grants of 100 acres along the Wollombi Brook.	Crago 1979:38
1834	Two thousand acre grant granted to B Jacob Josephson on 15 August, forming the Barraba Estate (which contained much of the current proposed Stage 3 Modification Area).	Umwelt 2008e
1850	Population of Wollombi c.1500, while the residents of Cessnock only numbered between 7 and 11.	Crago 1979:38
1853-1855	Cessnock estate subdivided and sold as individual lots, basis of future Cessnock township.	Parkes et al. 1979:166
1880s	South Maitland Coalfields developed. By this time, Cessnock was a farming area on the margins of the Hunter Valley.	HLA 1995b:5
1892	Coal discovered at Cessnock, by George Brown while excavating in the SW corner of the old Cessnock estate.	Crago 1979:41
1906	Mines established in the Cessnock area by this year. Shire of Cessnock established.	HLA 1995b:5
1916	Underground mining of Pelton/Ellalong commences.	Umwelt 2008e
1926	Cessnock defined as a municipality, with population of 12,000 people.	Crago 1979:41
1956	Cessnock municipality merged with the Shire of Kearsley, into the Municipality of Greater Cessnock.	Parkes et al. 1979:273
1958	Municipality of Greater Cessnock proclaimed the City of Greater Cessnock.	Parkes et al. 1979:273

As detailed above, the history of the Cessnock region is characterised by pastoral estates and a slow intensification of residential development prior to 1892, with mining then becoming increasingly significant to the region's economy and development particularly from the 1910s. The history of the proposed Stage 3 Modification Area reflects this, with land first taken up as part of a pastoral estate in 1834, then being progressively subdivided for pastoral use (Umwelt 2008e). Mining infrastructure in the Quorrobolong area – for the Pelton, Ellalong, Bellbird and Southland Collieries – dates to the 1910s, resulting in the rapid intensification of use of the local region.

The history of the proposed Stage 3 Modification Area is discussed by Umwelt (2008e). In summary, parish maps dating to the 1880s show the area is controlled under several land grants including Jacob Josephson (2000 acres), George Thomas Palmer (1200-1280 acres), Edward Charles Close (2841/2 acres), William Tacon (100 acres) and Edward Blackwell (103 acres), and smaller land grants of 30 to 40 acres to George Hall, Sara Hall, Joseph Hall, R Palmer, H Kerr, and R H Jordan. The Josephson estate was the largest of these, and is referred to in historical records as the 'Barraba Estate' or 'Abbotsford'. George Thomas Palmer's estate is also later referred to as the Barraba Estate and the northern lands as Cony Creek Paddock. The homestead for the Barraba Estate is believed to be outside the proposed Stage 3 Modification Area approximately a kilometre south-west of Barraba Lane. As in other regions, it is likely that these early homesteads were placed in areas that were previously Aboriginal camp sites, with permanency of water valued as a resource by both Aboriginal groups and European settlers.

Earlier land grants were made under a system of quit rent or 'free grants' implemented between 1821 and 1831. The free grant system operated by an immigrant presenting a letter to the Secretary of State for the Colonies which stated that they required 'a grant of land in proportion to his means of cultivating it' (Parkes et al. 1979:25). The resulting grants were conditional title and the land holder had to fulfil certain conditions over a period of seven years such as 'provide fencing and buildings and general improvements', at the end of the first seven years of their occupation of the land, the landholder had to pay a quit rent sum which was related to the productivity and assets built on the land (Parkes et al. 1979:25). This system was abandoned after 1831 as it lead to landholders dispersed over too great an area and encouraged 'many members of the labouring classes to become landed proprietors and hence too deprive capitalist farmers of an adequate workforce' (Parkes et al. 1979:26).

In 1831 Alexander McLeay, then Colonial Secretary passed legislation which ensured that 'no land will be sold below the rate of 5 shillings an acre….a deposit of 10 per cent upon the value of the purchase must be paid at the time of the sale, and the remainder must be paid within one calendar month' (cited from Parkes et al. 1979:26). This legislation backfired and only encouraged members of working class to become 'landed proprietors and lead to the acquisition of small 40 and 60 acre portions of Crown land which is a pattern that is reflected in the north-west and south-east of the proposed Stage 3 Modification Area by small grants held by the Jordan, Chapman, Palmer and Kerr families. This legislation also led to larger land holders who were based in Sydney, such as George Thomas Palmer, to extend their larger empires of land into the Cessnock region which included the proposed Stage 3 Modification Area.

The history of the Barraba Estate dates to 1834, when it is believed that George Thomas Palmer acquired the property with a 'ready made homestead and farm buildings' and 'little more than 100 acres had been cleared' (Parkes et al. 1979:75). Palmer also acquired 'a narrow 40-acre block on the verge of the road on the north side of the *Barraba'* and approximately a mile north-east of *Barraba '*a 1200 acre portion against the Broken Back, adjacent to a 284 ½ acre portion which E C Close acquired later' (Parkes et al. 1979:75). The review of parish maps dating from 1888 to 1952 indicates that these grants are within the eastern portion of the proposed Stage 3 Modification Area.

As a result of the land use history described above, the landscape of the proposed Stage 3 Modification Area has undergone extensive pastoral grazing and residential development, with native vegetation cleared, foreign grasses introduced, localised areas of excavation and earthworks for infrastructure, and changes to stream morphology and hydrology. These changes have resulted in incision of tributary streams and extension of gullies, erosion and sedimentation during major floods, and in some places, increases in water salinity (Dean-Jones and Mitchell 1993:4).

3.4.5.1 Archaeological implications of Land Use History

Clearance of vegetation throughout the proposed Stage 3 Modification Area has been widespread, with little mature, native vegetation remaining especially on the wooded lower slopes and creeklines. Vegetated areas in the modern landscape are predominantly regrowth, with few trees over 50 years in age observed within the Stage 3 assessment area in 2008 (Umwelt 2008c). Clearance of vegetation can result in disturbance to the upper soil horizons through removal of tree stumps and roots. Any archaeological sites that survive in these areas will have had their spatial and stratigraphic integrity affected by tree clearance which was also usually followed by erosion of the topsoil from slopes and crests.

With extensive clearance of the Quorrobolong Valley, stream morphology and hydrology has changed significantly since European settlement, with common changes including damming of tributary streams and erosion from trampling by stock. Hard hooves once foreign to these soils have caused the loss of duricrust, extension of gullies, erosion and downslope movement of soils and subsequent sedimentation during major floods (Dean-Jones and Mitchell 1993:4).

Pastoralism has been the dominant land use of the proposed Stage 3 Modification Area, and has further resulted in the introduction of foreign grasses and areas of localised earthworks for pastoral infrastructure and soil stabilisation. Dense, introduced grasses can obscure surface archaeological deposits in pastoral areas, and any archaeological sites within localised earthwork areas are likely to have been destroyed or highly disturbed. Grazing by stock in pastoral areas may also create areas of exposure along creek banks and along stock trails, providing opportunities for archaeological detection. The construction of dams along the streams of the proposed Stage 3 Modification Area for stock has also created localised areas of high disturbance where archaeological sites are likely to have been highly disturbed or destroyed. Soils exposed by dam construction works and erosion, however, may act to expose archaeological material allowing its detection.

At Cony Creek significant amounts of disturbance has been observed where attempts have been made to improve grazing land and stock safety by infilling secondary channels. In this area newly dug channels redirect water and as a result, modern stream alignments do not represent pre-contact alignments. Archaeological sites originally found near streams may therefore be isolated from their original context within adjacent landforms. The flow velocity of these modern channels is likely to be greater where secondary channels have been infilled.

Residential and primary industrial development within the proposed Stage 3 Modification Area, such as roads, tracks, houses and poultry sheds, have resulted in some areas of high disturbance. This applies to an estimated 36 hectares (2 to 3 per cent) of the proposed modification assessment area principally on lower slopes where archaeological sites are likely to have been destroyed or highly disturbed.

Agricultural cultivation is currently limited to around 75 hectares (6 per cent) of the proposed Stage 3 Modification Area, but is known to have been more widespread on lower slopes and flats in the past. Contouring for soil conservation is also found on some hillsides near Sandy

Creek. In these areas, archaeological sites are likely to have been affected with these processes known to redistribute artefacts spatially and relocate stone to the surface (Dean-Jones and Mitchell 1993:47). As contouring of slopes was introduced to try and halt advancing erosion it can also be expected that any artefactual material located in these areas would have been in a secondary depositional context when contouring was undertaken. Thus any artefactual material located within contoured areas is highly unlikely to retain any stratigraphic or spatial integrity. The one exception to this could be areas of low gradient at the base of the slope where archaeological sites/material may have been buried by the downslope movement of topsoil and may not have been subject to contouring.

3.5 Ethnohistoric Records

Historical records, including official records and personal observations recorded in diaries or publications, may provide information on the Aboriginal history of a region since European contact. While a valuable information source, these documents are limited as colonial observers tended to record unusual rather than everyday events, religious and social life rather than economic activity and men's behaviour rather than that of women and children. Further, early observations of the Hunter Valley tended to focus on the coastal rather than the inland regions. Consequently, ethnohistoric records may be biased or incomplete and cannot provide a complete understanding of Aboriginal beliefs and practices at the time of contact.

Published ethnohistoric sources for the Central Lowlands of the Hunter Valley region are relatively rare, although information may be found in sources such as Breton (1833), Cunningham (1827), Curr (1887), Dawson (1830), Ebsworth (1826), Eyre (1859), Grant (1803), Howe (1819), Ridley (1864) and Sturt (1833). Secondary sources such as Blyton et al. (2004), Brayshaw (1966; 1986), Davidson and Lovell-Jones (1993), Miller (1985), Needham (1981) and Wood (1972) form the basis of the following discussion of the Aboriginal history of the Central Lowlands and the Cessnock-Wollombi area, with specific reference to locations and material culture utilised to provide context for the proposed Stage 3 Modification Area .

3.5.1 Hunter Valley Region

The Central Lowlands of the Hunter Valley is the country of the Wonnarua People. Early European observers recorded the lives of the Wonnarua as intensely religious and constrained by strictly enforced laws (Ridley 1864 in Brayshaw 1986). Traditional Aboriginal people lived and travelled in small clan groups of often less than twenty people, but regularly gathered along kinship and moiety lines for ceremonies where larger numbers of people gathered for weeks at a time.

Matrilineal moieties in south-eastern Australia were an essential element of Aboriginal social and cultural organisation and expressed distinct and strict ritual responsibilities for the maintenance of the natural world. Exogamy was a common practice where women married into an opposite moiety group. This meant that neighbouring clans were often interrelated through marriage and often shared cultural histories and responsibilities.

The traditional lives of the ancestral Wonnarua focused on the Hunter Valley and were structured around a schedule of these social interactions loosely designed to take advantage of seasonal availability of resources; meaning that people moved often, but not at random. Before the arrival of the Europeans the Wonnarua were described as a large grouping of individual family units and bands which occasionally came together for religious and ceremonial functions (Davidson and Lovell-Jones, 1993:3). These (types of) gatherings were likely to have included tribes related on kinship lines for shared social and ceremonial life,

adjacent tribes on a basis of mutual benefit and agreement, and between tribes separated from each other by geographic distance (Wheeler 1910).

People were reported to have travelled freely within the broad area of responsibility of their own clan group. Social and cultural responsibilities and obligations meant that people (often young men) sometimes travelled great distances beyond their own territories to journey songlines (songs of Country), attend ceremonies, trade and develop social networks. This potentially linked people across extensive areas with the Wonnarua recorded as having had social ties from the coast to the western plains of NSW (Brayshaw 1986: 38-41). These gatherings provided trading opportunities for a wide range of goods, from ceremonial songs and dances to stone axes, spears, possum skins and native tobacco (Mulvaney 1986). Some groups specialised in producing high quality trade goods. Events like this were scheduled when and where seasonal resources were plentiful or at least where it was possible to use available resources more intensively.

There is little ethnographic evidence about where Aboriginal people camped, however, there is mention of the importance of fresh water. The provision of vantage points was also of importance in camp location in case of enemy attack (Fawcett 1898:152 in Brayshaw 1986:42). From camp sites, people would travel each day to gather plant foods and to hunt or to visit areas that provided required resources (for example stone, ochre, bark and resin). The daily foraging area was generally within a day's walk of camp. Brayshaw (1986:59) notes that of all raw materials available, bark appears to have been the most widely used and the most adaptable. The use of bark for huts, or 'gunyers' (gunyahs) as they are often referred to, is well documented, with descriptions by Caswell (1841) and Threlkeld (in Gunson 1974:45). Breton (1833) and Eyre (1859) noted that bark for wooden implements such as shields was collected from suitable trees.

Early historic reports describe the Hunter Valley as having extensive grasslands and floodplains with few trees (Breton 1833, Cunningham 1827, Howe 1819). These grasslands are thought to be the result of Aboriginal 'fire stick' farming techniques, which involved burning the countryside as a land management technique and a hunting strategy (Davidson and Lovell-Jones, 1993:5). This activity left a mosaic of vegetation communities and the development of grasslands resulting in increased biodiversity. Burning also facilitated travel by clearing the ground surface of undergrowth and timber and fresh growth which attracted prey animals. Fawcett (1898) and Cunningham (1827) refer to the use of fire by the Wonnarua.

Kangaroos, emus, possums and fish were recorded as plentiful (Breton 1833, Cunningham 1827, Dawson 1830) and mention was made of an abundance of food on the flatter ridges and plains that supported large populations of kangaroos (Cunningham 1827:157). Hunted species included kangaroos, wallabies and emus (Fawcett 1898:153), echidna (Fitzpatrick 1914:43 in Brayshaw 1986), goanna and native dogs (Dawson 1830:203), bandicoot (Ebsworth 1826:80), snakes (Threlkeld in Gunson 1974:55), flying foxes (Dawson 1830:309), possums (Dawson 1830:68) and insect larvae (Grant 1803:162-3). There is little evidence on the place of birds in the Aboriginal diet, although there are references to mutton bird hunting on Nobbys Island and ducks, geese, swans and pigeons (Threlkeld in Gunson 1974:55). Hunting was frequently a group exercise, although animals were sometimes speared by individual hunters.

Weirs, or fish traps, were observed by early colonial observers, such as one observed by Grant (1803:154-155 in Brayshaw 1986:42) along the lower Hunter in 1801. Fishing by building a weir of bushes across a stream and men beating the fish towards waiting nets is described by Threlkeld (in Gunson 1974:190).

Initiation ceremonies along the Hunter are described as using one or two cleared circles, often 350 metres apart (Brayshaw 1986:83). Carved trees surrounded the circles and in

some cases, figures of raised earth were created on the ground. Threlkeld (in Gunson 1974:63-66) described that red ochre, sourced from a volcano 'up the River Hunter' was used on important ceremonial occasions, as well as for other purposes.

Several forms of burial were recorded in the Hunter Valley. Earth burial is the most *commonly* recorded type, although the position of the body varied and could be extended or flexed, face down or up, or on its side (Brayshaw 1986:86). Bark was widely used as a burial shroud. Burial practices apparently varied between coastal and inland areas. Threlkeld (in Gunson 1974:47, 89, 100) indicated that coastal burials were deliberately smoothed and scattered with branches to leave little surface indication of the burial. This contrasts with descriptions of inland burials (Breton 1833, Howitt 1904:446, Sturt 1833:14) where burials were usually marked with carved trees. A description of the burial of four men and two women of the Kamilaroi tribe by Breton (1833:203-204) involved the individuals being covered with mounds of earth (instead of being placed in a hole) in the centre of a circle approximately thirty feet in diameter cleared of vegetation. Breton further noted that the trees for some distance were carved with figures representing kangaroos, emus, possums and weapons, some of which extended twenty feet above ground.

Most of the evidence for Aboriginal occupation in the Hunter Valley comes from stone implements, although there is little ethnography concerning their production and use. The only known mention is of the use of quartz for spear barbs and of the use of stone hatchets (Brayshaw 1986: 66, 68).

Europeans arrived in the Hunter Valley with the discovery of coal at Newcastle in 1797.By 1801 the Valley was reserved by the Crown as both a new convict settlement (a penal settlement was established in the Newcastle area in 1804) and for its resources in coal and timber (Davidson and Lovell-Jones, 1993:8). This effectively restricted free settlement of the area, however by 1819 the demand for grazing and settlement land increased beyond the current bounds of the colony's free settlement area. In 1821 Henry Dangar was commissioned to undertake a survey of the Hunter area to assess its suitability for settlement and farming. Davidson and Lovell-Jones state that within months of Dangar's favourable account of the Hunter Valley, claims for purchase and leasehold were being made by selectors in Sydney and by 1825 '…both sides of the Hunter River and associated brooks had been claimed' (Davidson and Lovell-Jones, 1993:8). The rapid settlement in the area disrupted Aboriginal economy and in a very short time the Aboriginal population was substantially affected by a combination of starvation, introduced diseases and massacres.

First contact between the Wonnarua and the settlers may have been cordial (see citations in Davidson and Lovell-Jones, 1993:10) but rapidly turned hostile and violent when the Aboriginal community actively resisted the colonisation and appropriation of their land and its resources. European landholders and their stockmen implemented widespread and indiscriminate violence against Aboriginal people'. The violence escalated significantly after 1826 and was fuelled in particular by the institutionalised violence of the Mounted Police (MacDonald and Davidson, 1998:60).

Documentary evidence suggests that by 1830 (only nineteen years after the first European settlers arrived in the Hunter) 'all armed resistance by local Aborigines' had ceased (Davidson and Lovell-Jones, 1993:17) and the traditional use of the land by the Wonnarua together with their social structure and daily interactions had been dramatically affected – all within one generation. There are, however, some accounts of cultural ceremonies being conducted decades later, such as a ceremony held at Bulga in 1852, noted by Blyton et al. (2004:9); and a ceremony held at the junction of the Page and Isis Rivers at Gundy, reported in the 1870s (McDonald 1878:255-258).

Since European settlement the Hunter Valley landscape has undergone radical changes with establishment of pastoral holdings, small towns and villages. Blyton et al. (2004:9) argues

that the European pattern of settlement and land use rapidly became the norm and 'replaced traditional Aboriginal communities' (Blyton et al., 2004:9). Davidson and Lovell-Jones (1993:17) also argue that shortly after European settlement all that remained were isolated family groups of Wonnarua existing 'on the fringes of towns and on properties trying as best they could to survive in a European modified environment'.

The material culture of Aboriginal people changed dramatically following contact, with the rapid influx of new technologies and materials. Threlkeld (in Gunson1974:54, 67) provides two examples of new technologies being utilised by Aboriginal people within the Lake Macquarie area, noting that bottle glass replaced stone ('fragments of quartz') in Aboriginal weapons and that iron and glass were used for fish hooks.

European settlement and encroachment on resources and traditional camping groups restricted Aboriginal occupation and dramatically affected Aboriginal communities, but it did not completely destroy connections to traditional camping grounds. There was a continuation of cultural connection and, in some cases, occupation of these places that date well into the twentieth century.

3.5.2 Cessnock and Wollombi

In addition to the above, there are a number of specific references to the Aboriginal history of the Cessnock and Wollombi areas. Aboriginal camp sites were recorded by early observers, such as Felton Mathew's recording (as late as 1830) of Aboriginal people camped in a 'romantic spot' on the bank of the Wollombi River near Broke (Brayshaw 1986:42). Another observation from this early period Breton (1833:90-92 in Brayshaw 1986:57) describes an encounter with some sixty warriors from the Illarong and Wallombi [sic], tribes, fantastically painted in white pipe clay, on their way to wage war with another tribe.

Needham (1981) discusses the Aboriginal history of the Cessnock and Wollombi region, based on a review of primary sources and from discussions with local residents and gives the Aboriginal meaning of several locations within the Quorrobolong Valley. He also identifies a number of Aboriginal sites within the Cessnock and Wollombi region, including one ceremonial ground (1981:35.) and two burial sites (1981:38) at Quorrobolong, based on information from a Mr Reynolds and local residents. A second ceremonial site is described as being near Payne's Crossing (to the west of Millfield), and this site is described as consisting of a trio of rings.

The burial sites at Quorrobolong are reported to be two of three known in the Wollombi region (1981:38 from Reynolds pers. comm.). All three burial sites were described as being under a tree or trees. There is a description of a burial at Quorrobolong of an apparently important person buried in a rectangular plot some 3 x 2 metres in size, containing a raised mound with an ironbark tree at each corner. One of the trees had been chopped down, the other struck by lightning and the site faced north (1981:35 from Reynolds pers. comm.). The second burial at Quorrobolong was reportedly of a young boy according to Needham (1981:38 from Reynolds pers. comm.). Mr Reynolds was contacted by Umwelt on 12 April 2011 to establish the reliability of this information. He explained the burials he referred to were shown to him by his father and were located in relation to an earthen mound on a ridge (midslope) 2.6 kilometres to the south-west of the proposed Stage 3 Modification Area near the Sandy Creek bridge (i.e. in the vicinity of the Wallis Creek bora – refer to **Section 3.2**).

The nature of the site patterning in relation to ceremonial gatherings is likely to have been complex. Even though details of the ceremonial life of the Wonnarua have not been recorded it is still possible to discern patterning in the archaeological record as ceremonial behaviour was spatially structured. Kelleher's (2002) work in the Blue Mountains region suggests site patterning was based upon a continuum of 'sacredness' and exhibited a pocketed distribution of sites. This distribution is likely to have been based upon moiety and kinship lines and

involved the use of transit areas and economic zones. Societal necessities would ensure people camped in cultural and spatial arrangements replicating similar territorial arrangements in the wider cultural landscape. Distinct divisions, often based on gender or age (Beckett 1967; Berndt 1950), separated the main intertribal gathering. As such it is likely public areas existed where preparations for ceremonial activities occurred preceding the 'main events'. Completion of certain ceremonies marks developmental stages in a person's social life and supplementary activities in these public areas often marked these transitions as well. Archaeologists can use this knowledge for intra-site comparative analysis to hypothesise and test for variation in spatial behaviour.

In relation to the proposed Stage 3 Modification Area, there is no highly productive economic zone that would stand out as a suitable area for a ceremonial gathering that included large numbers of people or that allowed for stays of an extended period (such as may have been found associated with Wallis Creek or Ellalong Lagoon – both resource rich areas). Thus there are no areas that would be likely candidates for an intertribal bora ground. However, it is possible that people attending a bora in the Wallis Creek or Paynes Crossing area may have had a camp site within the proposed Stage 3 Modification Area that was used during travel to a bora ceremony or by members of the group not attending the full bora ceremony (e.g. women, children and uninitiated males).

Archaeological implications of Ethnohistory

Whereas (as mentioned above) records kept by European observers may be biased or incomplete a number of important conclusions can be made from the documented accounts of Wonnarua society and its implications for the archaeological record:

- it is well documented that Wonnarua society was decimated by disease and conflict in the early days of settlement and by the 1830's land tenure and traditional society had been dramatically affected. It has been at least 180 years since traditional land use practices and archaeological site formation processes have been interrupted;

- locations that provided fresh water and good vantage points are recorded as having been a determining factor in the location and density of Aboriginal camp sites. These same factors were also important in locating European homesteads;

- it is well documented Aboriginal people moved widely around their natural and cultural landscape and utilised all landscape areas. Sites found throughout the region will reflect the subtleties of this cultural system. Smaller sites (in resource or transit areas) are likely to be located in landscapes away from permanent water and to have suffered less overall impact from European land use practices;

- larger, more permanent camp sites were reported as being located in places with a permanent water supply and a range of flora and fauna resources, such as at Ellalong Lagoon. Similar factors encouraged European residential settlement around permanent water today at Ellalong and Paxton;

- it is likely the Quorrobolong valley provided access to hinterland areas for Aboriginal people and that these known transit routes were quickly utilised by Europeans;

- post-contact sites (sites that contain evidence suggesting they were used by Aboriginal people after European settlement) are likely to be rare due to the rapid pace of settlement in the Hunter Valley, with traditional Aboriginal groups being affected by disease and driven away from traditional lands by pastoralists;

- European land clearance over the last two hundred years in the Quorrobolong Valley is likely to have removed Aboriginal scarred or carved trees, the last having been lost in

the late 20th century. Carved trees – such as the registered carved tree once recorded along Sandy Creek (NPWS #37-6-0114) – are commonly associated with burial or ceremonial sites and if present could indicate a culturally significant place; and

- oral history of two burial sites and one ceremonial site in the Quorrobolong Valley indicate they are outside of the proposed Stage 3 Modification Area.

4.0 The Predictive Model

Predictive models are developed to indicate which site types are likely to be found in an area and specify their likely distribution, content and integrity. Importantly, predictive models also suggest what site types are not likely to be found in the landscape.

This section presents the predictive model developed for the proposed Stage 3 Modification Area, based on the understanding of Aboriginal land use and archaeological site survival as developed in **Section 3**. This predictive model was used to inform the survey strategy for the proposed Stage 3 Modification Area, and following the survey, was evaluated against survey results to identify the extent to which survey results were consistent with or differed from the predictive model, as discussed in **Section 5**.

The following sections therefore identify the archaeological site types that are considered likely to occur, their predicted location within the landscape, content and condition or integrity.

4.1 Site Type Occurrence

The range of site types that may be found in the proposed Stage 3 Modification Area, as identified by previous archaeological and ethnohistoric research include:

- **artefact scatters** and **isolated finds** (the dominant site types within the local region identified in all landform contexts);
- **scarred trees** (have been previously recorded in the region and can occur in all landform contexts retaining mature, native vegetation);
- **PADs** located in areas where erosion has not acted to uncover archaeological material. Most likely to be located in slightly elevated areas (lower slopes or terraces) associated with more reliable water sources; and
- **grinding groove sites** (occur in the lower Hunter Valley in sandstone geological areas, such as those found within the north of the proposed Stage 3 Modification Area).

Site types not considered likely to occur include:

- **carved trees** are highly visible Aboriginal sites and generally do not survive in areas with a long non-Aboriginal history and particularly in cleared agricultural or pastoral regions. A registered carved tree site was however located to the south of the proposed Stage 3 Modification Area but as noted on the AHIMS site card, the tree was destroyed at the time of recording;
- sandstone sites such as **engravings, grinding bowls, stone arrangements, water holes or wells and pot holes**. These site types do occur in sandstone geological areas, but are relatively rare site types more common in ridge areas with exposed rock shelf;
- **ochre and stone quarries**, as no source of these materials is known to occur within the proposed Stage 3 Modification Area;
- **rockshelter sites**, although shelters and overhangs may occur in the steeper slopes of the Broken Back Range, survey by Umwelt (2008b) in these steep slopes did not identify their presence or that they were likely to occur;

- **fish traps** as Cony and Sandy Creeks (and their tributaries) are not key aquatic habitats and the fabric of fish traps are unlikely to be conserved;

- **ceremonial grounds or 'bora'** are very rare site types usually associated with a rich economic resource area (as indicated by literature review) and such rich resource areas are not known within the proposed Stage 3 Modification Area;

- **burial sites**, are very rare site types (as indicated by literature review identifying two unprovenanced burials in the Quorrobolong Valley). Though possible, burials are not likely to be found within the proposed Stage 3 Modification Area due their rarity and/or due to poor preservation within the acidic soils; and

- **post contact sites** such as homestead camps, camp sites with knapped glass or massacre sites, as these are not indicated by the ethno-historical research in this area.

4.2 Site Type Location

Within the proposed Stage 3 Modification Area, **artefact scatters** and **isolated finds** are predicted to occur in the following areas:

- in all landform contexts, but with increased frequency within 50 metres of watercourses;

- in low-gradient landscape areas in association with permanent or semi-permanent water and creek confluences. These areas are preferred for camp sites. Areas such as spur crests and ridge crests offer broad outlooks and creeklines or spur crests may provide excellent travel routes between resources;

- Sandy and Cony Creeks are classified as wetland environments and, as such, would have provided increased resource diversity. Artefact scatters rather than isolated finds are expected to characterise these areas, reflecting increased intensity of Aboriginal use; and

- artefact scatters and isolated finds are expected to be found in exposed areas resulting from erosion and/or human action, as these areas often provide the only effective visibility within pastoral landscapes covered by dense grasses.

Within the proposed Stage 3 Modification Area, **grinding groove** sites are predicted to occur in the following areas:

- on sandstone ledges that outcrop in or immediately adjacent to creek beds within sandstone geological areas; and

- in landforms with sufficient gradient (steep slopes) so that geomorphic processes expose rather than bury the sandstone ledges.

Consequently, within the proposed Stage 3 Modification Area grinding groove sites are most likely to occur in the landforms of the Broken Back Range, as any sandstone ledges within the valley lowlands are most likely to be buried by alluvial deposition along watercourses. The majority of grinding grooves recorded within the wider region are found in the Sugarloaf Range where many have been found in areas of higher elevation where sandstone bands occur (Umwelt 2003:4.6, Umwelt 2010c). This pattern may be replicated in the Broken Back Range.

Within the proposed Stage 3 Modification Area, **scarred trees** may occur wherever mature, native vegetation remains intact. Regrowth however dominates the vegetation of the proposed Stage 3 Modification Area. Occasional mature trees were observed within the regrowth vegetation during the 2008 survey (Umwelt 2008b). . Given this, no prediction can be made of exact locations of scarred trees, as they may occur in low numbers throughout regrowth vegetation areas and in areas that have not been subject to heavy land clearance activities.

4.3 Site Type Content

Artefact scatters and isolated finds are comprised of stone artefacts and the following predictions are made regarding likely site composition:

- the majority of sites are likely to be small artefact scatters of less than 10 artefacts or isolated finds;

- artefact scatters of more than 50 artefacts are rare but may occur along Cony and Sandy Creeks where erosion and/or disturbance has acted to expose them, as these areas are predicted to have had higher levels of use;

- silcrete and indurated mudstone dominate the stone artefact assemblages of the Quorrobolong Valley and are expected to dominate in any new sites recorded. Other raw materials utilised in the area include quartz, quartzite, petrified wood, porcellanite, crystalline tuff, chalcedony and volcanics, which may be present in the larger assemblages;

- predominant artefact types are expected to be flakes (mostly broken flakes), then cores and retouched flakes. Evidence of retouch and use wear may be present in a small percentage of the assemblage. Microblade technology is rare and is most likely to only be found in large assemblages; and

- ground artefacts (grindstones and axes) are not common artefact types and may not occur within the proposed Stage 3 Modification Area (or may only be found in very low frequencies).

Scarred trees result from the removal of bark (most common) or wood and leave distinctive marks. Two primary types are removal for a canoe or container (which would result in a symmetrical elliptical shape) or removal for use in a shelter (which would result in a rectangular sheet shape). Scars are generally recorded on the lower portion of the trunk near ground level and should the tree survive the removal event (which many do), the original wounds can be obscured by bark regrowth. The majority of scarred trees exhibit only one scar, although multiple scars on a single tree have been recorded. Eucalypt species, specifically box, are the most common trees scarred. If scarred trees occur in the proposed Stage 3 Modification Area, they are likely to be symmetrical, elliptical shapes with only one occluded scar.

Grinding grooves are grooves on rock surfaces manufactured by the sharpening of stone axe heads, stone chisels or fire hardened wooden spear points. In the lower Hunter Valley, the majority of known axe grinding grooves are located in the Sugarloaf Range and the Watagan Ranges. These can be complex sites containing numerous grooves, often associated with features such as pot holes. In other areas of the Hunter Valley, for example at Loders Creek near Singleton, a grinding groove site with 55 grooves was recorded in association with a concentrated and extensive artefact scatter (AHIMS site card 37-6-0148).

4.4 Site Type Integrity

The following predictions are made regarding the integrity of artefact scatters and isolated finds within the proposed Stage 3 Modification Area:

- artefact scatters and isolated finds within most landforms of the valley lowlands will have low to moderate integrity as a result of widespread vegetation clearance and grazing;

- artefact scatters and isolated finds within areas subject to past and present cultivation will probably have low integrity, as ploughing redistributes artefacts both spatially and stratigraphically. Where cultivation has been undertaken on terraces and lower slopes with soil profiles of some depth, subsurface artefactual material may survive with some spatial integrity beneath the plough zone (stratigraphic integrity is highly unlikely due to bioturbation);

- artefact scatters and isolated finds within areas subject to past contouring activities will have low integrity, due to firstly erosion uncovering and redistributing artefacts downslope and then due to earthworks redistributing artefacts both spatially and stratigraphically;

- artefact scatters and isolated finds within areas of localised earthworks or excavation, (including residential, pastoral, agricultural and industrial) are expected to have very low integrity, and many sites in these areas will have already been destroyed;

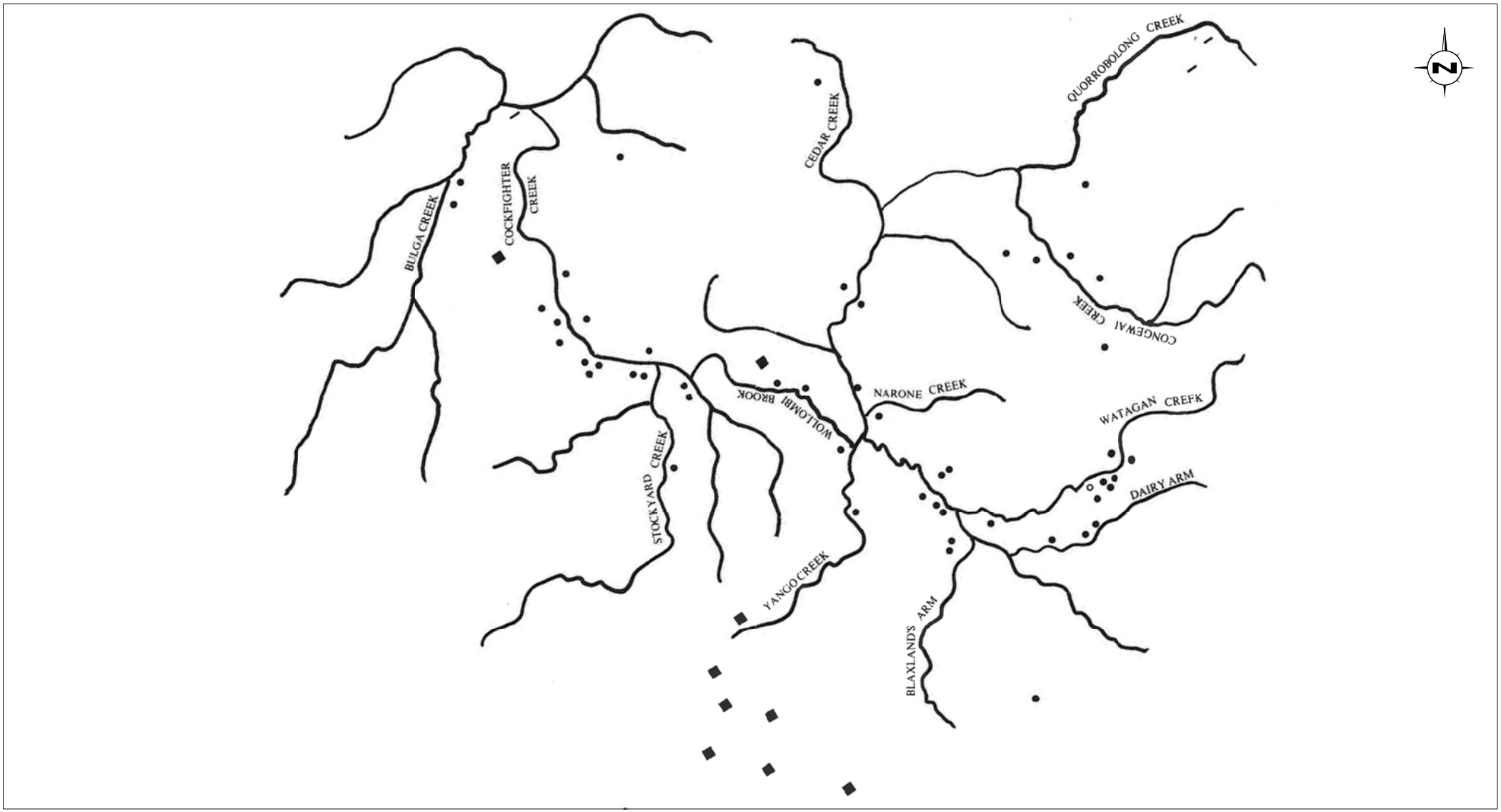
- artefact scatters and isolated finds associated with ephemeral creeks were unlikely to retain integrity due to the remnant shallow soils, erosion and stock trampling; and

- artefact scatters on slopes were expected to have been affected by the down slope movement of soils, causing redistribution of the artefacts and remixing and reburial further below.

Sandstone archaeological sites were predicted to occur within the landforms of the Broken Back Range and these site types were expected to retain higher integrity than those in land used for agricultural purposes as the area is part of the Werakata SCA. Sites, however, may be subject to ongoing water erosion, particularly any grinding groove sites within or adjacent to watercourses which may be affected by stream flow that carries abrasive sediment.

Scarred trees may occur in any landforms of the proposed Stage 3 Modification Area, wherever mature, native vegetation is retained. The vast majority of existing vegetation within the area is regrowth, attesting to past widespread clearance. Such clearance would require the use of large machinery and any remnant mature vegetation may have been damaged by the movement of such machinery throughout significant portions of the landscape. The integrity of scarred trees also relates to impact by natural processes, such as the age of the tree/scar, insect attack and bushfire. Due to the likely length of time since Aboriginal people ceased scarring trees and the degree of historic European impact it is unlikely that scarred trees of high integrity will be located within the proposed Stage 3 Modification Area.

Needham (1981) indicated that the **two burials** within the Quorrobolong Valley were positioned on alluvial flats near Quorrobolong Creek (see **Figure 4.1**). This suggests that although it is possible that burials may be located along Cony and/or Sandy Creek – survival of burials in such alluvial contexts is limited by geomorphic processes, with these areas being subject to periods of wetting and drying, flood action, creek channel migration, as well as the natural acidic pH of the alluvial flats which limits any potential for organic and skeletal material to survive.



Source: Needham, W.J. 1981. Burragurra, Where the Spirit Walked, The Aboriginal Relics of the Cessnock-Wollombi Region in the Hunter Valley of NSW

0 5 10 20km
1:400 000

Legend

- Rock Painting
- Rock Carving
- Ceremonial Ground
- Burial Ground

FIGURE 4.1

Needham (1981) Aboriginal Site Map

The survival of a **ceremonial site** would be dependent on the land use history of the area. Low-lying areas, such as along Cony and Sandy Creeks where resources would have been most concentrated, have had a long history of European use (including cultivation) and it is unlikely that earthen mounds or stone circles of a bora site would survive in this context (aerial photograph analysis of the proposed modification assessment area did however reveal the location of a circular feature near Cony Creek which was inspected and assessed for its potential to have been related to ceremony (refer to **Section 5.5**).

5.0 Archaeological Survey

This section provides details of fieldwork carried out as part of the archaeological investigation of the proposed Stage 3 Modification Area. It covers Registered Aboriginal Party participation and the subsequent development of a survey design including the placement of survey transects and analysis of effective survey coverage.

It is highlighted that the 2008 survey (Umwelt 2008b) had been limited in the area available for inspection due to landholder access issues (refer to **Figure 3.3** for details of the transects able to be completed at that time). Many areas not available for survey in 2008 became available for the 2011 survey. Thus, previously unknown sites were recorded in these areas. This section provides details on the additional sites recorded and examines areas of identified archaeological potential. The interpretation of the 2008 and 2011 survey results undertaken by Umwelt and Registered Aboriginal Party representatives is discussed, with survey results cross-referenced to the predictive model developed in **Section 4**. The likely Aboriginal archaeological values of properties that were still not accessible are also addressed, on the basis of the refined understanding of the Aboriginal archaeological context of the area.

5.1 Aboriginal Participation

All 15 Aboriginal parties that registered an interest in the 2008 Aboriginal Cultural Heritage Assessment were invited to participate in the archaeological assessment, with all participants involved in a Project Inception Meeting on 7 December 2010, a Survey Strategy Workshop held on 15 February 2011 and seven days of field survey between 28 February and 8 March 2011. **Table 5.1** lists the Registered Aboriginal Parties that participated in the meetings that preceded the survey and the days and activities in which they participated. Kathleen Steward-Kinchela as a representative of Yinarr Cultural Services, who later registered an interest in the project, took part in the Project Inception and Survey Strategy Meetings.

Table 5.1 – Registered Aboriginal Party participation in Pre-survey Meetings

Date	Activity/Meeting	Registered Aboriginal Party in attendance	Representative
7/12/10	Project Inception	Aboriginal Native Title Consultants	Margaret Matthews.
7/12/10	Project Inception	Upper Hunter Heritage Consultants	Darryl Matthews
7/12/10	Project Inception	Wonnarua Cultural Heritage	Gordon Griffiths
7/12/10	Project Inception	Giwiirr Consultants	Michele Stair Rodney Mathews
7/12/10	Project Inception	Hunter Valley Cultural Consultants	John Mathews
7/12/10	Project Inception	Culturally Aware	Justin Govar
7/12/10	Project Inception	MLALC	Steve Talbot
7/12/10	Project Inception	Wonn1 Contracting	Arthur Fletcher
7/12/10	Project Inception	Mingga Consultants	Clifford Matthews
15/2/11	Survey Strategy Workshop	Aboriginal Native Title Consultants	Margaret Matthews
15/2/11	Survey Strategy Workshop	Upper Hunter Heritage Consultants	Darryl Matthews
15/2/11	Survey Strategy Workshop	Lower Hunter Wonnarua Council	Tom Miller
15/2/11	Survey Strategy Workshop	Wonnarua Cultural Heritage	Gordon Griffiths

Table 5.1 – Registered Aboriginal Party participation in Pre-survey Meetings (cont)

Date	Activity/Meeting	Registered Aboriginal Party in attendance	Representative
15/2/11	Survey Strategy Workshop	Yarrawalk	Barry French
15/2/11	Survey Strategy Workshop	Wattaka Wonnarua Cultural Consultants Services	Des Hickey
15/2/11	Survey Strategy Workshop	Hunter Valley Cultural Consultants	John Mathews
15/2/11	Survey Strategy Workshop	MLALC	Steve Talbot
15/2/11	Survey Strategy Workshop	Mingga Consultants	Clifford Matthews

The fieldwork submission form provided by the Registered Aboriginal Parties in 2008 requested that stakeholders nominate representatives for fieldwork and identify the experience of each and respond to the following criteria:

- representatives must have appropriate experience, ability and reliability;
- the group must demonstrate they have appropriate experience;
- the group must provide each of their representatives appropriate Personal Protective Equipment and Clothing (PPE&C) including boots long trousers and hat;
- representatives must be physically fit, capable of walking very steep slopes and have no serious medical conditions which are likely to inhibit fitness during fieldwork;
- representatives must have demonstrated ability to work effectively in a team environment; and
- individuals can only be represented by a single head organisation for the purposes of fieldwork.

5.2 Research Design

The primary aim of the archaeological survey was to identify any visible surface archaeological materials or PADs within the proposed Stage 3 Modification Area and to assess their likelihood of impact by the proposed modifications. Further, the survey aimed to document sufficient information on identified sites/PADs to inform the archaeological significance assessment. Understanding the likely impact on the sites/PADs and their archaeological significance is fundamental in determining appropriate management strategies for archaeological sites in the proposed Stage 3 Modification Area.

A survey strategy was developed in a workshop held with Registered Aboriginal Parties at Austar Coal mine on 15 February 2011. **Table 5.1** lists Registered Aboriginal Party representatives who attended that workshop and participated in discussions.

5.2.1 Survey Strategy: Aims and Objectives

The Survey Strategy Workshop identified some key survey objectives brought up by the Registered Aboriginal Parties including:

- the need to reinspect key Aboriginal archaeological sites (the grinding groove site ACM6 and large artefact scatter along Cony Creek – ACM14) located in the 2008 Aboriginal Cultural Heritage Assessment (Umwelt 2008b – refer to **Figure 3.2**) to update existing site records on site integrity and provide representatives from Registered Aboriginal Parties another opportunity to visit these sites;

- the need to inspect properties not subject to past archaeological survey, to identify surface archaeological deposits and evaluate subsurface archaeological potential. Registered Aboriginal Parties expressed the desire to attempt 100 per cent survey of accessible properties;

- the need to inspect areas of high archaeological or cultural potential as identified by archaeologists and Registered Aboriginal Parties to identify any previously unrecorded surface archaeological sites and further refine the current understanding of the subsurface archaeological potential;

- the need to identify appropriate Aboriginal heritage management outcomes for identified sites; and

- the need to be flexible in regards to survey strategy to respond to limitations and opportunities in the field.

The survey strategy requested by the Registered Aboriginal Parties aimed to develop a fuller understanding of the Aboriginal archaeological resource of the proposed Stage 3 Modification Area to inform appropriate management strategies for the development of an ACHMP. The above works were also seen to provide Registered Aboriginal Parties with the opportunity to identify sites/areas of cultural significance within the proposed Stage 3 Modification Area and discuss appropriate management of these sites for inclusion in the ACHMP.

5.3 Landform Classification

Prior to the archaeological survey, the landscape of the proposed Stage 3 Modification Area was delineated into a series of landform elements and stream orders, based on definitions outlined in McDonald et al. (1990) and Strahler (1964). Landform terms utilised in this Aboriginal Cultural Heritage and Archaeological Assessment are defined in **Table 5.2** below.

Table 5.2 - Landform Element Definition (from McDonald et al. 1990:13-19)

Landform Element	Description
Crest	Landform element that stands above all, or almost all, points in the adjacent terrain. Characteristically smooth convex. Margin of the crest should be drawn at the observed curvature. Relevant element types include: • Hillcrest: very gently inclined to steep crest, smoothly convex. Typical element of hills and rises. • Summit surface: very wide level to gently inclined crest with abrupt margins, commonly eroded by sheet wash or water-aided mass movement.
Hillock	Compound landform element comprising a narrow crest and short adjoining slopes, the crest length being less than the width of the landform element. Relevant element types include: • Tor: steep to precipitous hillock with a surface of mainly bare rock, eroded by sheet wash or water aided mass movement. • Mound: Hillock built by human activity.
Ridge	Compound landform element comprising a narrow crest and short adjoining slopes, the crest length being greater than the width of the landform element. Relevant element types include: • Embankment: ridge or slope built up by human activity. • Levee: long, low sinuous ridge adjacent a stream channel, built up by over bank flow. Usually either side of a stream channel, at the level reached by frequent floods.
Slope	Planar landform element that is neither a crest nor a depression and has a greater inclination than 1%. Can be further subdivided into simple slope, upper slope, mid-slope and lower slope based on gradient, and relationship between slope breaks. Relevant element types include: • Scarp: wide maximal slope eroded by gravity, sheet flow or water aided mass movement. • Footslope: waning lower slope resulting from aggradation or erosion by sheet flow, earth flow or creep. • Bench: short gently or very gently inclined minimal midslope element, eroded or aggraded by any agent.
Flat	Planar landform element that is neither a crest nor a depression and is level or very gently inclines (less than 3% tangent approximately). Relevant element types include: • Plain: large gently inclined to level element of unspecified geomorphic agent. • Fan: large gently inclined to level element resulting from aggradation or erosion from channelled stream flow, or possible sheet flow. • Terrace flat: small flat eroded or aggraded by over bank stream flow and no longer frequently inundated (part of a former flood plain).
Open Depression	Landform element that stands below all, or almost all, points in the adjacent terrain. Open depressions extend at the same elevation or lower beyond the observed locality. Relevant element types include: • Gully: open depression with short precipitous walls, small stream channel, eroded by channelled water flow. • Stream channel: linear generally sinuous open depression, comprising stream banks and stream beds.
Closed Depression	Landform element that stands below all points in the adjacent terrain. Relevant element types include: • Swamp: almost level closed (or almost closed) depression with a seasonal water table at or above the surface. • Lagoon: closed depression with water, typically salt or brackish.

The slope landform element defined above describes a significant proportion of the proposed Stage 3 Modification Area, and was further subdivided by slope class, as presented in **Table 5.3**.

Table 5.3 - Slope Class (from McDonald et al. 1990:12)

Slope Description	Slope Class	Approximate Slope (%)	
		Boundary	Average
Slope (VG)	Very gently inclined	1-3	1
Slope (G)	Gently inclined	3-10	6
Slope (MO)	Moderately inclined	10-32	20
Slope (ST)	Steep	32-56	40
Slope (VS)	Very steep	56-100	70
Slope (PR)	Precipitous	100-300	170
Slope (C)	Cliffed	300-	500

Figure 5.1 presents the slope class mapping conducted for this project, based on aerial laser scanning (ALS) survey data collected by AAM Hatch during August 2006. This survey captured approximately 80 million survey points within the Quorrobolong Valley describing the land and channel systems, each with an average horizontal accuracy of less than 0.55 metres (AAM Hatch 2006). This level of topographic information far exceeds the usual sources for landscape analysis, being review of contour information on NSW topographic maps.

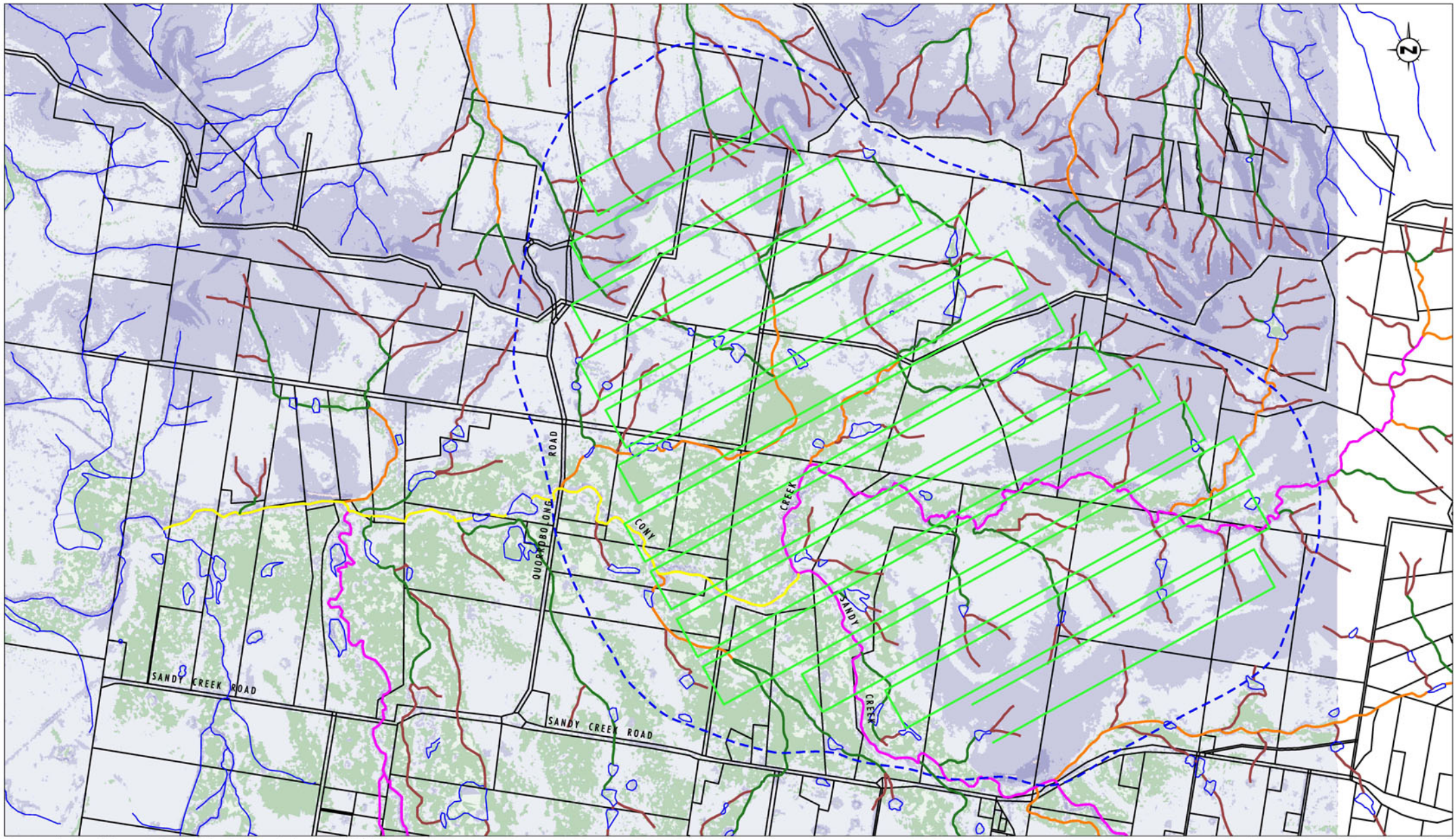
The open depressions defined in **Table 5.2** are further classified by stream order for the purposes of this archaeological assessment. Strahler (1964) defined a simple method of stream order classification based on the number of upstream tributaries, and in summary, a stream with no tributaries is considered a first order stream, then two first order streams join to become a second order stream, two second order streams join to become a third order stream, and so on. **Figure 5.1** also illustrates all creek lines within the project area by stream order.

5.4 Archaeological Site Classification

The term 'archaeological site' is used to define a location where Aboriginal objects (artefacts) occur in the landscape. 'Objects' are defined under the NPW Act as:

> ….any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

The majority of sites predicted to occur within the proposed Stage 3 Modification Area are artefact scatters or isolated finds, and the difficulty in defining the limits of these site types is well recognised as archaeological survey alone can only determine the visible extent of the surface material. The extent of the subsurface deposit, and obscured surface material, can only be determined through archaeological excavation. Given this, site boundaries are often defined based on the visible extent of the artefactual material observed within surface exposures, or the predicted subsurface site extent based on an understanding of archaeological potential.



Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW

Legend

- Proposed Stage 3 Modification Longwall Panels
- 20mm Subsidence Contour for Proposed Stage 3 Modification

Slope (Degrees)

- Range [0.000 : 1.000]
- Range [1.000 : 3.000]
- Range [3.000 : 10.000]
- Range [10.000 : 32.000]
- Range [32.000 : 56.000]
- Range [56.000 : 100.000]

Stream Order

- Stream Order 1
- Stream Order 2
- Stream Order 3
- Stream Order 4
- Stream Order 5

FIGURE 5.1

Slope Class and Stream Order Mapping

File Name (A3): R60_V1/2274_973.dgn

During the field survey, all identified artefacts were recorded as individual find locations to ensure sufficient detail on location and environmental context was documented for each. Where individual find locations were found in association, these have been grouped together as archaeological sites (artefact scatters). Site descriptions provided in **Section 5.8** identify the boundary of each additional site recorded in the proposed Stage 3 Modification Area.

5.4.1 Areas of Archaeological Potential

In this report, the term 'archaeological potential' is used to refer to the likelihood of subsurface artefacts being present at a specific locale. The evaluation of archaeological potential is based on two primary criteria: the probability of artefactual deposition resulting from past Aboriginal land use; and the terrain integrity of the locale following consideration of geomorphic processes and human action. Following consideration of these criteria, the following terms will be employed to classify the archaeological potential of specific locations:

- **no archaeological potential**: areas where the natural soil profile has been removed through geomorphic processes or human action, thereby removing any archaeological resource of the location. Examples of this category would include a landslide or industrial quarry sites;

- **low archaeological potential**: landscape areas that may have been utilised by Aboriginal people in the past, but at a lower intensity than all surrounding landforms. The density of artefacts deposited within these areas would therefore be low. This category also includes landscape areas of low terrain integrity, where geomorphic processes or human action may have redistributed artefacts from their deposited locations, resulting in site disturbance or destruction;

- **moderate archaeological potential**: landscape areas that are predicted to have been utilised by Aboriginal people in the past, but not intensively or repeatedly. There is therefore potential for artefactual deposition, but at a lower frequency and density than in areas of high archaeological potential. Terrain integrity in these areas may be variable, but the majority of open camp sites are expected to be of low to moderate integrity only, with geomorphic processes not acting to bury deposits *in situ*;

- **high archaeological potential**: landscape areas predicted to have been intensively or repeatedly utilised by Aboriginal people in the past, such as creek confluences or elevated terraces above major watercourses. Terrain integrity in these areas may be variable, but the majority of open camp sites are expected to be of low to moderate integrity only, with geomorphic processes not acting to bury deposits *in situ*; and

- **very high archaeological potential**: landscape areas predicted to have been more intensively or repeatedly utilised than all surrounding landforms by Aboriginal people in the past, such as major creek confluences or lagoons. Terrain integrity in these areas may be variable, but these landforms may include areas of high terrain integrity, where geomorphic processes may have acted to bury deposits *in situ*. Sites may therefore be of very high archaeological research potential.

Potential Archaeological Deposits (PADs) are areas where it is predicted that there is a high likelihood of subsurface Aboriginal archaeological material (artefacts). Whilst there is a likelihood that low numbers of artefacts in a subsurface context will be found throughout the landscape (generally referred to as background scatter – i.e. stone implements lost or discarded during transient use of the landscape) there are also parts of the landscape where higher artefact numbers are predicted. These areas generally have common characteristics such as:

- they are a landform of gentle gradient suitable for camping. When associated with creeklines they are often elevated above the creekline;
- they are close to an important resource (e.g. a permanent or semi permanent water source, stone suitable for artefact manufacture, an ochre quarry, or a seasonally abundant animal or insect food resource);
- they retain an adequate depth of topsoil (either A1 and A2 or reasonable depth of A2) that would suggest that any artefacts discarded in the area had not been lost to erosion;
- they may be in an area where alluvial or colluvial deposits have aggraded;
- they are not located in an area where the migration of a watercourse is likely to have resulted in site destruction; and
- they are generally located in areas where ground disturbance may have been minor or where ground disturbance may relate to only the upper soil profile.

Thus PADs are often identified in areas close to higher order streams that are permanent, or when associated with lower order streams in areas where chains of ponds can be predicted which would have held reliable water for a predictable period of time after rain.

5.5 Survey Coverage

As per the requests from Registered Aboriginal Parties the survey attempted to cover 100 per cent of accessible properties. Only 13 of the 15 Registered Aboriginal Parties chose to participate in the survey. All archaeological survey was conducted on foot by a field team consisting of 2 archaeologists and the 13 Registered Aboriginal Party representatives. Inspections of key known sites were conducted by all field team members, and survey coverage was determined by the requirements of each survey area.

Linear survey transects were conducted by team members (with spacing no wider than 20 metres); and where wider transects were appropriate (e.g. in dense grasslands), transects were conducted by the field team (with spacing no wider than 40 metres). Tighter transects were undertaken for all major creeklines, where higher archaeological site densities were expected (within 50 metres of the creek line).

Survey coverage was recorded using handheld GPS units and mapping (topographic and aerial), and notes of the location of pedestrian transects were also made on aerial photographs. The environmental characteristics of all transects were documented, including landform, gradient, vegetation cover, ground surface exposure, current land use and any areas of disturbance (either from geomorphic processes or human action). The presence of key Aboriginal resources such as plants, stone or ochreous materials were also recorded. Photographs were taken to document environmental characteristics of the survey area.

Although artefact scatters and isolated finds were the most common site types expected within the proposed Stage 3 Modification Area, the need to inspect mature trees for evidence of Aboriginal cultural scarring, the need to inspect all stone outcrops for evidence of extraction and the need to inspect sandstone bedrock for evidence of grinding grooves was also recognised.

All Aboriginal archaeological sites identified during the survey were recorded to the standard required by the *DECCW Code of Practice for Archaeological Investigations of Aboriginal Objects in New South Wales* (2010). This included information on site location, site boundaries, site type, content and condition. Information recorded on stone artefacts included: artefact type; raw material; size class; cortex; retouch; use wear; heat affect and other relevant attributes. Photographic records of each site were also taken and a sketch map prepared to be attached to the requisite AHIMS site card.

Areas of archaeological potential were also recorded during survey, whether they occurred in association with a surface archaeological site or in areas with no surface sites. Information recorded for these areas included location, PAD boundary, environmental characteristics, proximity to known Aboriginal resources and integrity. Photographic records of each area of archaeological potential were also taken and a sketch map prepared.

When Registered Aboriginal Parties representatives wished to comment during the survey on the cultural significance of the landscape, or the cultural significance of any sites recorded during the survey, these comments were noted by Umwelt archaeologists and included on the AHIMS site card.

On the basis of the coverage aims outlined above, the size of the survey team and the recording methods, seven days were required for the archaeological survey.

Site cards will be submitted to the AHIMS sites database following an opportunity for Registered Aboriginal Parties to provide further input on the cultural significance of each site. Landowners will also be notified of sites located during the survey on their land.

A summary of the survey results in the form of the draft AHIMS site recording cards were provided to the Registered Aboriginal Parties on 29 March 2011 for their information and to request any further input on Aboriginal cultural significance of the sites.

5.5.1 Field Team

Table 5.4 lists all members of the field team involved in the archaeological survey of the proposed Stage 3 Modification Area.

Table 5.4 – Archaeological Field Team

Date	Organisation	Field Representative
28/2/11	Wonn 1 Contracting	Arthur Fletcher
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mingga Consultants	Gay Horton

Table 5.4 – Archaeological Field Team (cont)

Date	Organisation	Field Representative
	Mindaribba Local Aboriginal Land Council	Adam Clark
	Yarrawalk	Dany Franks
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
1/3/11	Wonn 1 Contracting	Arthur Fletcher
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mingga Consultants	Clifford Matthews
	Mindaribba Local Aboriginal Land Council	Tamika Matthews
	Yarrawalk	Danny Franks
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
2/3/11	Wonn 1 Contracting	Arthur Fletcher
	Mingga Consultants	Clifford Matthews
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mindaribba Local Aboriginal Land Council	Christine Dever
	Yarrawalk	Dany Franks
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
3/3/11	Wonn 1 Contracting	Arthur Fletcher
	Lower Hunter Wonnarua Council	Dean Miller
	Mindaribba Local Aboriginal Land Council	Christine Dever
	Yarrawalk	Danny Franks
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh

Table 5.4 – Archaeological Field Team (cont)

Date	Organisation	Field Representative
4/3/11	Wonn 1 Contracting	Arthur Fletcher
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mingga Consultants	Gay Horton
	Mindaribba Local Aboriginal Land Council	Carl McDonald
	Yarrawalk	Dany Franks
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
7/3/11	Wonn 1 Contracting	Arthur Fletcher
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mingga Consultants	Gay Horton
	Mindaribba Local Aboriginal Land Council	Adam Clark
	Yarrawalk	Dany Franks
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
8/3/11	Wonn 1 Contracting	Arthur Fletcher
	Aboriginal Native Title Consultants	Margaret Matthews
	Giwiirr Consultants	Colleen Stair
	Hunter Valley Cultural Consultants	John Matthews
	Lower Hunter Wonnarua Council	Dean Miller
	Mingga Consultants	Clifford Mathews
	Mindaribba Local Aboriginal Land Council	Adam Clark
	Upper Hunter Heritage Consultants	Adam Roberts
	Wonnarua Culture Heritage	Shannon Griffiths
	Wattaka Wonnarua Cultural Consulting Services	Mark Hickey
	Hunter Valley Cultural Surveying	Luke Hickey
	Culturally Aware	Katrina Cavanagh
30/3/11	All Registered Aboriginal Parties sent site cards and summary survey results report	

5.6 Survey Coverage

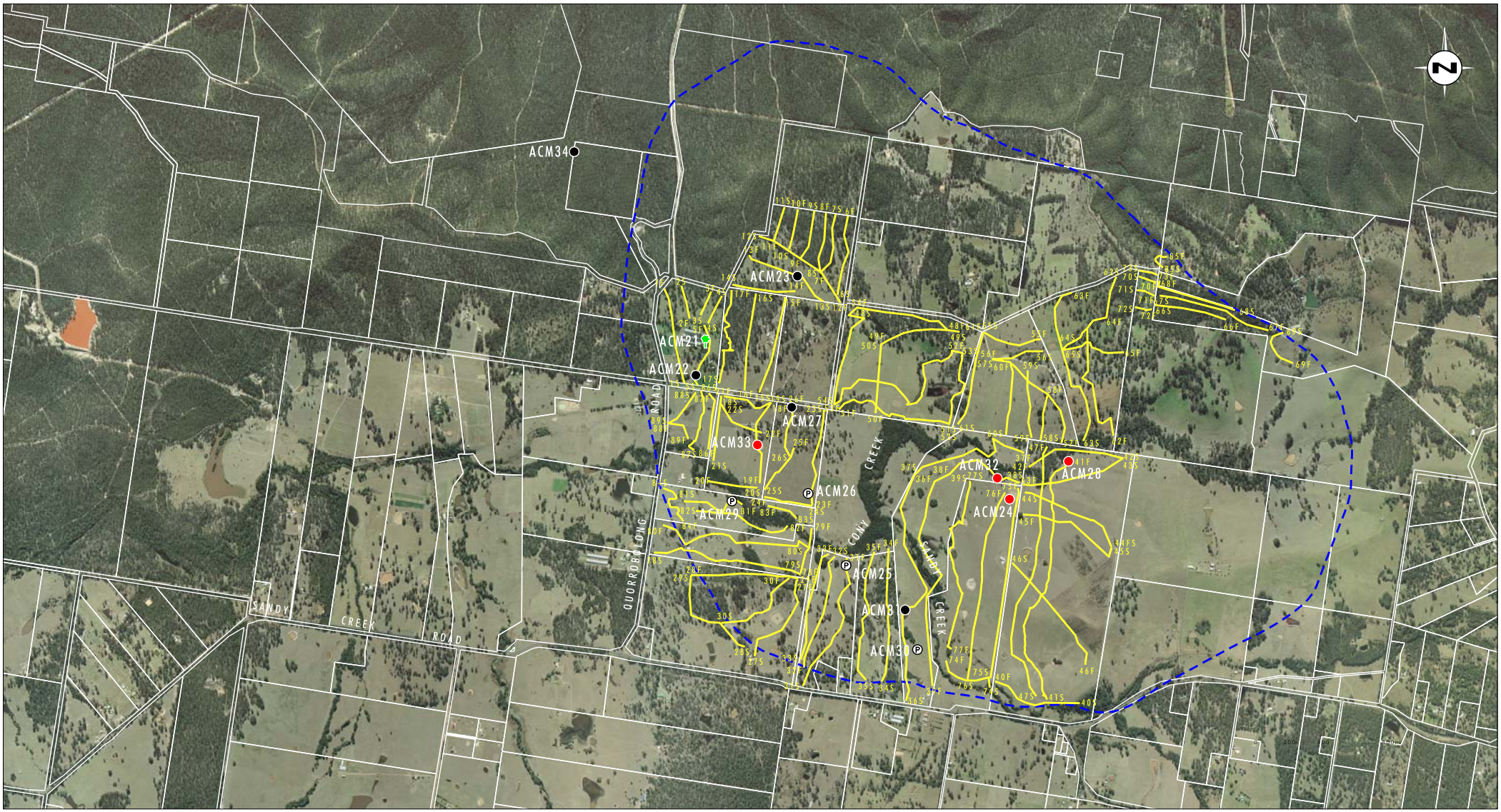
A total of 90 pedestrian survey transects were conducted, covering 476 hectares or 39 per cent of the total 1210 hectares within the proposed Stage 3 Modification Area.

A further 552 hectares of the proposed Stage 3 Modification Area were accessed in 2008 (Umwelt 2008b) bringing the total survey access to 1028 hectares or 84 per cent. Overall it is estimated 52.5 per cent of the Stage 3 Modification Area surface has been inspected by archaeologists and Registered Aboriginal Parties. The remaining areas not surveyed include inaccessible properties (16 per cent), areas where predictive models indicated archaeological potential was low and approximately 2 kilometres of road verge along Cony Creek Lane.

Table 5.5 provides the location of each survey transect undertaken for the Aboriginal Cultural Heritage and Archaeological Assessment (MGA and environmental context). **Figure 5.2** locates each of the survey transects with respect to located sites. **Figure 5.3** presents all of the sites located within the Stage 3 Modification Area, from prior surveys for the Stage 3 Austar Mine Aboriginal Cultural Heritage Assessment undertaken in 2008 (Umwelt 2008b) and for Due Diligence surveys undertaken in 2010 & 2011 (Umwelt 2010a, 2010b & 2011). **Table 5.5** also presents key information on survey method, location and dominant environmental context for each survey transect, and **Table 5.6** summarises detailed information recorded for each transect, including length, width, ground surface exposure, visibility and archaeological sites recorded.

Table 5.5 – Archaeological Survey Transects

Transect #	Method	Start (MGA)	End (MGA)	Environmental Context		
				Geology	Soil	Landform
1	Pedestrian	347387 635775	347208 635775	Branxton	Aberdare	Hillslope (mid)
2	Pedestrian	347310 6358335	347350 6358097	Branxton	Aberdare	Hillslope (mid)
3	Pedestrian	347343 6358104	347427 6358298	Branxton	Aberdare	Hillslope (mid)
4	Pedestrian	347514 6358287	347459 6350082	Branxton	Aberdare	Hillslope (mid)
5	Pedestrian	347351 6357745	347459 6350082	Branxton	Quorrobolong	Hillslope (low)
6	Pedestrian	348224 6358278	348273 6358699	Branxton	Aberdare	Hillslope (low)
7	Pedestrian	348214 6358714	348160 6358368	Branxton	Aberdare	Hillslope (low)
8	Pedestrian	348073 6358460	348129 6358692	Branxton	Aberdare	Hillslope (mid)
9	Pedestrian	348055 6358723	348005 6358492	Branxton	Aberdare	Hillslope (mid)
10	Pedestrian	347897 6358593	347936 6358727	Branxton	Aberdare	Hillslope (upper)
11	Pedestrian	347814 6358777	347781 6358666	Branxton	Aberdare	Hillcrest



Source: Cadastral: LPI NSW, Aerial Photo: AAM Hatch 2006

0 0.5 1 1.5km
1:32 000

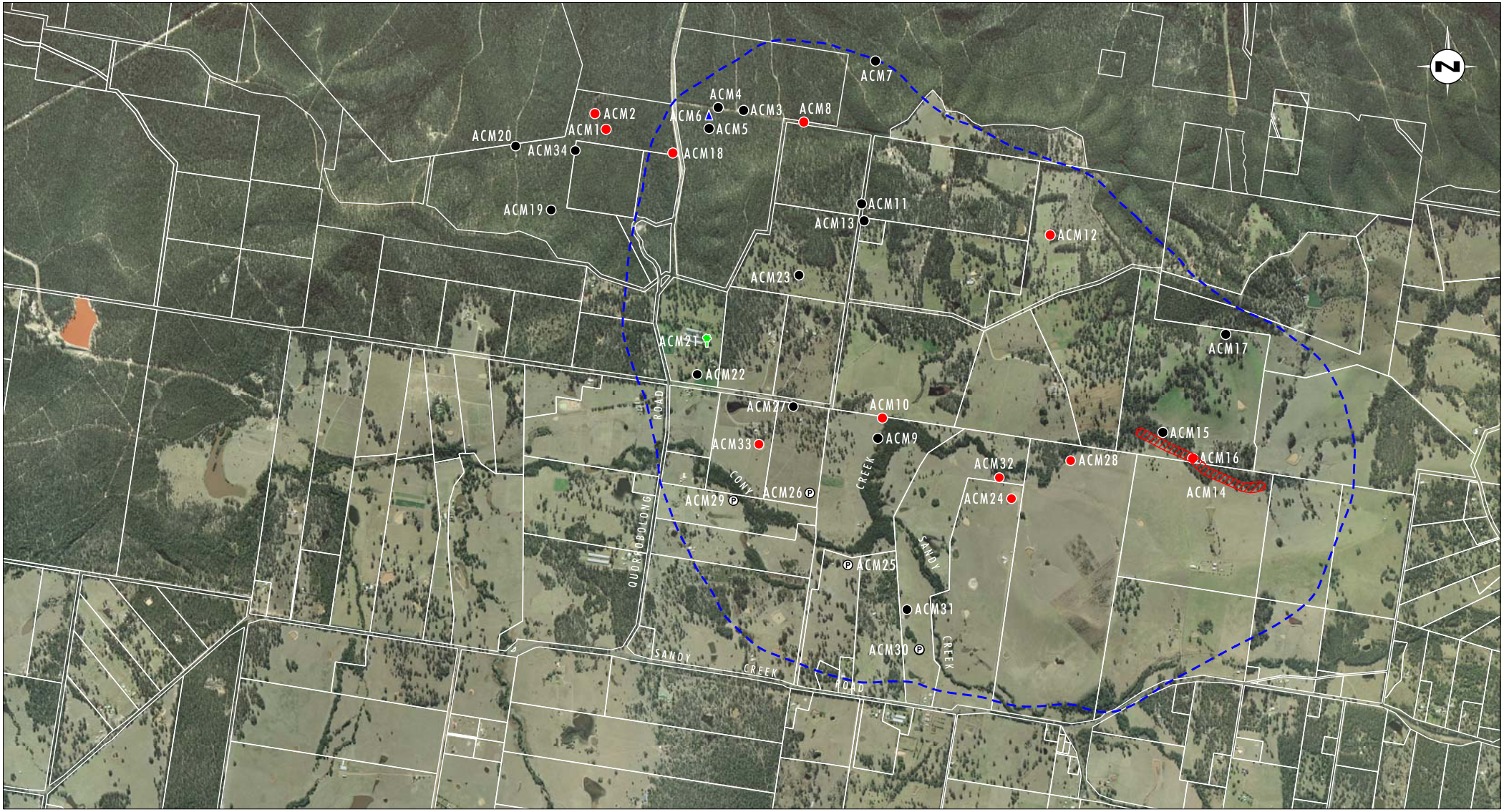
Legend

- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Survey Track
- Artefact Scatter
- Isolated Find
- PAD
- Scarred Tree

FIGURE 5.2

Austar Archaeological Survey February/March 2011

File Name (A4): R60_V1/2274_964.dgn



Source: Cadastral: LPI NSW, Aerial Photo: AAM Hatch 2006

Legend

- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Continuous Distribution of Artefacts
- Artefact Scatter
- Isolated Find
- PAD
- Scarred Tree
- Axe Grinding Groove

FIGURE 5.3

Archaeological Sites in Proposed Stage 3 Modification Area

Table 5.5 – Archaeological Survey Transects (cont)

Transect #	Transect Method	Start (MGA)	End (MGA)	Environmental Context		
				Geology	Soil	Landform
12	Pedestrian	347690 6358677	348191 635826	Branxton	Aberdare	Hillslope (mid)
13	Pedestrian	348191 6358261	347654 6358527	Branxton	Aberdare	Hillslope (mid)
14	Pedestrian	347032 6358386	348188 6358260	Branxton	Aberdare	Hillslope (low)
15	Pedestrian	347527 6357724	347592 6358286	Branxton	Quorrobolong & Aberdare	Hillcrest
16	Pedestrian	347687 6357694	347693 6357706	Branxton	Aberdare & Quorrobolong	Hillslope (mid)
17	Pedestrian	347804 6358220	347861 6358220	Branxton	Quorrobolong & Aberdare	Hillslope (mid)
18	Pedestrian	347492 6357676	347836 6357619	Branxton	Quorrobolong	Stream (Order 5)
19	Pedestrian	347836 6357619	347228 6357106	Branxton	Quorrobolong	Hillslope (low)
20	Pedestrian	347228 6357106	347464 6357337	Branxton	Quorrobolong	Hillslope (low)
21	Pedestrian	347464 6357337	347502 6377544	Branxton	Quorrobolong	Hillslope (low)
22	Pedestrian	347502 6377544	347741 6357355	Branxton	Quorrobolong	Hillslope (low)
23	Pedestrian	348117 6357596	348055 63557036	Branxton	Quorrobolong	Hillslope (low)
24	Pedestrian	348055 63556881	347784 6357072	Branxton	Quorrobolong	Hillslope (low)
25	Pedestrian	347784 6357072	347966 6357353	Branxton	Quorrobolong	Hillslope (low)
26	Pedestrian	347966 6357353	347923 6357621	Branxton	Quorrobolong	Hillslope (low)
27	Pedestrian	347931 6356146	348002 6356572	Branxton	Quorrobolong	Hillslope (low)
28	Pedestrian	347767 6356215	347830 6356617	Branxton	Quorrobolong	Hillslope (mid)
29	Pedestrian	347830 6356617	347396 6356687	Branxton	Quorrobolong	Hillslope (mid)
30	Pedestrian	347396 6356687	347931 6356146	Branxton	Quorrobolong	Hillslope (low)
31	Pedestrian	348270 6356075	348309 6356706	Branxton	Quorrobolong	Hillslope (low)
32	Pedestrian	348207 6356710	398139 6356166	Branxton	Quorrobolong	Hillslope (low)
33	Pedestrian	347960 6356099	348079 6356786	Branxton	Quorrobolong	Hillslope (low)

Table 5.5 – Archaeological Survey Transects (cont)

Transect #	Transect Method	Start (MGA)	End (MGA)	Environmental Context		
				Geology	Soil	Landform
34	Pedestrian	348559 6355975	348517 6356834	Branxton & Alluvium	Quorrobolong	Hillslope (low)
35	Pedestrian	348399 6357456	348408 6355978	Alluvium & Branxton	Quorrobolong	Stream confluence (Order 4/5)
36	Pedestrian	348731 6355961	348581 6357004	Alluvium	Quorrobolong	Floodplain
37	Pedestrian	348517 6357001	349345 6357354	Branxton	Quorrobolong	Hillslope (low)
38	Pedestrian	349297 6357170	348871 6357228	Branxton	Quorrobolong & Aberdare	Hillslope (low)
39	Pedestrian	348871 6357228	348753 6356704	Alluvium	Aberdare & Quorrobolong	Stream (Order 4)
40	Pedestrian	3449720 6355884	349180 6355996	Alluvium	Aberdare	Stream (Order 3)
41	Pedestrian	349354 6355974	349545 6357272	Branxton	Aberdare	Hillslope (low)
42	Pedestrian	349943 6357330	349374 6357361	Branxton	Quorrobolong	Hillslope (low)
43	Pedestrian	349935 6357332	349329 6357103	Branxton	Aberdare	Hillslope (mid)
44	Vehicular	349338 6357109	349856 6356825	Branxton	Quorrobolong	Hillslope (mid)
45	Vehicular	349304 6356710	349738 6356251	Branxton	Aberdare	Hillslope (mid)
46	Pedestrian	349740 6356254	349439 6355955	Branxton	Aberdare	Hillslope (low)
47	Pedestrian	349712 6357345	349485 6355962	Branxton	Aberdare	Hillslope (low)
48	Pedestrian	348288 6358211	348912 6358121	Branxton	Quorrobolong	Hillslope (low)
49	Pedestrian	348961 6358049	348501 6358037	Branxton	Quorrobolong	Hillslope (low)
50	Pedestrian	348501 6358037	348487 6357594	Branxton	Quorrobolong	Hillslope (low)
51	Pedestrian	348487 6357594	348959 6357512	Branxton	Quorrobolong	Hillslope (low)
52	Pedestrian	348959 6357512	349006 6358001	Branxton	Quorrobolong	Stream (Order 2)
53	Pedestrian	349006 6358001	348225 6357645	Branxton	Quorrobolong	Hillslope (low)
54	Pedestrian	348225 6357645	348288 6358180	Branxton	Quorrobolong	Hillslope (low)
55	Pedestrian	349099 6358002	349363 6358093	Branxton	Quorrobolong	Hillslope (low)

Table 5.5 - Archaeological Survey Transects (cont)

#	Transect Method	Start (MGA)	End (MGA)	Environmental Context		
				Geology	Soil	Landform
56	Pedestrian	349466 6357907	349218 6357880	Branxton	Quorrobolong	Hillslope (mid)
57	Pedestrian	349298 6357875	349626 6357413	Branxton	Quorrobolong & Aberdare	Hillslope (mid)
58	Pedestrian	349626 6357413	348973 6357524	Branxton	Quorrobolong & Aberdare	Hillslope (low)
59	Pedestrian	349311 6357401	349367 6357787	Branxton	Quorrobolong	Hillslope (mid)
60	Pedestrian	349134 6357484	349218 6357880	Branxton	Quorrobolong	Hillslope (mid)
61	Pedestrian	348973 6357524	349074 6357980	Branxton	Quorrobolong	Hillslope (low)
62	Pedestrian	34916 6358395	349853 6357477	Branxton	Aberdare	Hillslope (upper)
63	Pedestrian	349848 6357482	349651 6357447	Branxton	Quorrobolong	Stream (Order 4)
64	Pedestrian	349715 6357451	349573 6358272	Branxton	Aberdare	Hillslope (mid)
65	Pedestrian	349818 6358216	349839 6357919	Branxton	Aberdare	Stream (Order 2)
66	Pedestrian	350094 6358169	350502 6358153	Branxton	Aberdare	Hillslope (upper)
67	Pedestrian	350116 6358364	350507 6358192	Branxton	Aberdare	Hillslope (upper)
68	Pedestrian	350789 6358016	350796 6357907	Branxton	Aberdare	Hillslope (upper)
69	Pedestrian	350789 6358016	350900 6357891	Branxton	Aberdare	Hillslope (upper)
70	Pedestrian	350098 6358387	350003 6358397	Branxton	Aberdare	Hillslope (upper)
71	Pedestrian	349992 6358326	350095 6358312	Branxton	Aberdare	Hillslope (mid)
72	Pedestrian	350088 6358235	349986 6358234	Branxton	Aberdare	Hillslope (mid)
73	Pedestrian	349983 6358178	350086 6358176	Branxton	Aberdare	Hillslope (low)
74	Pedestrian	349097 6358939	348803 6356030	Alluvium	Quorrobolong	Stream (Order 4)
75	Pedestrian	348803 6356030	349021 6357167	Alluvium & Branxton	Quorrobolong &Aberdare	Hillslope (low) & Stream (Order 4)
76	Pedestrian	349186 6357146	348995 6355981	Branxton	Quorrobolong & Aberdare	Hillslope (mid)
77	Pedestrian	349100 6355959	349268 6357104	Branxton	Quorrobolong & Aberdare	Hillslope (lower)

Table 5.5 - Archaeological Survey Transects (cont)

#	Transect Method	Start (MGA)	End (MGA)	Environmental Context		
				Geology	Soil	Landform
78	Pedestrian	347397 6356722	348012 6356626	Branxton	Quorrobolong	Hillslope (low)
79	Pedestrian	348012 6356626	348051 6356868	Branxton	Quorrobolong	Stream (Order 4)
80	Pedestrian	348033 6356779	347315 6356883	Branxton	Quorrobolong	Hillslope (low)
81	Pedestrian	347244 6357145	347289 6356947	Alluvium	Quorrobolong	floodplain
82	Pedestrian	347289 6356947	348022 6356824	Alluvium	Quorrobolong	floodplain
83	Pedestrian	348022 6356824	348046 63566975	Alluvium	Quorrobolong	floodplain
84	Pedestrian	348046 63566975	347325 6357049	Alluvium	Quorrobolong	Stream (Order 4)
85	Pedestrian	350101 6358429	349976 6358495	Branxton	Aberdare	Hillslope (upper)
86	Pedestrian	347480 6357694	347430 6357336	Branxton & Alluvium	Quorrobolong	Hillslope (lower)
87	Pedestrian	347494 6357509	347387 6357708	Branxton & Alluvium	Quorrobolong	Stream (Order 4)
88	Pedestrian	347387 6357708	347219 6357569	Branxton	Quorrobolong	Hillslope (lower)
89	Pedestrian	347219 6357569	347303 6357426	Alluvium	Quorrobolong	Hillslope (lower)
90	Pedestrian	34706 6357744	348185 6357763	Branxton	Aberdare	Hillslope (lower)

Table 5.6 - Effective Coverage Analysis

Transect	Length (m)	Width (m)	Area (m^2)	General Visibility		Exposures		Total Visibility		Archaeological Sites Recorded
				%	Area (m^2)	%	Area (m^2)	%	Area (m^2)	
1	580	150	87000	5	4350	1.80	1566	6.8	5916	
2	270	120	32400	5	1620	0.80	259.2	5.8	1879.2	
3	230	100	23000	3	690	2.40	552	5.4	1242	
4	240	100	24000	3	720	2.10	504	5.1	1224	
5	360	150	54000	3	1620	4.50	2430	7.5	4050	
6	420	90	37800	4	1512	2.10	793.8	6.1	2305.8	ACM21, ACM22
7	350	70	24500	1	245	0.20	49	1.2	294	
8	230	80	18400	2	368	0.40	73.6	2.4	441.6	
9	230	90	20700	1	207	0.50	103.5	1.5	310.5	
10	150	100	15000	1	150	1.50	225	2.5	375	
11	120	120	14400	4	576	0.50	72	4.5	648	
12	710	80	56800	5	2840	3.00	1704	8	4544	
13	600	80	48000	3	1440	2.00	960	5	2400	ACM23
14	350	70	24500	3	735	1.50	367.5	4.5	1102.5	
15	560	90	50400	1	504	0.40	201.6	1.4	705.6	
16	580	140	81200	1	812	0.50	406	1.5	1218	
17	530	110	58300	1	583	1.50	874.5	2.5	1457.5	
18	320	100	32000	0.5	160	0.20	64	0.7	224	
19	520	90	46800	1	468	1.20	561.6	2.2	1029.6	ACM33
20	350	60	21000	2	420	0.20	42	2.2	462	
21	220	70	15400	1	154	0.20	30.8	1.2	184.8	
22	310	100	31000	1	310	0.40	124	1.4	434	
23	560	20	11200	2	224	0.00	0	2	224	
24	330	50	16500	1	165	1.00	165	2	330	ACM26
25	340	50	17000	1	170	0.50	85	1.5	255	
26	280	150	42000	2	840	1.50	630	3.5	1470	ACM27

Table 5.6 - Effective Coverage Analysis (cont)

Transect	Length (m)	Width (m)	Area (m^2)	General Visibility		Exposures		Total Visibility		Archaeological Sites Recorded
				%	Area (m^2)	%	Area (m^2)	%	Area (m^2)	
27	470	130	61100	10	6110	2.50	1527.5	12.5	7637.5	
28	440	150	66000	3	1980	1.50	990	4.5	2970	
29	440	80	35200	5	1760	2.50	880	7.5	2640	
30	720	80	57600	5	2880	3.50	2016	8.5	4896	
31	670	100	67000	5	3350	0.20	134	5.2	3484	
32	610	130	79300	7.5	5947.5	0.25	198.25	7.75	6145.75	ACM25
33	690	70	48300	7.5	3622.5	0.35	169.05	7.85	3791.55	
34	860	130	111800	10	11180	0.20	223.6	10.2	11403.6	
35	770	140	107800	5	5390	0.45	485.1	5.45	5875.1	
36	1010	180	181800	3	5454	1.50	2727	4.5	8181	ACM30, ACM31
37	1100	150	165000	4	6600	0.10	165	4.1	6765	
38	440	100	44000	1	440	4.50	1980	5.5	2420	ACM32
39	570	180	102600	3	3078	0.10	102.6	3.1	3180.6	
40	550	120	66000	1	660	0.00	0	1	660	
41	1320	220	290400	1.5	4356	0.20	580.8	1.7	4936.8	ACM28
42	570	120	68400	1	684	0.30	205.2	1.3	889.2	
43	640	150	96000	3	2880	0.40	384	3.4	3264	
44	590	15	8850	15	1327.5	5.00	442.5	20	1770	
45	630	15	9450	15	1417.5	50.00	4725	65	6142.5	
46	420	150	63000	1	630	0.10	63	1.1	693	
47	1400	150	210000	1.5	3150	0.20	420	1.7	3570	
48	620	60	37200	2	744	0.10	37.2	2.1	781.2	
49	470	100	47000	4	1880	4.50	2115	8.5	3995	
50	420	200	84000	2	1680	2.20	1848	4.2	3528	
51	460	110	50600	2.5	1265	1.20	607.2	3.7	1872.2	
52	420	130	54600	3	1638	0.40	218.4	3.4	1856.4	

Table 5.6 - Effective Coverage Analysis (cont)

Transect	Length (m)	Width (m)	Area (m^2)	General Visibility		Exposures		Total Visibility		Archaeological Sites Recorded
				%	Area (m^2)	%	Area (m^2)	%	Area (m^2)	
53	790	170	134300	5	6715	0.40	537.2	5.4	7252.2	
54	560	120	67200	2	1344	0.20	134.4	2.2	1478.4	
55	290	150	43500	0	0	0.00	0	0	0	
56	250	90	22500	2	450	0.20	45	2.2	495	
57	560	100	56000	1	560	0.20	112	1.2	672	
58	650	120	78000	1	780	0.10	78	1.1	858	
59	330	100	33000	2	660	0.00	0	2	660	
60	380	120	45600	1	456	0.25	114	1.25	570	
61	480	70	33600	1	336	0.10	33.6	1.1	369.6	
62	920	150	138000	1	1380	0.50	690	1.5	2070	
63	240	80	19200	15	2880	1.50	288	16.5	3168	
64	820	160	131200	2	2624	0.50	656	2.5	3280	
65	500	60	30000	3	900	3.00	900	6	1800	
66	400	80	32000	1	320	0.00	0	1	320	
67	400	50	20000	1	200	0.00	0	1	200	
68	110	80	8800	1	88	0.00	0	1	88	
69	110	50	5500	1	55	0.00	0	1	55	
70	100	70	7000	1	70	0.10	7	1.1	77	
71	100	70	7000	1	70	0.15	10.5	1.15	80.5	
72	100	70	7000	1	70	0.18	12.25	1.175	82.25	
73	100	70	7000	1.5	105	0.10	7	1.6	112	
74	310	50	15500	0.5	77.5	0.20	31	0.7	108.5	
75	1150	100	115000	1	1150	0.10	115	1.1	1265	
76	1150	100	115000	0.5	575	0.10	115	0.6	690	
77	1170	70	81900	2	1638	0.50	409.5	2.5	2047.5	ACM24
78	610	90	54900	1	549	0.10	54.9	1.1	603.9	

Table 5.6 - Effective Coverage Analysis (cont)

Transect	Length (m)	Width (m)	Area (m^2)	General Visibility		Exposures		Total Visibility		Archaeological Sites Recorded
				%	Area (m^2)	%	Area (m^2)	%	Area (m^2)	
79	240	50	12000	1	120	0.35	42	1.35	162	
80	720	90	64800	1	648	0.10	64.8	1.1	712.8	
81	200	50	10000	1	100	0.35	35	1.35	135	
82	740	80	59200	2	1184	0.10	59.2	2.1	1243.2	
83	170	100	17000	3	510	0.20	34	3.2	544	ACM29
84	730	100	73000	3	2190	0.10	73	3.1	2263	
85	100	50	5000	3	150	0.50	25	3.5	175	
86	360	50	18000	2	360	1.50	270	3.5	630	
87	320	120	38400	1	384	1.75	672	2.75	1056	
88	210	20	4200	2	84	3.00	126	5	210	
89	180	90	16200	3	486	4.00	648	7	1134	
90	1150	20	23000	3	690	4.00	920	7	1610	

Effective coverage ranged between 0 per cent in thickly vegetated grasslands to 60 per cent on Cony Creek Lane verge, with the majority of transects (49 of 90) having less than 3 per cent effective coverage (refer to **Table 5.7**). Following analysis of ground surface exposure, effective coverage within survey transects has been calculated as 17.7 hectares, or 3.2 per cent of the total survey area.

Survey inspected all landforms, with 15 transects along streams, 70 transects on hillslopes (24 transects on mid hillslopes, 37 transects on lower hillslopes, 9 transects on upper hillslopes), 2 transects on crests, and 3 transects on flats. The vast majority of transects were pedestrian with only 2 vehicular transects undertaken.

Archaeological sites were found in 10 survey transects. Effective coverage within transects where surface archaeological material was detected ranged between 1.7 per cent and 7.75 per cent, with the majority (6 of 10) having less than 4 per cent effective visibility.

Surface archaeological site distribution is a key factor to the understanding of the Aboriginal heritage values of a location; however, the above results indicate that effective visibility throughout the proposed Stage 3 Modification Area is generally low, meaning that artefact scatters and isolated finds may go undetected throughout all landforms. These results further indicate that archaeological sites are more likely to be found in landforms or areas with higher visibility, such as stream banks and crests, further discussed in **Section 5.7**.

Table 5.7 – Survey Coverage by Landform

Landform	Survey Coverage			Effective Coverage	
	No. Transects	Total Area ha	% Survey Area	Total Area ha	% Survey Area
Stream	10	52.63	11.0	1.6	0.3
Flat	6	48.76	10.2	1.9	0.04
Hillslope (lower)	38	196.3	41.2	8.6	1.8
Hillslope (mid)	25	141.08	29.6	5.1	1.1
Hillslope (upper)	9	31.32	6.6	.05	0.1
Crest	2	6.48	1.4	.01	0.028
Totals	90	476.5	100	17.897	3.75

5.7 Inspection of Known Archaeological Sites

Visits were undertaken with Registered Aboriginal Party representatives to three previously recorded sites on 28 February 2011 prior to the survey of accessible properties in the proposed Stage 3 Modification Area. One site, ACM6 (NPWS# 35-6-1890), is a grinding groove associated with pot holes and an isolated artefact (refer to **Figure 3.3**). ACM6 is the subject of discussions in regards to an offset agreement reached between Austar and the Registered Aboriginal Parties in 2008 (refer to **Section 8.3.1**). The site visit was undertaken to enable Registered Aboriginal Party representatives and the archaeologists to establish its current condition as requested in the Survey Strategy Workshop held on 15 February 2011.

Site ACM1 is located near Austar's Surface Infrastructure Site which was surveyed extensively for the 2008 Aboriginal Cultural Heritage Assessment and approved for development. After some initial difficulties the site area for ACM1 was located and was observed to have suffered from continued erosion from off-road motorcycles and the artefacts found there were no longer visible on the surface.

ACM 18 was located in the course of Due Diligence investigations for seismic lines and borehole locations (refer to **Section 3.4**) and is located between the Surface Infrastructure Site and Quorrobolong Road and consists of a disturbed artefact scatter. The site was located and assessed as not having changed in nature since being located a few months before.

5.8 Additional Archaeological Sites Recorded

The survey of the proposed Stage 3 Modification Area identified 13 previously unrecorded Aboriginal archaeological sites (ACM21 to 33). A further isolated artefact (ACM34) was located near the Surface Infrastructure Site in a disturbed context during the site visit to ACM1 described in **Section 5.7**. **Table 5.8** provides a key summary and **Table 5.9** details the information from each site recorded in 2011 including location, environmental context and site condition at the time of recording. The location of all newly recorded sites is illustrated on **Figure 5.3.**

Table 5.8 – Additional Aboriginal Archaeological Sites Recorded

Site Name	MGA (E)	MGA (N)	Site Type	No. Artefacts
ACM21	347435	6357976	Potential scarred tree	0
ACM22	347378	6357798	Isolated find	1
ACM23	347980	6358385	Isolated find	1
ACM24	349236	6357063	Artefact scatter	12
ACM25	348268	6356671	PAD	0
ACM26	348043	6357097	PAD	0
ACM27	347946	6357608	Isolated find	1
ACM28	349586	6357288	Artefact scatter	12
ACM29	347592	6357052	PAD	0
ACM30	348691	6356172	PAD	0
ACM31	348618	6356407	Isolated find	1
ACM32	349164	6357188	Artefact scatter	6
ACM33	347743	6357385	Artefact scatter	2
ACM34	346517	6359138	Isolated find	1

5.8.1 ACM21 (Potential Scarred Tree)

The site is located to the east of Quorrobolong Road near a junction of first and second order streams of Cony Creek. The site consists of a possible modified tree with a single scar. The tree is located on a dam wall of the easterly creek arm. It is located in the paddock of a private rural property currently used for pasture and poultry farming. The area maintains a southerly aspect with a slope of less than 5 per cent and is surrounded by grasslands and isolated trees. The tree, (originally on the stream bank) has fallen, its roots become completely exposed and its limbs have been lopped. The site boundary is defined by the dam wall; no other artefacts were noted in this context. The site and its immediate environment is considered highly disturbed with low archaeological potential and the potential scarred tree is in poor condition yet is likely to remain in a deteriorating state for many decades. During the survey Registered Aboriginal Party representatives indicated the scarred trees had cultural significance and while this tree had no specific cultural

associations it should be protected from further timber getting until its cultural origin is verified.

5.8.2 ACM22 (Isolated Find)

The site is located to the east of Quorrobolong Road on a junction of first and second order streams of Cony Creek. The site is located near this junction on a dam wall of the easterly (first order) creek. The site is an isolated artefact – a quartzite hammerstone located in disturbed context on a dam wall. The area maintains a southerly aspect with a slope of less than 5 per cent and is surrounded by grasslands and isolated trees. The artefact is located on a very gently inclined lower slope landform. The site area is in a state of active erosion (sheetwash) with 90 per cent visibility in the exposure on the dam wall. The site area has been impacted by past vegetation clearing, dam construction and stock trampling. ACM22 and the surrounding landscape have low archaeological potential.

5.8.3 ACM23 (Artefact Scatter)

ACM 23 is located north of Coney Creek Lane on a midslope and consists of a muller (top grindstone) and hammerstone. The site is in a disturbed context below a dam wall near a second order tributary of Cony Creek. The site is defined by surface artefact distribution (1 m^2) on a 10 m^2 exposure with 5 per cent visibility within the exposure. The site area maintains a southerly aspect with a slope of less than 5 per cent and is surrounded by grasslands and isolated clumps of trees. The site has been impacted by vegetation clearing, dam construction and grazing. The ACM23 site area is in a state of active erosion (sheetwash) and has low archaeological potential.

5.8.4 ACM24 (Artefact Scatter)

ACM 24 is located on a pastoral property to the north of Sandy Creek Road on a low gradient hillslope with a northerly aspect. It is located 130 metres south of a fourth order tributary of Cony Creek. The site consists of 10 mudstone flakes and broken flakes and a silcrete backed artefact and grindstone fragment. The site is in a state of active erosion (sheetwash) and has been impacted by past vegetation clearing, dam construction and grazing. The site boundary is defined by the surface artefact distribution (21 m^2) of the main scatter of flakes and two silcrete artefacts on the opposite side of the dam wall.

The site is in poor condition with the majority of artefacts eroding from an exposure on the dam wall which has 60 per cent visibility. ACM24 has low archaeological potential.

5.8.5 ACM25 (Potential Archaeological Deposit)

ACM25 is located north of Sandy Creek Road on an elevated area (possible terrace) within 40 metres of the main channel of Cony Creek. The site is located 180 metres west of a junction with Sandy Creek. ACM25 is a PAD – suggested for its location with respect to these hydrological features and the presence of palaeo-channels in the vicinity. The possible terrace is at least two and a half metres higher than the surrounding grassland landscape. A range of Aboriginal resource species were present in the site area including water birds, goanna, wallaby, paperbark and casuarina. The ACM25 site area has had limited impact from past vegetation clearing and grazing and is considered to have low to moderate archaeological potential. No archaeological surface material was observed however due to poor ground surface visibility. During the survey Registered Aboriginal Party representatives noted the suitability of this location as a potential camp site in respect to the surrounding aquatic habitat.

5.8.6 ACM26 (Potential Archaeological Deposit)

ACM26 is located south of Coney Creek Lane on an elevated landform (possible terrace) within 200 metres of the main (fifth order) channel of Cony Creek and 430 metres north-west of its junction with Sandy Creek. The possible terrace rises two metres above the surrounding floodplain. The PAD is suggested for its location with respect to these hydrological features and the presence of palaeo-channels in the vicinity. A range of Aboriginal resource species including water birds, goanna, wallaby, paperbark and casuarina are found in this location. The ACM26 site area has had limited impact from past vegetation clearing and grazing and is considered to have low to moderate archaeological potential. No surface archaeological material was observed however due to poor ground surface visibility. During the survey Registered Aboriginal Parties representatives noted the suitability of this location as a potential camp site in respect to the surrounding aquatic habitat.

5.8.7 ACM27 (Isolated Find)

ACM27 is located south of Coney Creek Lane on an access track near a chain of ponds in a (now attenuated) third order tributary of Cony Creek that provides semi-permanent water. ACM27 is an isolated flake made from silcrete in a disturbed context in an area of active erosion (sheetwash) on the track surface. The site area has been impacted by past vegetation clearing, track construction and maintenance and grazing although soil profiles observed in the ponded area nearby indicate that some are relatively undisturbed. ACM27's location near semi-permanent water and within an area of accumulating soils (away from the track) is assessed as an indication that the soils near the chain of ponds have at least low archaeological potential and that a PAD may be located in association with this isolated find. It is possible that the PAD area extends along the watercourse but it assessed as only likely to have limited archaeological potential.

5.8.8 ACM28 (Artefact Scatter)

ACM28 is a disturbed artefact scatter located north of Sandy Creek Road on a waning lower hillslope near terraces on the south side of Cony Creek. Drainage has been modified in the vicinity by the in-fill of smaller channels and the excavation of a new channel at the base of the contoured slope. These activities have remodelled much of the 'A' colluvial and alluvial soils and penetrated basal soils at the bottom of slope. Artefacts are eroding out of 'A' soils below the new channel in what may be a smaller channel and terrace of Cony Creek. There are 12 artefacts, principally mudstone flakes and broken flakes and silcrete broken flakes. The site area has also been impacted by past vegetation clearing and grazing. ACM28 has low archaeological potential due to its highly disturbed nature.

5.8.9 ACM29 (Potential Archaeological Deposit)

ACM29 is located to the east of Quorrobolong Road on a small terrace associated with an in-filled spring/pond located directly to the south of Cony Creek and to the north of permanent springs in the nearby vicinity. The fifth order stream of Cony Creek in this area contains evidence of ponding in the main soil profile of the creek channel indicating reliable water has been accessible at this location in the past. A fourth order stream confluence of Sandy Creek is located less than a hundred metres to the south-east. The terrace is more than a metre higher than the surrounding lower slopes and terraces and is located in a relatively rich Aboriginal resource zone. This area was first noticed during aerial photograph analysis and the circular ring caused by the in-filled spring investigated as a potential bora ring as these had been reported for the valley in historical accounts. There was however no evidence of this having been a cultural feature. ACM29 has low to moderate archaeological potential.

5.8.10 ACM30 (Potential Archaeological Deposit)

ACM30 is located to north of Sandy Creek Road on an elevated landform (possible terrace) within 200 metres of the main (fourth order) channel of Sandy Creek and 680 metres south-east of its junction with Cony Creek. The possible terrace rises two metres above the surrounding floodplain. The PAD is suggested for its location with respect to these hydrological features and the presence of palaeo-channels in the vicinity. A range of Aboriginal resource species including water birds, goanna, wallaby, paperbark and casuarina are found in this location. The identified PAD area has had limited impact from past vegetation clearing and grazing and is considered to have low to moderate archaeological potential. No archaeological material was observed however due to poor ground surface visibility.

5.8.11 ACM31 (Isolated Find)

ACM31 is located to north of Sandy Creek Road on a dam wall located within 200 metres of the main (fourth order) channel of Sandy Creek and 500 metres south of its junction with Cony Creek. The site consists of an isolated artefact (mudstone broken flake) located in a disturbed context on the dam wall. The artefact is located on a very gently inclined lower slope landform with a westerly aspect. The site is in a state of active erosion (sheetwash) with 75 per cent visibility in the exposure on dam wall. The site area has been impacted by dam construction and past vegetation clearing and grazing. ACM31 has low archaeological potential.

5.8.12 ACM32 (Artefact Scatter)

ACM32 is located north of Sandy Creek Road on a terrace near Cony Creek. ACM32 is a disturbed concentration of ex-situ artefacts and small amounts of marine shell that have been brought to the site and deposited in six discrete (1 tonne) piles on the edge of the terrace near a dry channel. The site consists of six artefacts and a small amount of shell. It is not known where these artefacts originated from, however, they are likely to have been deposited during earthworks for flood and erosion control along Cony Creek. For this reason ACM32 has no archaeological potential.

5.8.13 ACM33 (Isolated Find)

ACM33 is located south of Coney Creek Lane on a dam 400 metres north of Cony Creek. ACM33 consists of a disturbed artefact scatter located on the top of the dam wall comprised of two artefacts including two pieces of a silcrete backed artefact and a mudstone flake. ACM33 has low archaeological potential due to high levels of disturbance.

5.8.14 ACM34 (Isolated Find)

ACM34 is located to the west of Quorrobolong near the western perimeter of the Austar Coal Mine Surface Infrastructure Site. The site area has a northerly aspect and low gradient of less than two percent. The isolated find was located near a second order stream of Black Creek. The site is surrounded by spotted gum, ironbark and heavy leaf litter. The artefact is located near the north-west corner of the Surface Infrastructure Site on top of a drainage channel. ACM34 contained a mudstone flake found in a disturbed context in an area previously assessed as having low archaeological potential.

Table 5.9 – Details of Additional Archaeological Sites*

Site #	Site Type	MGA		Artefacts Recorded		Site Area[2], m^2	Geology	Soil	Landform	Distance to Water	Site Condition
		Easting	Northing	#	Type/Material						
ACM 21	Potential scarred tree	347435	6357976	0		10 m^2	Branxton Formation	Aberdare	Hillslope (lower)	0 m (1st order)	Site on dam, disturbed/tree fallen, stock, erosion, vehicle use
ACM 22	Isolated Find	347378	6357798	1	quartzite hammerstone	1 m^2	Branxton Formation	Aberdare	Hillslope (lower)	0 m (1st order)	Site on dam wall, disturbed by excavation, erosion
ACM 23	Artefact scatter	347980	6358385	2	Muller & hammerstone (quartzite?)	1 m^2	Branxton Formation	Aberdare	Hillslope (mid)	170 m (1st order)	Site below dam wall, disturbed by excavation, erosion
ACM 24	Artefact scatter	349236	6357063	12	6 mudstone flakes 4 broken mudstone flakes Silcrete backed artefact Silcrete grinding fragment	21 m^2	Branxton Formation	Quorrobolong & Aberdare	Hillslope (lower)	0 m (2nd order)	Site below dam wall, disturbed by excavation, erosion

[2] The site area for all isolated finds is 1 m^2 based on archaeological distribution. Where the isolated find occurs within an exposure, the exposed area is listed in brackets.
* Sites ACM 18-20 recorded during Due Diligence works in 2010/11

Table 5.9 – Details of Additional Archaeological Sites* (cont)

Site #	Site Type	MGA		Artefacts Recorded		Site Area[3], m^2	Geology	Soil	Landform	Distance to Water	Site Condition
		Easting	Northing	#	Type/Material						
ACM 25	PAD	348268	6356671	na		1600 m^2	Branxton Formation	Quorrobolong	Hillslope (lower)	40 m (5^{th} order)	Site on elevated area (possible terrace) 2.5 m above surrounding landscape in undisturbed context
ACM 26	PAD	348043	6357097	na		400 m^2	Branxton Formation	Quorrobolong	Hillslope (lower)	200 m (5^{th} order)	Site on elevated area (possible terrace) 2.0 m above surrounding landscape in undisturbed context
ACM 27	Isolated Find	347946	6357608	1	1 mudstone flake	1 m^2	Branxton Formation	Quorrobolong	Hillslope (lower)	30 m (3^{rd} order)	Site on track, disturbed by excavation, erosion, vehicle use
ACM 28	Artefact Scatter	349586	6357288	12	9 mudstone flakes 3 silcrete flakes	8 m^2	Branxton Formation	Aberdare	Hillslope (lower)	50 m (4^{th} order)	Site disturbed by earthworks

[3] The site area for all isolated finds is 1 m^2 based on archaeological distribution. Where the isolated find occurs within an exposure, the exposed area is listed in brackets.
* Sites ACM 18-20 recorded during Due Diligence works in 2010/11

Table 5.9 – Details of Additional Archaeological Sites* (cont)

Site #	Site Type	MGA		Artefacts Recorded		Site Area[4], m^2	Geology	Soil	Landform	Distance to Water	Site Condition
		Easting	Northing	#	Type/Material						
ACM 29	PAD	347592	6357052	na	na	3000 m^2	Undifferentiated Alluvium	Quorrobolong	Floodplain	20 m (5^{th} order)	Site on elevated area (possible terrace) 2.0 m above surrounding floodplain in undisturbed context
ACM 30	PAD	348691	6356172	na	na	1250 m^2	Undifferentiated Alluvium	Quorrobolong	Floodplain	110 m (4^{th} order)	Site on elevated area (possible terrace) 2.0 m above surrounding floodplain in undisturbed context
ACM 31	Isolated Find	348618	6356407	1	Mudstone broken flake	1 m^2	Undifferentiated Alluvium	Quorrobolong	Floodplain	150 m (4^{th} order)	Site on dam wall, disturbed by excavation, erosion, grazing
ACM 32	Artefact Scatter	349164	6357188	6	Mudstone flakes	10 m^2	Undifferentiated Alluvium	Quorrobolong	Hillslope (lower)	70 m (4^{th} order)	Artefacts and shell ex situ.
ACM 33	Artefact Scatter	347743	6357385	2	Mudstone flake & silcrete backed artefact	2 m^2	Branxton Formation	Quorrobolong	Hillslope (lower)	210 m (3^{rd} order)	Site on dam wall, disturbed by excavation, erosion, grazing

[4] The site area for all isolated finds is 1 m^2 based on archaeological distribution. Where the isolated find occurs within an exposure, the exposed area is listed in brackets.
* Sites ACM 18-20 recorded during Due Diligence works in 2010/11

Table 5.9 – Details of Additional Archaeological Sites* (cont)

Site #	Site Type	MGA		Artefacts Recorded		Site Area[5], m^2	Geology	Soil	Landform	Distance to Water	Site Condition
		Easting	Northing	#	Type/Material						
ACM 34	Isolated Find	346517	6359138	1	Mudstone flake	1 m^2	Branxton Formation	Branxton Soil Landscape	Hillslope (lower)	60 m (2^{nd} order)	Site located in disturbed context on drainage channel

[5] The site area for all isolated finds is 1 m^2 based on archaeological distribution. Where the isolated find occurs within an exposure, the exposed area is listed in brackets.
* Sites ACM 18-20 recorded during Due Diligence works in 2010/11

5.9 Discussion

The Aboriginal Cultural Heritage and Archaeological Assessment of the proposed Austar Stage 3 Modification Area has involved two separate periods of survey. In 2008 Umwelt prepared an Aboriginal Cultural Heritage Assessment as a component of Austar Coal Mine's Environmental Assessment for the Stage 3 Mine Plan (Umwelt 2008b). The 2008 survey accessed 552 hectares of the proposed Stage 3 Modification Area concentrating on creeklines and ridge crests and as such only 13.5 per cent of this area (76 hectares coverage) was surveyed. During the recent survey for the proposed Stage 3 Modification Area total survey coverage was 476 hectares. Combined the 2008 and 2011 surveys accessed a total of 1028 hectares of the 1210 hectares within the proposed Stage 3 Modification Area (84 per cent). The estimated total *coverage* of the Stage 3 Modification Area by the two surveys is 552 hectares or 45 per cent. due to the limited coverage in 2008.

The following discussion is therefore based on the results of both the 2008 Aboriginal Cultural Heritage Assessment, the Due Diligence surveys in 2010 and 2011 and the 2011 archaeological survey and is presented to develop an understanding of archaeological site patterning within the proposed Stage 3 Modification Area (for site locations refer to **Figure 5.3**). Although sites ACM1, ACM2, ACM7, ACM19 and ACM20 are outside of the proposed Stage 3 Modification Area they are nevertheless included in the following analysis.

5.9.1 Stage 3 Survey Results (Umwelt 2008b)

The Stage 3 archaeological survey in 2008 identified 17 archaeological sites (ACM1 to 17), consisting of seven artefact scatters, nine isolated finds and one grinding groove/isolated find. The majority of these sites (76 per cent) were in a disturbed condition. Most sites were impacted by geomorphic processes and/or human action, such as access track construction and use, tree clearance, the deposition of fill and water erosion. Of the 16 artefact scatters and isolated finds in the Stage 3 Assessment area all had low scientific significance for rarity, representativeness, archaeological integrity, connectedness and complexity on both local and regional levels. Four of these sites were assessed as having moderate archaeological potential. ACM6 (grinding groove/isolated find) was rated as having a high scientific significance for rarity, with low scientific significance for representativeness, archaeological integrity, connectedness and complexity.

5.9.2 Due Diligence Reporting (Umwelt 2010a, 2010b & 2011)

Due diligence reporting for seismic lines and borehole locations identified three other archaeological sites (ACM18 to 20) consisting of two isolated finds and an artefact scatter. Again these sites were located in disturbed contexts. These sites have been assessed as having low archaeological significance on a local and regional level however all of these sites are contained within the Black Creek catchment area which has some small areas close to second and third order creeks assessed as having low to moderate archaeological potential or moderate archaeological potential.

5.9.3 Summary of Results of Archaeological Survey in the Proposed Stage 3 Modification Area

The recent Archaeological survey of the proposed Stage 3 Modification Area identified 13 additional archaeological sites (ACM21 to 33) and a further site (ACM34) near the Austar Coal Mine Surface Infrastructure Site (outside of the proposed Stage 3 Modification Area). The majority of these sites (64 per cent) were in a disturbed condition or contained ex-situ archaeological material. Most sites, in particular artefact scatters and isolated finds, were impacted by geomorphic processes and/or human action, such as access track construction and use, tree clearance, dam construction, the deposition of fill and water erosion.

Table 5.10 presents a summary of the known sites and their condition.

Table 5.10 – Summary of 2008, 2010 and 2011 Survey Results

AHIMS #	Site Name	Site Type	Site Area m^2	Site Condition
37-6-1885	ACM1 (Quorrobolong)	Isolated find	48	disturbed (track)
37-6-1886	ACM2 (Quorrobolong)	Isolated find	40	disturbed (track)
37-6-1887	ACM3 (Quorrobolong)	Isolated find	1	disturbed (easement)
37-6-1888	ACM4 (Quorrobolong)	Isolated find	1	disturbed (easement)
37-6-1889	ACM5 (Quorrobolong)	Isolated find	1	ex situ (alluvial)
37-6-1890	ACM6 (Quorrobolong)	Grinding groove and Isolated find	90	undisturbed groove artefact ex-situ (alluvial)
37-6-1891	ACM7 (Quorrobolong)	Isolated find	1	disturbed (track)
37-6-1892	ACM8 (Quorrobolong)	Artefact scatter	60	disturbed (track)
37-6-1893	ACM9 (Quorrobolong)	Isolated find	1	disturbed (bioturbation)
37-6-1894	ACM10 (Quorrobolong)	Isolated find	28	disturbed (bioturbation)
37-6-1895	ACM11 (Quorrobolong)	Isolated find	1	disturbed (track)
37-6-1896	ACM12 (Quorrobolong)	Artefact scatter	54	disturbed (fill)
37-6-1897	ACM13 (Quorrobolong)	Isolated find	1	disturbed (bioturbation)
37-6-1898	ACM14 (Quorrobolong)	Artefact scatter	7000	disturbed (track & livestock)
37-6-1899	ACM15 (Quorrobolong)	Isolated find	1	disturbed (track & livestock)
37-6-1900	ACM16 (Quorrobolong)	Isolated find	10	disturbed (track)
37-6-1901	ACM17 (Quorrobolong)	Isolated find	1	disturbed (erosion)
n/a	ACM18 (Quorrobolong)	Artefact scatter	28	partially disturbed (track)
n/a	ACM19 (Quorrobolong)	Isolated find	1	disturbed (track)
n/a	ACM20 (Quorrobolong)	Isolated find	1	disturbed (track)
n/a	ACM21 (Quorrobolong)	Potential scarred tree	10	disturbed/fallen
n/a	ACM22 (Quorrobolong)	Isolated find	1	disturbed (dam)
n/a	ACM23 (Quorrobolong)	Artefact scatter	1	disturbed (dam)
n/a	ACM24 (Quorrobolong)	Artefact scatter	21	disturbed (dam)
n/a	ACM25 (Quorrobolong)	PAD	1600	undisturbed
n/a	ACM26 (Quorrobolong)	PAD	400	undisturbed
n/a	ACM27 (Quorrobolong)	Isolated find	1	disturbed (track)
n/a	ACM28 (Quorrobolong)	Artefact scatter	8	disturbed (channel)
n/a	ACM29(Quorrobolong)	PAD	3000	undisturbed soil
n/a	ACM30 (Quorrobolong)	PAD	1250	undisturbed
n/a	ACM31 (Quorrobolong)	Isolated find	1	disturbed (dam)

Table 5.10 – Summary of 2008, 2010 and 2011 Survey Results (cont)

AHIMS #	Site Name	Site Type	Site Area m^2	Site Condition
n/a	ACM32 (Quorrobolong)	Artefact scatter	10	ex situ
n/a	ACM33 (Quorrobolong)	Artefact scatter	2	disturbed (dam)
n/a	ACM34 (Quorrobolong)	Isolated find	1	disturbed (channel)

5.10 Overall Stage 3 Modification Area Survey Results

5.10.1 Artefact Scatters and Isolated Finds

Artefact scatters and isolated finds were recorded at a low density throughout the landscape, with 23 sites identified within the proposed Stage 3 Modification Area in the 1028 hectares inspected during 2008, 2010 and 2011 (or 0.2 sites per hectare). An additional six sites were found in the original Stage 3 area (and outside the proposed Stage 3 Modification Area) that included the Surface Infrastructure Site bringing the total of artefact scatters (13) and Isolated Finds (16) found across the total areas surveyed in the 2008, 2010 and 2011 surveys to 29. Sites were recorded in all landform elements present within the proposed Stage 3 Modification Area, with sites recorded along lower hillslopes (17), stream banks (5), stream beds (2), flats (1), floodplains (1) and crests (1). Sites found associated with hillslopes were found in mid and lower slopes, but not on upper slopes.

Most artefact scatters and isolated finds were recorded no more than 100 metres from a watercourse, with the majority of sites (19 of 29) recorded within 25 metres of a watercourse. Nine sites were in proximity to first order streams, eight sites were in proximity to second order streams, four sites were in proximity to third order streams, and eight sites were in proximity to fourth order streams. Sites are predominantly located in the Branxton Formation geological unit, with two located in Undifferentiated Alluvium and only one of the 29 sites recorded in the Fenestella Shale geological unit. Sites were found in all three of the soil landscapes of the proposed Stage 3 Modification Area, with 11 sites recorded in the Branxton Soil Landscape, 10 in the Aberdare Soil Landscape and eight in the Quorrobolong Soil Landscape.

All sites have been found in areas of erosion or disturbance and some have been impacted by multiple factors including dam and channel construction, vehicular movement and livestock. Ten sites were recorded along graded vehicle access tracks (and one of these atop a culvert), a further six had been disturbed by vehicles on ungraded tracks. Three sites were recorded on an ants' nests, two sites located on creek bank erosion and two located within stream beds. Five sites were associated with dams, two sites recorded on introduced fill, and one site recorded in a crest erosion scour.

Artefacts were also recorded at a low density, with only 92 within the 552.9 hectares inspected during all surveys. The majority of sites (16 of 29) contained only one artefact, with 10 sites containing between two and six artefacts. Only three sites contain more than 4 artefacts – (ACM14, ACM 24 and ACM 28) with the largest containing 24 artefacts (ACM 14).

Artefacts recorded consisted of flakes (48), broken flakes (28), cores (6), flaked pieces (2), backed artefacts (2), hammerstones (2), a muller (1), a retouched flake (1), a flake used as a core (1) and a grindstone fragment (1). Raw materials utilised included mudstone (53), silcrete (26), quartzite (10), chert (2) and quartz (1). Only one artefact recorded had macroscopic evidence of retouch or use wear, and only one artefact retained any cortex, the latter suggesting that the various raw material sources were relatively distant. A significant proportion of the assemblage was broken, with 26.3 per cent consisting of broken flakes.

The above summary identifies the recorded assemblage to have a number of characteristics. A key characteristic is the low density at which sites and artefacts are found, with only 29 sites recorded in approximately 1210 hectares of the proposed Stage 3 Modification Area – meaning one site was recorded for every 7.2 hectares. Low artefact numbers were recorded, with only three find locations containing more than four artefacts. Although constrained by effective ground surface visibility, survey results do suggest a landscape with low site and artefact density, which appears characteristic of the Cessnock area, with previous surveys (discussed in **Section 3.2** and **Appendix C**) generally locating only a small number of sites that contain only a small number of artefacts. Low site and artefact density within the proposed Stage 3 Modification Area suggests that although Aboriginal use of the landscape was widespread there is no evidence it was intensively used.

The artefact assemblage recorded does not enable detailed analysis, with only 92 artefacts recorded within the 29 sites and all of those in disturbed contexts, so few conclusions can be made regarding specific Aboriginal activities at individual sites. However, it can be noted that the small range of artefact types and raw materials present is characteristic of the Hunter Valley, and do not contain unique or rare artefacts types or materials. The high level of breakage evident in the assemblage is considered reflective of the land use history of the area, with the majority of artefacts recorded in disturbed environments such as on access tracks and dam walls, and may also reflect stock movement within this pastoral landscape. The association of sites with disturbed areas further indicates that site condition and integrity is generally low.

5.10.2 Potential Archaeological Deposits

Four PADs were located during the survey of the proposed Stage 3 Modification Area (ACM25, ACM26, ACM29 and ACM30). All are located on possible terraces within one kilometre of the confluence of Sandy and Cony Creeks. All sites were located no more than 250 metres from a watercourse, with two located within 50 metres of a watercourse. The three Cony Creek sites were in proximity to its fifth order stream. The PADs were all located in the Undifferentiated Alluvium geological unit and the Quorrobolong Soil Landscape. All sites were located in areas with minimal erosion or disturbance, yet had been subject to clearing and grazing and were dominated by pasture.

All locations were in areas of negligible gradient suitable for camping with increased potential for biodiversity with access to reliable water. They retained an adequate depth of topsoil (both A1 and A2 of reasonable depth) that would suggest that any artefacts discarded in the area had not been lost to erosion. They are in areas where alluvial deposits have aggraded (especially at ACM29) and where ponding and terracing are indicated.

The PADs are located in areas where creek channels have migrated and the surrounding floodplains are inundated during 1 in 100 year flood events. ACM29 is notable for the presence of an in-filled spring/pond and is located next to a chain of ponds in the fifth order stream of Cony Creek.

5.10.3 Potential Scarred Tree

A single potential scarred tree was located during the assessment of the Stage 3 Modification Area (ACM21). The tree occurred in a lower hillslope context near a confluence of two first order streams of Cony Creek. It occurs within the Branxton Geological Unit and the Aberdare Soil Landscape. The tree has fallen, its roots are completely exposed and tree has been partially cut for firewood. The site and its immediate environment is considered highly disturbed with low archaeological potential and the potential scarred tree is in poor condition yet is likely to remain in a deteriorating state for many decades.

5.10.4 Grinding Groove

One grinding groove site (ACM6) is located east of Quorrobolong Road in the Werakata SCA, within a first order stream bed; an isolated find was also found at this location. The site maintains a northern aspect and is surrounded by heavy vegetation; including, regrowth Eucalypts, paperbarks, ironbarks, spotted gums, grass trees (Xanthorrhoea) and heavy leaf litter.

The grinding groove is positioned on a sandstone conglomerate platform within the stream bed, measuring approximately 15 metres by 6 metres. The grinding groove is 320 millimetres by 35 millimetres in size, and is 8 millimetres deep. The platform also exhibits three circular depressions, which measure (approximately) 20 centimetres in diameter by 7 centimetres deep, 43 centimetres in diameter by 16 centimetres deep and 47 centimetres in diameter by 14 centimetres deep. At the time of survey, it could not be determined whether the depressions had been enlarged or utilised, as each was filled with water and leaf litter. No suitable rocks were identified at the site or in the surrounding landscape that could have been used to cover and retain water in each depression.

From the northern edge of the platform the stream bed level drops vertically approximately two metres and continues in a northerly direction, providing a northerly outlook downstream from the platform. The east and west banks of the stream also drop sharply approximately one to two metres to the stream bed as the stream continues north from the platform. The stream channel south of the platform is no more than two metres wide, and this expands up to three metres to the north of the platform. The hillslopes surrounding the stream are up to 10 per cent in gradient.

The sandstone conglomerate platform has been previously impacted by quarrying, with evidence of a drill mark and blasting on the northern ledge of the site. SCT (2008) identified that the northern end of the rockbar may have originally been an overhang rock shelf approximately 60 centimetres thick and up to four metres longer than present. Further inspection indicates that the overhang was more likely to be approximately 1 metre in length. A lens of mudstone 20 centimetres thick is found immediately beneath the sandstone, and has preferentially eroded to form a slight overhang (which was much larger before blasting). Another sandstone layer underlies the mudstone. SCT (2008) estimate that the quarrying took place at least 30 years ago based on sedimentation of the plunge pool and vegetation regrowth.

The remaining sandstone platform is of moderate integrity being subject to continued erosion from alluvial action, and having a low-angle joint crossing the upper sandstone layer in the southern portion of the rockbar.

During the 2008 survey and the 2011 site visit, the Registered Aboriginal Party representatives identified the high cultural importance of grinding grooves – and therefore this site – to Aboriginal people.

5.11 Assessment of Predictive Model

This section of the report assesses the results of the 2008, 2010 and 2011 archaeological surveys in light of the predictive model presented in **Section 4** to identify key consistencies and differences and therefore refine the current understanding of archaeological site patterning within the proposed Stage 3 Modification Area. **Table 5.11** outlines the original predictive statements and evaluates the survey outcome against the predictive model, with reference to site type occurrence, distribution, content and integrity.

Table 5.11 - Assessment of Predictive Model

	Summary of Predictive Model	Survey Results*	Assessment
Site Type Occurrence	Artefact scatters and isolated finds are predicted to occur in the proposed Stage 3 Modification Area, and to be the dominant site type.	Surveys identified 34 sites, of which 29 were artefact scatters or contained isolated finds.	Survey results conform to predictive model, and archaeology of broader Hunter Valley.
	Scarred trees may occur in all landform contexts retaining mature, native vegetation.	Although little mature native vegetation was observed a potential scarred tree was located	Survey identified local vegetation to be predominantly regrowth, reflecting past clearance. The potential scarred tree was fallen and had been used for firewood. Scarred trees are assessed as possible site types and may be located as fallen timber as well as in areas where mature native vegetation remains.
	Rockshelter sites may occur in the sandstone landscapes of the Stage 3 Area, should there be sufficiently steep slopes.	Survey did not identify any rockshelter sites within the Stage 3 Area.	Survey identified that slopes in the Broken Back Range were not sufficiently steep to create overhangs or shelters; therefore there is no potential for this site type to occur within the proposed Stage 3 Modification Area.
	Grinding groove sites may occur in the sandstone landscapes in the far north of the proposed Stage 3 Modification Area.	Surveys identified 34 sites, one of which (ACM6) contained a single grinding groove.	Survey identified one grinding groove in the Broken Back Range, on a rockbar exposed within a steep gully, demonstrating this site type does occur in this landform context. No sandstone rockbars were identified in the valley landforms, where underlying geology is covered by aggrading soil landscapes, indicating limited potential for this site to occur in these landform contexts.
	Needham (1981) documented one ceremonial site within the Quorrobolong Valley referred to in personal communication with a Mr Reynolds. Further interviews with a Mr Phil Reynolds (the source of information presented by Needham) has indicated that the bora referred to is located 2.6 kilometres to the south-west of the proposed Stage 3 Modification Area in a resource rich habitat near Wallis Creek. Ceremonial grounds are rare site types and unlikely to be located in the proposed Stage 3 Modification Area,	Survey did not identify any ceremonial sites within the proposed Stage 3 Modification Area.	Survey results conform to predictive model, No physical evidence of a ceremonial site was observed within the proposed Stage 3 Modification Area. A circular feature noted on aerial photographs near Cony Creek was observed during survey to be an infilled spring or pond near a terrace assessed as a PAD.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Occurrence	Needham (1981) documented two burials within the Quorrobolong Valley referred to in personal communication with a Mr Reynolds. Further interviews with a Mr Phil Reynolds (the source of information presented by Needham) has indicated the burials and mound referred to is located 2.6 kilometres to the south-west of the study area near Wallis Creek. Burial sites are rare site types and unlikely to be located/to be preserved in the proposed Stage 3 Modification Area,	Survey did not identify any burial sites/potential burial within the proposed Stage 3 Modification Area.	Survey results conform to predictive model, No physical evidence of a burial site was observed within the proposed Stage 3 Modification Area.
	Sandstone sites such as engravings, grinding bowls, stone arrangements, water holes or wells and pot holes were not predicted to occur, as although these site types do occur in sandstone geological areas, they are relatively rare site types and therefore not expected.	Survey did not identify any engravings, grinding bowls, stone arrangements or water holes/wells/pot holes within the proposed Stage 3 Modification Area.	Although no water holes/wells/pot holes were recorded, it is noted that the ACM6 rockbar containing a single groove also contains three circular depressions that may have been utilised as small water holes/pot holes for use during stone implement grinding and/or food processing. At the time of survey, these were obscured by sediment, leaf litter and water and evidence of human enlargement or use could not be identified.
	The former presence of a carved tree to the south of the proposed Stage 3 Modification Area suggests past occurrence of this site type. Carved trees however were not predicted to occur, being highly visible sites that are often removed/destroyed, particularly in areas of extensive clearance.	Survey did not identify any carved trees within the proposed Stage 3 Modification Area.	Survey results conform to predictive model, with survey identifying local vegetation to be predominantly regrowth, reflecting past extensive clearance and no carved trees.
	Ochre and stone quarries were not predicted to occur, as no source of these materials is known within the proposed Stage 3 Modification Area.	Survey did not identify any ochre or stone quarries within the proposed Stage 3 Modification area.	Survey results conform to predictive model, with no sources of raw material suitable for use as ochre or for stone tool manufacture recorded within the proposed Stage 3 Modification Area.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Occurrence (cont)	Fish traps were not predicted to occur, as the watercourses of the area are not key aquatic habitats, and the fabric of fish traps are unlikely to be conserved.	Survey did not identify any fish traps within the proposed Stage 3 Modification Area.	Survey results conform to predictive model, with no evidence of fish traps identified within the proposed Stage 3 Modification Area.
	Post contact sites such as missions, camp sites with knapped glass or massacre sites were not predicted to occur, as these are not indicated by the ethno-historical research in this area.	Survey did not identify any contact sites within the proposed Stage 3 Modification Area.	Survey results conform to predictive model, with no evidence of post contact sites identified within the proposed Stage 3 Modification Area.
Site Type Content	*The following section discusses only the identified site types: artefact scatters, isolated finds and grinding grooves.*		
	The majority of artefact scatters are likely to be small artefact scatters of less than 10 artefacts or isolated finds.	Of the 13 artefact scatters identified, only 3 contain more than 10 artefacts.	Survey results conform to predictive model, reflecting archaeological site patterning of broader Quorrobolong Valley/Cessnock region.
	Surface artefact scatters of more than 50 artefacts are rare, but they could occur along Cony and Sandy Creeks, as these areas are predicted to have had higher levels of use.	Survey did not identify any sites with more than 24 artefacts.	ACM14, ACM24 and ACM28 were recorded along Cony Creek, all with more than 10 artefacts. ACM14 contained the most with 24 artefacts and was the largest surface site observed within the proposed Stage 3 Modification Area.; but even this site contained no more than seven surface artefacts in any one find location.
	Silcrete and indurated mudstone were predicted to dominate the artefact assemblages, reflecting Hunter Valley and Quorrobolong Valley patterning. Other raw materials that may occur include quartz, quartzite, petrified wood, porcellanite, crystalline tuff, chalcedony and volcanics. Some of these materials, such as quartz and quartzite, may be locally sourced from conglomerates within the proposed Stage 3 Modification Area.	Silcrete and mudstone artefacts composed 86.8% of the assemblage. Other materials found included chert, quartz and quartzite.	Survey results generally conform to predictive model. It is noted that range of raw materials was smaller than found elsewhere in broader Quorrobolong Valley/Cessnock region and is reflective of the small size of the assemblages. The sources of the raw materials are unknown but silcrete and indurated mudstone are most likely to have been sourced from the cobble beds of the Hunter River while quartz, quartzite and possibly chert may have been locally sourced from pebbles in the conglomerates.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Content Cont'd	Dominant artefact types are expected to be flakes (including broken flakes), followed by cores and retouched flakes. Evidence of retouch and use wear may be present in a small percentage of the assemblage. Microblade technology will be rarer, and is most likely only to be found in large assemblages.	Survey identified a small assemblage, dominated by flakes and broken flakes, with a small number of cores, mullers, hammerstones and a single grinding fragment. Three retouched flakes were recorded including two backed artefacts	Survey results conform to predictive model, broadly reflecting archaeological site patterning of broader Quorrobolong Valley/Cessnock region... In general the proposed Stage 3 Modification Area contains a small artefact assemblage with artefact variability broadly representative of local sites. A range of artefact types found in the proposed Stage 3 Modification Area are indicative of artefact production (hammerstones) as well as food production including the use of mullers and grindstones.
	Ground artefacts (grindstones and axes) are not common artefact types, and may not be found within the proposed Stage 3 Modification Area (or found in very low frequencies).	Survey identified one grindstone fragment and a muller in separate sites.	Survey results did conform to the predictive model in that only small numbers of ground implements were located. A ground axe was also shown to the field team by a property owner reportedly found on her property north of Cony Creek.
	Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, stone chisels or fire hardened wooden spear points. Axe grinding groove sites in the Sugarloaf Range are often associated with pot holes, which provided water for the axe grinding process.	The 2008 survey identified one site – ACM6 – that contains a single grinding groove. Circular depressions in the rockbar were also recorded.	Containing one groove only, ACM6 is not reflective of the majority of grinding groove sites in the Hunter Valley, which often contain multiple grooves and associated features such as pot holes. ACM6 contains a single groove only, indicating the rockbar was utilised for only one grinding event – considered to reflect the poor quality of the sandstone. Circular depressions on the rockbar may have been utilised as water sources for grinding.
Site Type Distribution	*The following section discusses only the identified site types: PAD's, artefact scatters, isolated finds and grinding grooves*		
	Artefact scatters and isolated finds are predicted to occur in all landform contexts, but with increased frequency within 100 metres of watercourses.	89% (26) of these site types were recorded within 100 m of streams, with 19 of 29 artefact scatters and isolated finds recorded no more than 25 m from streams.	Survey results conform to predictive model, reflecting archaeological site patterning of broader Quorrobolong Valley/Cessnock region. Few sites (3) were located beyond 100 m from a watercourse suggesting lower use of landforms away from streams.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Distribution	Low-gradient landscape areas in association with permanent or semi-permanent water are generally preferred for camp sites, and creek confluences are often the location of sites. Areas such as spur crests and ridge crests that offer broad outlooks may also be used for camp sites. Creeklines or spur crests may provide excellent travel routes between resources.	Of the 21 sites recorded within 25 metres of a stream, 8 were recorded on flats/terraces above creeks and 2 were recorded within stream beds, 6 lower and 5 mid slope. Survey also identified 4 possible terraces with PAD's near confluence of Cony and Sandy Creeks.	Survey results conform to the predictive model, reflecting archaeological site patterning of broader Quorrobolong Valley/Cessnock region. PAD areas are relatively undisturbed and are located in areas with terracing, access to reliable water and increased biodiversity due to vicinity of aquatic habitats.
	Sandy and Cony Creeks are classified as wetland environments, and as such, would have provided increased resource diversity. Artefact scatters not isolated finds are expected to characterise these areas, reflecting increased intensity of Aboriginal use.	8 sites were recorded along Cony Creek: six artefact scatters and two isolated finds. No more than 12 artefacts were found in any one find location. Four PADs were also identified in association with Cony Creek (3) and Sandy Creek (1).	Survey results generally conform to the predictive model, with the largest artefact scatters within the Stage 3 Modification Area found along Cony Creek. However, the surface site/artefact density observed during survey is considered low within the Hunter Valley, and does not appear to indicate intensive Aboriginal use in the past. Before discounting subsurface archaeological potential in the Cony Creek area it should be noted that previous research in the district (Stedinger Associates 1995) has indicated surface distribution and numbers of artefacts may not reflect subsurface artefact numbers. It is assessed that the most likely areas to have higher artefact numbers are the four PADs associated with Cony Creek and Sandy Creek identified during the survey.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Distribution	Artefact scatters and isolated finds are expected to be found in exposed areas resulting from erosion and/or human action, as these areas often provide the only effective visibility within pastoral landscapes characterised by dense grasses.	All 29 sites were found in exposed landscape areas.	Survey results conform to the predictive model, reflecting archaeological site patterning of broader Quorrobolong Valley/Cessnock region. The survey results also evidence the limited visibility within most areas from vegetation cover, particularly dense native and introduced grasses.
	Grinding groove sites were predicted to occur on sandstone ledges that outcrop in or immediately adjacent to creek beds within sandstone geological areas. Further, grinding groove sites were predicted as most likely to occur on steeper landforms, where rockbars would be exposed rather than buried by geomorphic processes. This suggests the most likely location is within the landforms of the Broken Back Range.	Survey identified one grinding groove in ACM6 – located on a rockbar within a stream bed within the Werakata SCA (and Broken Back Range) in the north of the proposed Stage 3 Modification Area.	Survey results conform to the predictive model, with ACM6 found in a first order stream on the southern slopes of the Broken Back Range. At this location, the landform is eroding rather than aggrading and the terrain is moderately inclined; resulting in the exposure of the sandstone rockbar rather than its burial under alluvial sediments.
Site Type Integrity	*The following section only discusses identified site types: PADs, artefact scatters, isolated finds and grinding groove*		
	Artefact scatters and isolated finds within most landforms of the valley lowlands were expected to have low to moderate integrity as a result of vegetation clearance and grazing.	All sites were assessed to be of low or moderate integrity, with all found in areas affected by erosion or human activity.	Survey results conform to the predictive model, with no site considered to have high integrity.
	Artefact scatters and isolated finds within areas subject to past and present cultivation (within the valley lowlands) are expected to be of low integrity, as ploughing will redistribute artefacts both spatially and stratigraphically. Where cultivation is undertaken on terraces and lower slopes (i.e. in soil profiles of some depth), archaeological material may survive with some integrity beneath the plough zone.	Cultivation has been restricted only impacting small areas near Cony Creek, however contouring for erosion control was prevalent on hillsides near Sandy Creek.	No evidence of archaeological material was noted in areas subject to cultivation or contouring. Thus this prediction remains untested.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Integrity	Artefact scatters and isolated finds within areas of localised earthworks or excavation, including residential, pastoral, agricultural and industrial are expected to have very low integrity, and many sites in these areas may have been destroyed.	16 of 29 sites recorded were positioned along access tracks (recreational or for transmission lines). Two sites were located in fill and five had been disturbed by dam construction.	Survey results conform to the predictive model, with all sites recorded along access tracks, easements, dam walls and in fill considered to be of low integrity.
	Artefact scatters and isolated finds associated with ephemeral creeks are unlikely to retain integrity due to erosion and stock trampling.	19 of 29 sites were recorded within 25 metres of a second or third order stream, and of these 8 were located along access tracks, 2 in channel fill, 2 were found on ants' nests, 2 were within the stream bed and 5 were within an erosion area caused by stock.	Survey results generally conform to the predictive model, with sites recorded along ephemeral streams (i.e., all but Cony and Sandy Creeks) being associated with erosion and human or stock action. These sites are considered to be of low integrity.
	Artefact scatters on slopes are expected to have been affected by the downslope movement of soils causing the redistribution of the artefacts down the slope and their remixing and reburial downslope.	Survey identified 17 sites in hillslope contexts.	Survey results generally conform to the predictive model, although variations between hillslope sites do occur between the Broken Back Range and valley lowlands. In the latter, downslope movement of soil and therefore artefacts is minimal due to the low gradient of the landscape. This process is more evident in the Broken Back Range and hillslopes south-east of near Sandy Creek where terrain ranges from moderately to steeply inclined.

Table 5.11 - Assessment of Predictive Model (cont)

	Summary of Predictive Model	Survey Results	Assessment
Site Type Integrity	Sandstone archaeological sites such as grinding grooves were predicted to have high integrity due to their likely location within the Werakata SCA. Grinding groove sites within streams may be subject to ongoing erosion from sediment laden water action. The ACM6 site area was excluded from this prediction as it was known that it had been previously impacted by human action, specifically blasting and quarrying of the northern portion of the rockbar.	ACM6 was the only grinding groove site located	Survey results do not conform to the predictive model, as only the previously recorded ACM6 rockbar was located which was known to have low integrity.

*including results of 2008, 2010 and 2011 surveys of the broader Austar Coal Mine area (ACM 1-34)

In summary, the proposed Stage 3 Modification Area archaeological survey results generally conformed to the predictive model developed for the project, although the following key deviations are noted:

- scarred trees were restricted to a fallen tree with a potential scar due to extensive clearance of mature, native vegetation;

- Cony and Sandy Creeks were identified as wetland environments that may have provided increased resources for Aboriginal use in addition to low gradient flats and terraces along the creek suitable for camping. Consequently, larger artefact scatters were predicted to occur along the creeks, reflecting Aboriginal land use of higher intensity. However, survey identified low site and artefact numbers along the surveyed portion of Cony Creek (nine sites and 63 artefacts), which does not indicate intensive Aboriginal land use. However, as archaeological survey can only identify surface sites, the density of presence of subsurface artefacts (and the density at which they occur) cannot be determined at this time. Four PADs have been located along the higher order streams of Cony and Sandy Creek; and

- grinding groove sites were predicted to be of moderate to high integrity, being predicted to occur within creeklines of the Werakata SCA. However, the known site ACM6 – containing a single grinding groove on a rock bar within a creek line – was identified to be of low integrity as a result of past blasting and quarrying and was therefore excluded from this prediction.

No areas of very high archaeological potential have been identified within the proposed Stage 3 Modification Area although four PADs have been located with low to moderate (ACM25 and ACM26) or moderate (ACM29 and ACM30) archaeological potential. These PADs are defined as landscape areas predicted to have been more intensively or repeatedly utilised by Aboriginal people in the past than surrounding landforms. An example of an area considered to be of very high archaeological potential would be Ellalong Lagoon to the west of the proposed Stage 3 Modification Area, which has the potential to have been a focal point for resource exploitation and therefore occupation.

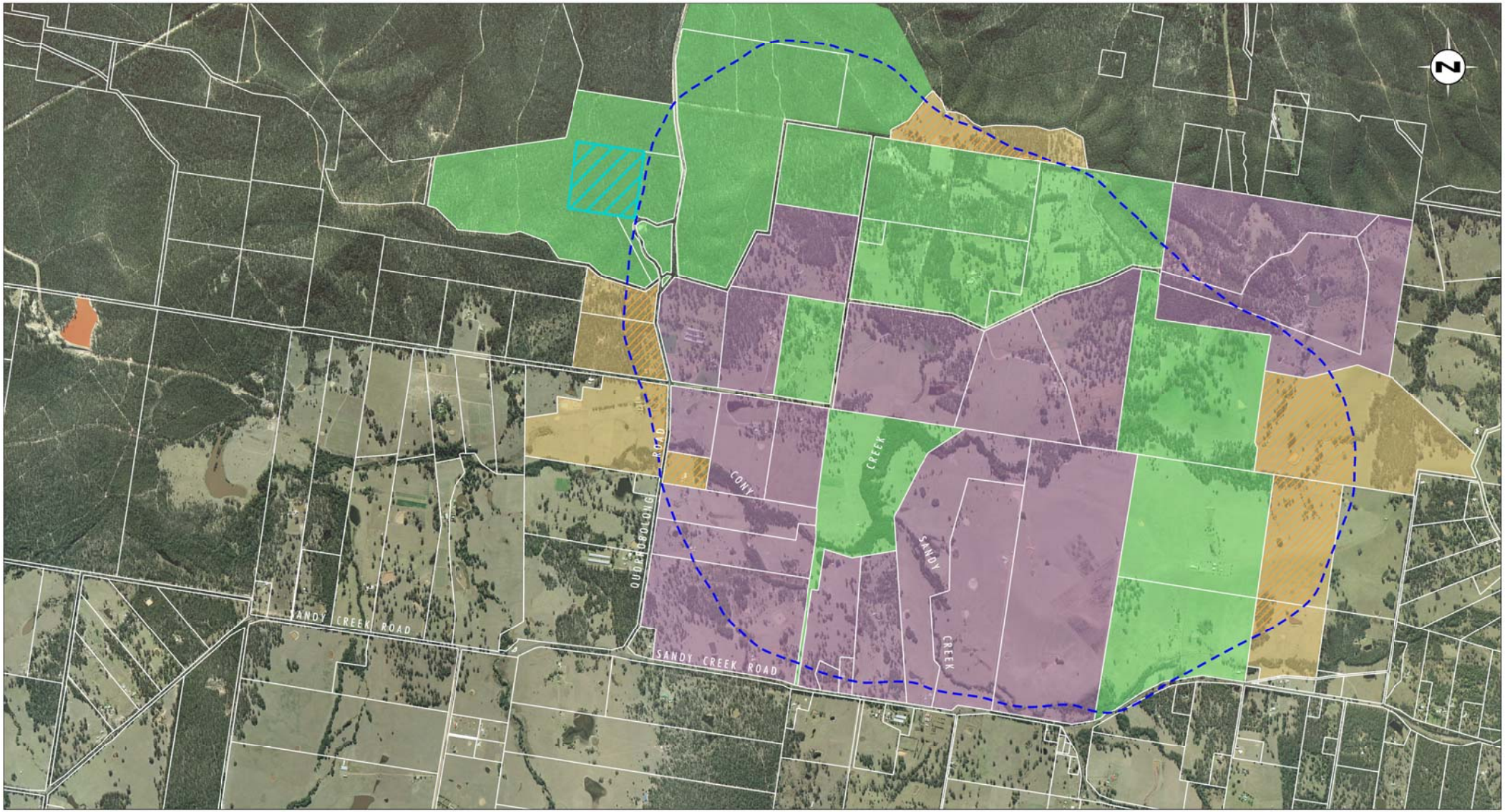
5.9.1 Likely Archaeological Resource of Inaccessible Properties

As identified in **Section 5.2,** survey of the entire proposed Stage 3 Modification Area was not possible at the time of inspection as access was only obtained to Austar owned properties, the Werakata SCA and 20 private properties.

Properties not accessed for archaeological survey in either 2008 or 2011 are illustrated on **Figure 5.4.** In order to develop an understanding of the likely Aboriginal heritage values of these properties, this section reviews their environmental characteristics and discusses the likely Aboriginal archaeological resources of each following consideration of the refined predictive model.

Most of the properties not accessed for survey are situated in the valley lowlands of the proposed Stage 3 Modification Area near Cony Creek. The total area of these properties is 96.38 hectares. The largest combined portion is located amongst low hillslopes and third and fourth order streams of Cony Creek.

Archaeological survey identified that grinding groove sites could occur within the slopes of the Broken Back Range, being sandstone geological areas of sufficient gradient to expose rockbars in or adjacent to streams. Landforms of the valley lowlands within sandstone geological areas were identified to be of gentle gradient, and characterised by aggrading soil landscapes. These areas are therefore unlikely to contain grinding groove sites as



Source: Cadastre: LPI NSW, Aerial Photography: AAM Hatch 2006

Legend

- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Areas not surveyed on Inaccessible Properties
- Approved Surface Infrastructure Site
- Properties Accessed in 2011 Survey
- Properties Accessed in 2008 Survey
- Inaccessible Properties

FIGURE 5.4

Inaccessible Properties and
Properties Surveyed in 2008 and 2011

File Name (A4): R60_V1/2274_975.dgn

geomorphic processes do not function to expose sandstone rockbars that could be utilised for ground edge implement production.

All properties have at least one stream or drainage line, and the majority display the characteristic landforms of the valley, with streams, hillslopes and crests present. Review of relevant literature and archaeological survey results has identified that artefact scatters and isolated finds are found throughout all landforms of the proposed Stage 3 Modification Area, and specifically within 100 metres of watercourses. Given this, it is recognised that artefact scatters and isolated finds may occur in all properties included in the proposed Stage 3 Modification Area, but are most likely to be found in close proximity (within 50 metres) of streams. Sites are predicted to be relatively small, with the majority containing less than 10 surface artefacts. A significant number of sites may be isolated finds.

The primary land use of all properties that were not accessible is pastoral with properties containing discrete areas of localised high disturbance, where archaeological sites with integrity are highly unlikely to be found. Remaining landscape areas will also have been subject to disturbance as a result of tree clearance, cultivation and/or grazing, and consequently, the majority of artefacts throughout the landscape are likely to have been subject to some level of spatial or stratigraphic displacement.

This assessment has identified that the Cony and Sandy Creek corridors are of higher archaeological potential than the surrounding landforms, and are likely to contain a slightly higher site and artefact density than surrounding landforms. Three of the remaining properties not accessed for survey contain sections of Cony Creek. An additional property contains sections of both Cony and Sandy Creeks. These properties therefore contain areas of archaeological potential, being the terraces, flats and lower hillslopes within 50 metres of Cony and Sandy Creeks. Integrity of sites along Cony and Sandy Creeks is predicted to be variable, with higher archaeological integrity expected in landforms above the 100 year flood event boundary, and in those areas not subject to intensive post-contact land use.

Scarred trees are potential site types that may occur in areas where mature, remnant vegetation is present. The majority of properties in the proposed Stage 3 Modification Area have been extensively cleared for pastoral grazing and development, and the potential for scarred or carved trees is consequently low. However, archaeological survey identified that some mature, native vegetation is retained in the private properties of the valley lowlands and one potential scarred tree was located (in poor condition) in the recent survey. It is recognised therefore that vegetation found on the inaccessible properties may include Aboriginal scarred trees.

A carved tree was recorded as being located directly south of the proposed Stage 3 Modification Area, however, it is recognised that this site type is rare and therefore that the inaccessible properties are highly unlikely include Aboriginal carved trees.

6.0 Archaeological Significance Assessment

Archaeological or scientific significance is assessed according to principles outlined originally in Australia in the Burra Charter (1979), which was adapted from the UNESCO sponsored ICOMOS (International Council for Monuments and Sites) Venice Charter. The Burra Charter defines cultural significance as the 'aesthetic, historic, scientific or social value for past, present or future generations' of a place. This section assesses the 34 sites found within the within the proposed Stage 3 Modification Area and within the broader Stage 3 area, located during archaeological surveys in 2008, 2010 and 2011. The reassessment of the previously recorded sites takes into account the additional information from the sites located during the 2011 surveys.

6.1. Assessment Criteria

The archaeological or scientific significance of Aboriginal archaeological sites is primarily assessed according to their value to contribute to the archaeological/scientific understanding of the Aboriginal history of Australia prior to and during the early contact period (their research potential). Six criteria underlie the Aboriginal Cultural Heritage and Archaeological Assessment process, being:

- **rarity:** whether the site (location, type, integrity, contents, and archaeological potential) is common or rare within the local and regional context;
- **representativeness:** whether the site (location, type, integrity, contents, and archaeological potential) is common or uncommon within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region;
- **integrity:** whether the site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from subsurface investigation;
- **connectedness:** whether the site is connected to sites in the local area or the region through chronology, site type, the use of an unusual raw material, knapping technique/reduction strategy, and/or information provided by Aboriginal oral history;
- **complexity:** whether the site exhibits or is predicted to contain either a complex assemblage of stone artefacts in terms of artefact types and/or raw materials, or features such as hearths or heat treatment pits, activity areas; and
- **potential for archaeological deposit:** whether the site has the potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that suggests its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

6.1.1 Rarity

The archaeological significance of a site is assessed as higher if it is perceived as unique or rare within the local area and/or within the region; conversely, the archaeological significance of a site is assessed as lower if it is perceived as common within the local area and/or within the region. Rarity may relate to the type of site, the age of the site, the location of the site in the landscape, the preservation of the site (undisturbed sites are rare), or the nature of the site contents (it may contain artefact types or reduction strategies that are unknown or not well represented in other sites; it may contain raw material types or mixes of raw material

types that are not usually found in sites or are unusually informative of Aboriginal resource use in that area, it may contain hearths or other features rarely preserved in sites).

All 29 **artefact scatters and isolated finds** within the proposed Stage 3 Modification Area and within the broader Stage 3 area, are assessed as having low scientific significance for rarity in the local and regional context, based on the following:

- artefact scatters and isolated finds are the most common site types in the local area, with a search of the AHIMS database in June 2010 identifying 97 artefact scatters and isolated finds out of a total of 117 sites. This reflects regional trends, with artefact scatters and/or isolated finds the most common site types in the Hunter Valley;

- the location of these artefact scatters and/or isolated finds within the landscape is typical of local and regional patterns, with 19 of 29 sites found within 25 metres of watercourses;

- the artefact types and raw materials recorded in these artefact scatters and/or isolated finds reflect local and regional patterns, being dominated by silcrete and indurated mudstone flakes and broken flakes, with lower frequencies of other raw materials and artefact types. No raw materials or artefact types that are considered rare at local or regional levels were identified within the proposed Stage 3 Modification Area; and

- all artefact scatters and/or isolated finds recorded are in landscape areas of low to moderate integrity, with all being recorded in exposures resulting from erosion or human action. This lack of undisturbed sites is typical of open sites at local and regional levels.

ACM6 (**grinding groove**) – is assessed as having moderate archaeological significance for rarity in the local context and moderate archaeological significance in regional context based on the following:

- grinding groove sites are relatively rare in the upper Hunter Valley, as demonstrated by ERM (2002) who identified that only 0.5 per cent of sites registered in the upper Hunter Valley (14 of 2641 registered sites) were grinding groove sites. However, grinding groove sites are more frequent in the lower Hunter Valley, as demonstrated by Umwelt (2003) who identified that 36 per cent of registered sites (along a 5 kilometre wide corridor) between Seahampton and Branxton (55 of 152 registered sites) were grinding grooves. In addition, during 2010 a further 17 grinding groove sites were located within the Sugarloaf Range to the south of the proposed Stage 3 Modification Area (Umwelt 2010). Thus while grinding grooves in the Lower Hunter Valley are not rare – to find so many in one area (the Sugarloaf Range) is rare;

- grinding groove sites are a rare site type within the local Quorrobolong area, with a search of the AHIMS database in June 2010 identifying only three grinding groove sites (including ACM6) amongst the 117 known sites recorded. However, as the landforms of the Broken Back Range to the north and the Watagan Mountains to the south are suitable for grinding groove sites, it is noted that the low numbers of grinding groove sites is likely to reflect the lack of archaeological survey rather than the absence of grinding groove sites;

- grinding groove sites of the Hunter Valley are predominantly located within or immediately adjacent to watercourses, as water is a critical element of the grinding or resharpening process. The location of ACM6 within a creek line therefore reflects common patterns within the region; and

- the ACM6 grinding groove site is not preserved in a manner that would make it rare due to its level of integrity.

ACM21 (**potential scarred tree**), (if verified) is assessed as having high scientific significance for rarity in the local context and moderate archaeological potential in a regional context based on the following:

- scarred trees are a rare site type within the local Quorrobolong area, with a search of the AHIMS database in June 2010 identifying only one amongst 117 archaeological sites recorded in the local region. This site (NPWS #37-6-0114, refer to **Figure 3.2**) was located on the Sandy Creek floodplains directly south of the proposed Stage 3 Modification Area but has since been destroyed;

- scarred trees are relatively rare in the Hunter Valley landscape due to the time since settlement and the significant amount of vegetation clearance that has occurred on valley floors and slopes; and

- the potential scarred tree is of low integrity, having been uprooted and partially cut for firewood. A high percentage of scarred trees in the Hunter Valley are similarly in poor condition.

6.1.2 Representativeness

One of the aims of cultural heritage management is to ensure that a representative sample of sites is preserved for future generations. The objective is to preserve a sample of every type of site in the range of landscapes in which they occur to provide for future research that may have different agendas than those of the contemporary Aboriginal and archaeological community.

All **artefact scatters and isolated finds** within the proposed Stage 3 Modification Area and within the broader Stage 3 area are assessed as having low archaeological significance for representativeness in the local and regional context, based on the following:

- they are common site types, and their distribution reflects local and regional patterns;

- the majority of sites were recorded in disturbed areas, indicating they are of low archaeological integrity and thus low research potential. Sites along Cony Creek may be of higher integrity due to less intensive post-contact land use; and

- similar sites are presently conserved within existing Conservation Areas or Heritage Management Zones in the Hunter Valley, for example, conservation areas at Beltana, Bulga, Mount Arthur, Yorks Creek and Mount Owen. The Werakata SCA adjoining the proposed Stage 3 Modification Area to the north is also expected to contain a range of similar site types, although archaeological survey in the area has been limited and actual sites present are unknown.

ACM6 (**grinding groove**) – is assessed as having moderate archaeological significance for representativeness in the local and regional context, based on the following:

- the site type is moderately rare at local and at regional levels;

- the single groove is not typical of the majority of grinding groove sites in the Hunter Valley which commonly have multiple grooves; and

- a relatively large number of grinding groove sites are presently protected within the Sugarloaf State Conservation Area and within the Watagans National Park. The landscape of the adjoining Werakata SCA also has the potential to contain further grinding groove sites, with large areas of sandstone geology and steeply sloping gullies and watercourses acting to expose sandstone outcrops.

ACM21 (**potential scarred tree**) – (if verified) is assessed as having high archaeological significance for representativeness in the local context and moderate archaeological significance for representativeness in the regional context based on the following:

- it is the only known modified tree within the Quorrobolong Valley that has survived since pre-contact times; and

- modified trees are relatively rare in the Hunter Valley landscape due to the time since settlement and the significant amount of vegetation clearance that has occurred on valley floors and slopes.

6.1.3 Archaeological Integrity

The archaeological integrity or intactness of a site is important when assessing its significance and conservation value. A site that has been subject to minimal disturbance following the deposition of cultural materials contains considerably more information about environmental change and/or cultural sequences than a similar site that has been disturbed by natural process or human actions.

Of the 16 **isolated finds** and 13 **artefact scatters** within the proposed Stage 3 Modification Area and within the broader Stage 3 area, all are assessed as having low scientific significance for archaeological integrity based on:

- ACM1, ACM2, ACM3, ACM4, ACM7, ACM8, ACM11, ACM16, ACM27 were recorded on access tracks, and have therefore been disturbed by construction and maintenance of the tracks (all have been graded), ongoing vehicle use and accelerated erosion from water action;

- ACM12 was also recorded on a track that has been constructed through deposition of fill. It is unclear whether the artefact was imported amongst the fill, or whether it has since washed down onto the track from a higher landform. In either scenario, the recorded site location has limited archaeological integrity;

- ACM22, ACMC23, ACM24, ACM31 and ACM33 were recorded on dam walls, and have therefore been disturbed by the construction of the dam and repeated trampling by stock. On this basis, the recorded sites have no archaeological integrity;

- ACM26 was recorded in amongst fill that had been transported to the location. On this basis, the recorded site has no archaeological integrity;

- ACM28 was recorded on the side of a drainage channel constructed at the base of a ploughed slope. On this basis, the recorded site area has no archaeological integrity;

- ACM 13 was recorded on an ants' nest in close proximity to Black Creek, within Werakata SCA. Although not directly impacted by construction activities, the site has been affected by tree clearance, stock grazing and insect activity. Further, the terrain at this location is relatively steep and the soil highly erodible, indicating that artefacts deposited in this area are likely to be subject to post-depositional movement. These factors indicate low archaeological integrity;

- ACM15 was recorded in a stream bed, with a single artefact washed into the stream from upstream. On this basis, the recorded site area has no archaeological integrity; and

- ACM17 was recorded in an erosion scour within the steep slopes of the Broken Back Range, and is considered to have little archaeological integrity due to the likelihood of post depositional artefact movement in this landform.

Of the 16 **isolated finds** and 13 **artefact scatters** within the proposed Stage 3 Modification Area and within the broader Stage 3 area, three are assessed as having moderate scientific significance for archaeological integrity in a local context and low archaeological significance for integrity in a regional context based on:

- ACM9 and ACM10 were recorded on ants' nests in close proximity to Cony Creek. Although these areas have been subject to disturbance, such as tree clearance, stock grazing and insect activity, the recorded site areas have not been impacted by construction activities. Further, both site areas are gentle in slope and soils are aggrading rather than eroding; suggesting that post-depositional movement may not be significant. On this basis, subsurface deposits associated with these sites may retain archaeological integrity;

- ACM14 is the largest artefact scatter recorded within the Stage 3 survey area, and consists of 24 artefacts recorded in ten discrete find locations. The site is positioned on the high southern terrace adjacent to Cony Creek, which is not subject to flooding. Disturbance to the site has been limited to tree clearance and stock grazing, although one track has been graded across the creek within the designated site area. As with ACM9 and ACM10, the site is gentle in slope and soils are aggrading rather than eroding, suggesting that post-depositional movement may not be significant. On this basis, the site – including subsurface materials that may be found between surface find locations – may retain some spatial integrity; and

- sites of similar levels of integrity are presently conserved within existing Conservation Areas or Heritage Management Zones in the Hunter Valley, for example, conservation areas at Beltana, Bulga, Mount Arthur, Yorks Creek and Mount Owen. The Werakata SCA adjoining the proposed Stage 3 Modification Area to the north is also expected to contain a range of similar site types, although archaeological survey in the area has been limited and actual sites present are unknown.

ACM6 (**grinding groove**) – is assessed as having low archaeological significance for archaeological integrity in the local and regional context, based on the following:

- the site has been directly impacted by quarrying, with the northernmost portion of the rockbar blasted and/or drilled to remove sandstone conglomerate; and

- ongoing erosion of the grinding groove, with the groove positioned within the base of the stream and therefore subject to regular water action. Erosion of the groove is compounded by the poor quality of the rockbar.

ACM21 (**potential scarred tree**) – (if verified) is assessed as having low archaeological significance for archaeological integrity in a local and regional context, based on the following:

- the tree is uprooted, the scar is exposed to weathering and limbs have been removed for firewood. The tree is likely however to remain in this deteriorating state for decades to come.

6.1.4 Connectedness

Connectedness refers to the relationship between sites within an area. Connectedness can be considered in a number of ways, at a number of scales. In its broadest sense,

'connectedness' refers to patterns linking sites within an area. Connectedness is often difficult to ascertain as the chronological sequence of use of surface sites is unknown at this stage of their assessment. Thus connectedness must be related to other features of sites and/or their assemblages. Sites may appear connected due to their location within the landscape (for example a series of sites associated with a terrain unit or landform element) or because of the nature of their assemblages (for example the use of similar raw materials and reduction sequences aimed at producing similar implement types) or the nature of features within the sites (for example heat treatment pits, hearths, knapping floors). In some cases, it may be that a series of sites within an area relates to a number of different activities which are in fact all components of a single land use system (for example a stone quarry, a camp site at which reduction of that stone takes place, a sandstone outcrop on which that stone is ground). As mentioned above, the difficulty with assessing such an aspect of connectedness arises in demonstrating that all of the sites relate to the same period of time. While it is broadly possible to assign some artefacts to limited time periods (backed blades, Bondi points, eloueras, edge ground axes), these time periods still span thousands of years and the artefacts in question generally only represent a minor component of most assemblages and thus their presence cannot be used to make statements about the majority of the artefacts within any assemblage. Thus, the use of 'artefact types' to date surface assemblages remains too broad (e.g. 4000 to 7000 years) to be useful in discussing the operation of a pattern of land use at any given time and to make judgements related to connectedness.

All sites recorded within the proposed Stage 3 Modification Area are assessed as having low archaeological significance for connectedness at both local and regional levels, as no recorded archaeological evidence provides associations between sites on the basis of landform distribution or the nature of assemblages recorded.

6.1.5 Complexity

The complexity of a site is an indication of its ability to contribute information on the local Aboriginal culture. The complexity of a site may be indicated by the number and/or density of stone artefacts it contains, or by the range of raw materials, knapping methods, reduction strategies and/or features that occur within it. Features that may occur within a site include knapping floors, heat treatment pits, hearths or other items that do not fall within the description of a generalised scatter of flaked stone artefacts.

Of the 16 **isolated finds** and 13 **artefact scatters** within the within the proposed Stage 3 Modification Area and within the broader Stage 3 area, are assessed as having low archaeological significance for complexity based on:

- the small number of stone artefacts recorded, with no single site within the proposed Stage 3 Modification Area containing more than 24 artefacts (and no single find location containing more than 12 artefacts). It is noted that additional subsurface artefacts are predicted to occur along Cony and Sandy Creeks, but that large complex assemblages are not likely to occur based on known surface artefacts and local patterning;

- the limited range of artefact types and raw materials present, which provides minimal information on raw material sourcing, knapping methods and reduction techniques. Only three artefacts from the total assemblage displays retouch;

- the absence of any features such as hearths, knapping floors or heat treatment pits; and

- the context of the sites – geomorphic processes and land use history identify that sites are unlikely to have subsurface deposits and therefore have limited potential for subsurface features.

ACM6 (**grinding groove**) – is also assessed as having low archaeological significance for complexity in the local and regional context, based on the single grinding groove, the absence of associated PAD within the surrounding landscape, which is characterised by moderately to steeply inclined slopes and highly dispersible soils.

ACM21 (**potential scarred tree**) – (if verified) is also assessed as having low archaeological significance for complexity in the local and regional context, due to loss of integrity of the local environment and absence of associated archaeological features within the surrounding landscape. The tree furthermore does not retain any evidence of obvious tool marks and the original dimensions of the scar are obscured by regrowth.

6.1.6 Potential for Archaeological Deposit

For a site to be able to contribute to an understanding of cultural sequences, it must contain distinguishable features or aspects that can be shown to have been created at different times within the context of that site or between sites. For such relationships to be possible the artefacts or features within the sites need to be located within a stratified context. It is also possible that a site may contain artefacts in a subsurface context that may not remain in a stratified context, but that may by their investigation add to the knowledge of Aboriginal use of the landscape/resource base in a more general sense.

Of the 16 **isolated finds** and 13 **artefact scatters** within the proposed Stage 3 Modification Area and within the broader Stage 3 area, ACM3-5, ACM8, ACM11-13, ACM15-17, ACM23-24, ACM27-28 28, and ACM31-33 are assessed as having low archaeological significance for potential archaeological deposit based on:

- the disturbed nature of each site area, with all impacted by geomorphic process and/or human action, such as access track construction and use, tree clearance, deposition of fill, and water erosion; and

- the limited potential for subsurface deposits, with the majority of sites situated in areas characterised by sloping land and highly dispersible soils. These landform areas are not conducive to the retention of archaeological deposits, and are unlikely to retain archaeological deposits with spatial and/or stratigraphic integrity.

Of the 16 **isolated find** and 13 **artefact scatter** sites within the proposed Stage 3 Modification Area and within the broader Stage 3 area, three are assessed as having moderate archaeological significance for potential archaeological deposit, being ACM9, ACM10 and ACM14. These sites are found along the Cony Creek alignment, which has been assessed to be of archaeological potential as a result of:

- the predicted Aboriginal use of the Cony Creek area, which is likely to have been higher than surrounding landforms due to the attractive combination of reliable water and flora and fauna resources. More intensive and/or repeated Aboriginal use is likely to be reflected in the archaeological record through higher site and artefact densities. This is reflective of local and regional site patterning, where a higher density of sites has been identified within 50 metres of reliable watercourses; and

- the moderate integrity of the sites, which although impacted by tree clearance, stock movement and insect activity, has not been affected by construction. Further, the Cony Creek terrace is above the 100 year ARI flood event level, indicating that geomorphic processes are less likely to impact spatial and stratigraphic integrity of any remnant archaeological deposits.

The area of archaeological potential associated with ACM14 spans the larger site area, and therefore includes the areas between surface find locations.

Four **Potential Archaeological Deposits (PADs)** were located during the survey of the proposed Stage 3 Modification Area (ACM25, ACM26, ACM29 and ACM30). These PADs are assessed as having moderate archaeological significance for PAD in a local context and low to moderate archaeological significance in a regional context as a result of:

- the PADs being located in elevated positions on possible terraces close to reliable water and are located in an area of increased biodiversity;
- the moderate integrity of the PADs, which although impacted by tree clearance, stock movement and bioturbation, have not been affected by construction;
- the PADs are in areas of negligible slope and soils are aggrading rather than eroding, suggesting that post-depositional movement of artefacts may not be significant; and
- ACM29 PAD area contains an in-filled spring or pond which appears to have been a source of reliable water for quite some time. Geomorphological investigation of this location is likely to assist in answering questions of contemporary palaeo-environmental and archaeological interest and indicate it should be protected for its future research potential.

ACM6 (**grinding groove**) – is assessed as having low archaeological significance for potential archaeological deposit in the local and regional context, based on the limited potential for subsurface deposit, with the site positioned in a stream bed and the surrounding landforms characterised by steep slopes and highly dispersible soils, indicating post-depositional movement is highly likely.

ACM21 (**potential scarred tree**) – (if verified) is assessed as having low archaeological significance for potential archaeological deposit in the local and regional context, based on the disturbed site environment and limited potential for subsurface deposit with integrity.

6.1.7 Ranking of Criteria for Evaluating Archaeological Significance

Past studies within the Hunter Valley have developed a standardised approach to the evaluation of archaeological significance, involving the use of numerical values for each significance criterion so that an overall significance assessment could be quantified. **Table 6.1** outlines the basis for numerical values attributed to each criteria set, which are as follows:

- low significance was afforded a score of 1;
- moderate significance was afforded a score of 2; and
- high significance was afforded a score of 3.

Overall significance was scored as follows:

- low significance 12-15;
- low to moderate significance 16-19;
- moderate significance 20-23;
- moderate to high significance 24-27; and
- high significance 27+.

Table 6.1 – Criteria Used in Evaluating Archaeological Significance

	Low (Score of 1)	**Moderate (Score of 2)**	**High (Score of 3)**
Rarity	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are common within the local and regional context.	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are common within the regional context but not the local context.	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are rare within the local and regional context.
Representativeness	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is common within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local context but common in a regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local and regional context and sites of similar nature (or in better condition) are not already set aside for conservation within the locality or region.
Integrity	Stratigraphic integrity of the site has clearly been destroyed due to major disturbance/loss of topsoil. The level of disturbance is likely to have removed all spatial and chronological information.	The site appears to have been subject to moderate levels of disturbance, however, there is a moderate possibility that useful spatial information can still be obtained from sub-surface investigation of the site, even if it is unlikely that any useful chronological evidence survives.	The site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from sub-surface investigation of the site, even if it is still unlikely that any useful chronological evidence survives. (In cases where both spatial and chronological evidence is likely to survive the site will gain additional significance from high scores for rarity and representativeness).
Connectedness	There is no evidence to suggest that the site is connected to other sites in the local area or the region through: - their chronology (rarely known); - their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction);	There is some evidence to suggest that the site is connected to other sites in the local area or the region through one of the following: - their chronology (rarely known); - their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction);	There is good evidence to support the theory that the site is connected to other sites in the local area or the region through two or more of the following: - their chronology (rarely known); - their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction);

Table 6.1 – Criteria Used in Evaluating Archaeological Significance (cont)

	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Connectedness	- by the use of an unusual raw material, knapping technique/reduction strategy; - similar designs/motifs in the case of art sites and engravings; and/or - information provided by Aboriginal oral history.	- by the use of an unusual raw material, knapping technique/reduction strategy; - similar designs/motifs in the case of art sites and engravings; or - information provided by Aboriginal oral history.	- by the use of an unusual raw material, knapping technique/reduction strategy; - similar designs/motifs in the case of art sites and engravings; and/or - information provided by Aboriginal oral history.
Complexity	The site does not exhibit and is not predicted to contain either of the following in a sub-surface context: - a complex assemblage of stone artefacts in terms of artefact types and/or raw materials (including use of local and imported raw materials) and/or knapping techniques/reduction strategies; and/or - features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain one of the following in a sub-surface context: - a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and/or - features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain both of the following in a sub-surface context: - a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and - features such as hearths or heat treatment pits, activity areas.
PAD	The site does not have or has only a low potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that suggests its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a moderate potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a high potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

Based on the discussion in **Section 6.1.7**, **Table 6.2** lists the numerical values attributed to each archaeological site recorded for each archaeological assessment criterion.

Table 6.2 – Archaeological Significance Assessment

Site Name	Rarity		Represent-ativeness		Archaeological Integrity		Connectedness		Complexity		Potential for Archaeological Deposit		*Overall Archaeological Significance*	
	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Score	*Significance*
ACM1	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM2	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM3	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM4	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM5	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM6	2	2	2	2	1	1	1	1	1	1	1	1	20	*Low to Moderate*
ACM7	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM8	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM9	1	1	1	1	2	2	1	1	1	1	2	2	16	*Low to Moderate*
ACM10	1	1	1	1	2	2	1	1	1	1	2	2	16	*Low to Moderate*
ACM11	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM12	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM13	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM14	1	1	1	1	2	2	1	1	1	1	2	2	16	*Low to Moderate*
ACM15	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM16	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM17	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM18	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM19	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM20	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM21	3	2	3	2	1	1	1	1	1	1	1	1	20	*Low to Moderate*

Table 6.2 - Archaeological Significance Assessment (cont)

Site Name	Rarity		Represent-ativeness		Archaeological Integrity		Connectedness		Complexity		Potential for Archaeological Deposit		*Overall Archaeological Significance*	
	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Local	Regional	Score	*Significance*
ACM22	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM23	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM24	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM25 PAD	na	na	na	na	na	na	na	na	na	na	na	na	na	*Not yet established*
ACM26 PAD	na	na	na	na	na	na	na	na	na	na	na	na	na	*Not yet established*
ACM27	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM28	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM29 PAD	na	na	na	na	na	na	na	na	na	na	na	na	na	*Not yet established*
ACM30 PAD	na	na	na	na	na	na	na	na	na	na	na	na	na	*Not yet established*
ACM31	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM32	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM33	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*
ACM34	1	1	1	1	1	1	1	1	1	1	1	1	12	*Low*

6.2 Summary of Archaeological Significance

This section provides a summary of the archaeological significance of all archaeological sites and PADs identified within the within the proposed Stage 3 Modification Area and within the broader Stage 3 area.

Of the 29 **artefact scatters** and **isolated finds** recorded, 26 sites (ACM1-5, ACM6-8, ACM11-13, ACM15-17, ACM18-20, ACM22-24, ACM27 & 28, ACM31-34) are assessed as having low archaeological significance.

The remaining three **artefact scatters** and **isolated finds** recorded (ACM9-10, ACM14) are assessed as having low to moderate archaeological significance as they deviate from the above sites in two key aspects: archaeological integrity and potential archaeological deposit, both of which have been assessed as moderate at both local and regional levels.

The **grinding groove** site (ACM6) is assessed as having low to moderate archaeological significance.

The **potential scarred tree** (ACM21) is assessed as having low to moderate archaeological significance.

The four **Potential Archaeological Deposits** (ACM25, ACM26, ACM29, and ACM30) did not contain surface archaeological features or artefacts and were identified as PADs. As they have not yet been investigated or their content and integrity established it is not currently possible to determine the archaeological significance.

7.0 Heritage Impact Assessment

This section identifies the potential impact of the Stage 3 Modification proposal on all known Aboriginal heritage sites identified by this assessment, including surface archaeological sites and areas of PAD. The following discussion outlines the potential impact of surface infrastructure and subsidence.

7.1 Identified Impacts

As discussed in **Section 2**, the proposed Stage 3 Modification involves a change to the Stage 3 mine plan only, with no proposed changes to underground mining method, total approved rate or quantity of extraction, or associated surface infrastructure. It is also noted that project mining leases will not change as a result of the proposed Stage 3 Modification. Surface infrastructure will not change from that approved under Project Approval 08_0111.

7.1.1 Exploration Drilling and Minor Infrastructure

It will be necessary for Austar Coal Mine to undertake further exploration drilling within the Stage 3 Modification Area and as described in Umwelt (2008b) there may be a need for additional unspecified minor infrastructure and works within the project mining leases, to be identified throughout the life of the Stage 3 project. As a result, the impact of construction of other unspecified minor infrastructure (if required) within the Stage 3 Modifications Area on Aboriginal archaeological and cultural values cannot be assessed at this time, as the locations of any such works is not yet known. Management outcomes for areas proposed for exploration and minor drilling will be determined in consultation with the Registered Aboriginal Parties and will be included in the ACHMP for review by OEH and DP&I.

7.1.2 Subsidence

As detailed in **Section 2** the approved Stage 3 proposal involved underground mining of thirteen longwalls with coal to be extracted using LTCC technology. The proposed Stage 3 Modification seeks the removal of longwall A6, and extraction of coal in longwalls A7 to A19, which are a reorientation of longwalls A7 to A17. A comparison between the longwall layouts of the Approved Stage 3 and Stage 3 Modification is provided in **Figure 2.2.** The location of the main headings is proposed to be moved to the west and the width of chain pillars is also proposed to be increased to reduce roadway failure risk and in turn subsidence impact risks (refer to **Figure 2.2**).

The normal ground movements resulting from longwall mining are referred to as systematic subsidence movements. These movements are typically described by the parameters of subsidence, tilt and strain, which are defined in the report by MSEC (2011) and are summarised below:

1. **subsidence** refers to both the vertical and horizontal displacement of a point, which is usually expressed in the units of millimetres;

2. **tilt** is the change of the slope of the ground as a result of differential subsidence, and is calculated by dividing the change of subsidence between two points by the distance between those points. Tilt is usually expressed in the units of millimetres per metre; and

3. **strain** is the relative change in horizontal distance between two points on the ground divided by the original distance between those points. Strain is typically expressed in the units of millimetres per metre. Tensile strain occurs where the distance between two

points increases; and compressive strain occurs when the distance between two points decreases.

Non-systematic subsidence includes far-field horizontal movements, irregular subsidence and valley related movements. Valley related movements are a natural phenomenon, resulting from the formation and ongoing development of the valley, which can be accelerated by longwall mining. The parameters typically used to describe valley related movements were defined in the report by MSEC (2011) and are summarised below:

1. **upsidence** is the reduced subsidence, or the net uplift in the base of a valley, which results from the dilation or buckling of near surface strata in the base of a valley resulting from the redistribution of horizontal stresses in the strata around the collapsed zones above extracted longwalls;

2. **closure** is the reduction in horizontal distance between the valley sides, also resulting from redistribution of horizontal stresses in the strata around the collapsed zones above extracted longwalls; and

3. **compressive and tensile strains**, as defined above.

Specialist advice regarding likely subsidence resulting from the proposed Stage 3 Modification and the potential impacts to Aboriginal heritage sites and areas within the proposed Stage 3 Modification Area has been provided by MSEC (2011). This report builds on the work undertaken for the original Stage 3 Project and is documented in MSEC (2008) and SCT (2008). A copy of MSEC (2011) is attached to the Environmental Assessment as Appendix 8. Detailed descriptions of the predicted subsidence parameters and the impact assessments were provided in these reports, and the following sections provide a summary of key findings regarding potential impacts to archaeological sites.

7.1.3 Flooding and Drainage Impacts

In general terms, the principal surface impact resulting from Longwall mining is subsidence, the extent of which is dependent on a number of factors including the depth of the coal seam worked, the design and location of the mine, the topography of the landscape, the nature of the overlying rock stratum, the width of the chain pillars and the ratio of the depth of overburden to the Longwall panel width (NSW Scientific Committee 2005c). Subsidence relating to Longwall mining may result in secondary impacts, which typically impact greatest on riparian areas. Broadly, potential changes to riparian environments that may be expected to occur as a result of Longwall mining include:

- changes to runoff and flow volumes through subsidence induced changes to catchment boundaries;

- changes to bank stability and channel alignment;

- changes to in-channel and out of channel ponding through changes to the bed profile of the creeks which may result in drying or waterlogging of root systems; and

- loss of water to near-surface groundwater flows due to subsidence-induced cracks occurring beneath a stream or other surface water body (valley closure).

Subsidence predictions provided by MSEC (2011) for the Proposed Development were used by Umwelt to model the flood response in the proposed Stage 3 Modification Area. The subsidence predictions included both the most likely subsidence and the maximum subsidence that can be reasonably expected as a result of the proposed mining operations. The use of both the most likely and the predicted maximum subsidence allows for the

incorporation of some of the uncertainty associated with subsidence modelling into the prediction of the flood impact of the Proposed Development. The modelling tool used by MSEC was calibrated using measured subsidence data from the Branxton Formation from previous mining at the Ellalong mine and Longwalls A1 to A3 from Stages 1 and 2 of the Austar Coal Mine.

Due to the geology of the area, the mine layout and the depth of cover to the coal seam (440 to 750 metres) within the Stage 3 Modification Area, the subsidence predicted to occur as a result of the proposed longwall mining is not expected to significantly impact on runoff regimes, bank stability, channel alignment, in-channel and out of channel ponding or groundwater availability. Subsidence predictions indicate that as for the approved Stage 3 Mine development, subsidence will occur reasonably consistently over the breadth of the Stage 3 Modification Area. The proposed changes to the mine plan for Stage 3 are predicted to result in similar, but slightly lower maximum predicted subsidence, tilt and curvature than that approved in Project Approval 08_0111 (MSEC 2011). A reduction in the area of impact (within the 20 mm subsidence contour) is also proposed. As a result the subsidence, flood and drainage predictions are very similar to those documented for the original Stage 3 Mine development (Umwelt 2008d). Consequently, subsidence impacts are not expected to have a significant impact on the archaeological values of the area. In addition, due to the depth of cover and relative predicted uniformity of subsidence over the Stage 3 Modification Area, it is predicted that surface mitigation works along drainage channels will not be required and hence disturbance of these areas is not likely to be necessary. The following points summarise the key findings of the subsidence modelling (MSEC 2011) and flood modelling (Umwelt 2011), relevant to archaeological values:

- subsidence will occur relatively uniformly over the Stage 3 Modification Area;
- analysis indicates that the Proposed Development will not have a significant impact on the flow regime of the Sandy Creek and Cony Creek systems with only minor changes predicted in runoff regimes and peak discharges compared to that previously approved under Project Approval 08_0111;
- the potential for mining to result in stream capture is considered negligible due to the depth of mining below the ground surface and the geology of the area;
- analysis indicates that there will be no changes to channel alignment as a result of subsidence from the Proposed Development;
- drainage line analysis of the predicted subsided landform indicates that all creek systems will remain free draining without mitigation works;
- average in-channel grade of Cony Creek is predicted to remain at approximately 0.4 per cent and Sandy Creek 0.4 per cent to 0.5 per cent, indicating that no significant changes in overall stream power or erosive potential along these reaches is expected;
- there are no areas in which subsidence is predicted to result in a reduction in water flow rates or volumes; and
- the potential to increase erosion on the landform is also expected to be minimal due to the relatively small predicted changes in landform grades combined with the relatively low percentage of exposed soils that exist in the area.

7.2 Potential Impact on Known Archaeological Sites

A total of 28 archaeological sites are located within the predicted 20 millimetre subsidence contour (refer to **Figure 5.3**). MSEC (2011) described the potential subsidence impacts for site types at various locations across all of the landscapes contexts reviewed for this report. In summary, the archaeological sites are located across the proposed Stage 3 Modification Area and are expected, therefore, to experience the full range of predicted systematic subsidence movements. The following sections discuss the potential impact to site types within the proposed Stage 3 Modification Area.

7.2.1 Artefact Scatters and Isolated Finds

This assessment identified that of the 23 artefact scatters and isolated finds in the proposed Stage 3 Modification Area, 20 are of low archaeological significance. ACM9, 10 and 14 were assessed to be of low to moderate archaeological significance. The maximum predicted mine subsidence movements for artefact scatters and isolated finds based on the approved Stage 3 mine plan and the proposed Stage 3 Modification mine plan as assessed by MSEC (2011) are shown in **Table 7.1**.

Table 7.1 – Maximum Predicted Total Conventional Subsidence Parameters for Artefact Scatters and Isolated Finds Resulting from the Extraction of the Stage 3 Longwalls (Source: MSEC 2011)

Layout	Maximum Predicted Total Conventional Subsidence (mm)	Maximum Predicted Total Conventional Tilt (mm/m)	Maximum Predicted Total Conventional Hogging Curvature (1/km)	Maximum Predicted Total Conventional Sagging Curvature (1/km)
Approved Stage 3 Mine Plan	1925	6.7	0.06	0.12
Proposed Stage 3 Modification mine plan	1850	6.5	0.05	0.10

As shown in **Table 7.1** the maximum predicted mine subsidence movements for the proposed Stage 3 Modification mine plan are predicted to be similar to, but slightly less than those predicted based on the approved Stage 3 mine plan for artefact scatters and isolated finds.

Open sites comprising artefact scatters and isolated finds can potentially be affected by cracking in the surface soils as a result of mine subsidence movements. It is unlikely, however, that the artefacts themselves would be impacted by surface cracking.

Surface cracking in soils as a result of systematic subsidence is rarely seen at depths of cover greater than 400 metres, such as at Austar (MSEC 2011:84). Surface cracking in soils as a result of systematic subsidence movements that has been observed in the past at these depths of cover has generally been isolated and of a minor nature.

Fracturing of bedrock due to valley related movements has been observed in the past at these depths of cover, however, if a sufficient depth of soil is present at the open sites, it is unlikely that any significant cracking would be expressed at the surface.

Any surface cracking in the overlying soils within the proposed Stage 3 Modification Area is therefore expected to be isolated and of a minor nature. In some cases, the surface cracking

of soils could be transient, as the tensile phase behind the longwall extraction face, which causes cracks, is generally followed by a compressive phase that partially closes them.

Following review of Stage 3 conditions, MSEC (2011:41) note that in areas where the depth of cover is around 500 metres or greater and where a reasonable thickness of soil exists, any surface cracking that occurs would be expected to be expressed as a number of narrower cracks rather than a single crack. In these instances, it is likely that cracks would be infilled by subsequent soil movement (MSEC 2011:41).

Potential surface cracking and associated underground cracking may impact on the sites containing artefact scatters and isolated finds throughout the proposed Stage 3 Modification Area, however, the artefacts themselves are unlikely to be directly impacted. Impacts are predicted to be similar to, but slightly less than those predicted based on the approved Stage 3 mine plan for artefact scatters and isolated finds. These impacts are considered to be similar to those of existing bioturbation processes already affecting many sites, and therefore not considered to be a significant impact. The infilling of cracks during subsequent soil movement is also likely to limit significant post-depositional movement.

Artefact Scatters (ACM28, ACM32, ACM10, ACM9) are located within 25 metres of Cony Creek (fourth order stream) on the stream bank or on the lower hillslopes. As described in **Section 7.1.2**, the average in-channel grade of Cony Creek and Sandy Creek is expected to remain at 0.4 per cent to 0.5 per cent indicating that no significant changes in overall stream power or erosive potential along these reaches is expected. The potential to increase erosion of the landform in the vicinity of the artefact scatters on Cony Creek is expected to be minimal.

7.2.2 ACM6 Grinding Groove

This 2008 Aboriginal Cultural Heritage Assessment identified that the grinding groove recorded at ACM6 is of high Aboriginal cultural significance and low to moderate archaeological significance.

The maximum predicted mine subsidence movements for ACM6 based on the approved Stage 3 mine plan and the proposed Stage 3 Modification mine plan are shown in **Table 7.2**.

Table 7.2 – Maximum Predicted Total Conventional Subsidence Parameters for ACM6 Grinding Groove Resulting from the Extraction of the Stage 3 Longwalls (Source: MSEC 2011)

Layout	Maximum Predicted Total Conventional Subsidence (mm)	Maximum Predicted Total Conventional Tilt (mm/m)	Maximum Predicted Total Conventional Hogging Curvature (1/km)	Maximum Predicted Total Conventional Sagging Curvature (1/km)	Maximum Predicted Upsidence (mm)	Maximum Predicted Closure (mm)
Approved Stage 3 Mine Plan	1450	3.5	0.03	0.13	115	80
Proposed Stage 3 Modification mine plan	250	1.5	0.02	<0.01	35	40

As shown in **Table 7.2**, the maximum predicted mine subsidence movements at the grinding grove site for the proposed Stage 3 Modification mine plan are much less than those for the approved Stage 3 mine plan.

As described in Umwelt (2008b), an investigation undertaken by SCT (2008) of the potential fracturing of the rock bar upon which ACM6 is located indicated that '…there is likely to be sufficient horizontal compression available to fracture rock as a result of the total predicted subsidence' for the approved Stage 3 mine plan. SCT (2008) further estimated the potential for perceptible fracturing to occur on the surface of the rockbar as a result of mining of the approved Stage 3 mine plan was in the range of 10 to 30 per cent. Natural jointing of the ACM6 rockbar is such that initial fracturing was considered most likely to occur along the projected location of the low angle joint visible on the southern side of the downstream rockbar (SCT 2007).

According to MSEC (2011) and as shown in **Table 7.2**, the assessed level of impact on ACM6 as a result of the proposed Stage 3 Modification mine plan is reduced compared to that for the approved Stage 3 mine plan. However, according to MSEC (2011) the maximum predicted curvatures and the range of potential strains for ACM6 could still be of sufficient magnitude to result in fracturing of the bedrock. Experience in the NSW Coalfields indicates that fracturing of bedrock at depths of cover greater than 400 metres, such as the case within the Stage 3 Modification Area, generally occurs in isolated locations and the likelihood that fracturing would be coincident with the grinding groove sites would be considered to be relatively low.

7.2.3 ACM21 Potential Scarred Tree

The Aboriginal Cultural Heritage and Archaeological Assessment has identified a possible scarred tree (ACM21 – to be verified by an arboriculturalist). ACM21 is assessed as being of low to moderate archaeological significance. As the tree is already in an uprooted and deteriorating state it is not expected that any of the predictions for subsidence will impact upon its current state of preservation. However, the tree is located next to a dam and could be impacted in the unlikely event that subsidence remediation was required in association with the dam.

7.3 Areas of Archaeological Potential

The 2008 assessment (Umwelt 2008b) identified three key areas to be of archaeological potential: the alignment of Cony Creek and surrounding landforms; the alignment of Sandy Creek and surrounding landforms; and the confluence of Sandy and Cony Creeks, particularly the elevated north-east terrace. It is predicted that these areas contain a higher frequency of archaeological sites, and that those sites have a higher frequency of artefacts, than surrounding landforms. These sites may occur as both surface and subsurface deposits.

Archaeological survey of the proposed Stage 3 Modification Area in 2011 (which included areas not able to be accessed in 2008) was able to confirm this prediction by identifying further sites and four PADs. The three PADs were located along the fifth order stream of Cony Creek (ACM 25, ACM26 and ACM29), and the fourth PAD (ACM30) on the fourth order stream of Sandy Creek. All four PADs were located on lower hillslope or terraces and were located near the confluence of the two creeks.

As detailed in **Section 7.1.3**, cracking of surface soils is identified as a key issue that may affect the sites containing artefactual deposits throughout the area, although it is unlikely that the artefacts themselves would be directly harmed. Any surface cracking in the soils is

expected to be minor in nature and reflective of historic ground disturbance in scope and scale. For example, potential cracking of surface soils is likely to occur as several smaller cracks, all of which are likely to be infilled during subsequent soil movement. Although this may result in the downward movement of artefacts, such downward movements are already evident through bioturbation at sites.

Subsidence of the valley floor has the added potential of increasing water velocity during peak flood events. PADs (ACM29 and ACM25) are located on elevated landforms (possible terraces) within 25 metres of the fifth order stream of Cony Creek. Soil profile integrity at these locations appears relatively intact. Based on flood modelling undertaken by Umwelt (2011), for the predicted subsidence case, velocities in the main channel of Cony Creek are expected to be similar to, or slightly less than pre-mining levels. Furthermore, as discussed in **Section 7.1.3**, no significant changes to stream power or erosive potential are predicted. Consequently, the potential to increase erosion of the landform in the vicinity of the PADs on Cony Creek is expected to be minimal.

8.0 Management Context

8.1 Statutory Controls

As noted in **Section 1**, Stage 3 of the Austar Coal Mine was defined as a Major Project under SEPP (Major Projects), in accordance with Clause 5 (1)(a) because it was 'development for the purpose of mining'. Consequently, Part 3A of the EP&A Act applied and the Minister for Planning determined and approved the Project Application. Austar seeks approval to modify its Stage 3 mine plan under section 75W of the EP&A Act. A Minister's consent granted under Part 3A can only be modified by the Minister under section 75W. This Aboriginal Cultural Heritage and Archaeological Assessment will accompany the EA in the development application to the NSW Minister for Planning and has been prepared in accordance with the Director-General's Requirements (DGRs).

As a result of its definition as a Major Project, the provisions of the NPW Act (1974) do not apply, and Section 90 Aboriginal Heritage Impact Permits will not be required for any investigation/salvage works undertaken as part of this project, if the 75W Modification is approved. This does not mean that the level of assessment work required or the way issues are managed changes, it mainly relates to reducing the number of separate approvals and time required to start a project once approved. Prior to granting approval for a project the Department of Planning and Infrastructure (DP&I) will consider Aboriginal cultural heritage issues and consult with the Office of Environment & Heritage (OE&H) regarding the project to ensure that those issues are appropriately considered when a decision is made about whether or not to approve a project. They will also consider what management requirements need to be implemented.

As no Section 90 Aboriginal Heritage Impact Permits are required for this project, Austar will be required to manage cultural heritage issues in accordance with the management recommendations made in an ACHMP and with any approval conditions imposed by the DP&I. This may include conservation outcomes, salvage of artefacts, subsurface works or any other management strategies. This current document was reviewed by the Registered Aboriginal Parties. Recommendations made by Registered Aboriginal Parties during the review process include;

- that any borehole and seismic works that are to be done are to require participation from Registered Aboriginal Parties; and

- that any areas identified of archaeological potential or where sites are potentially going to be destroyed will need an Aboriginal Heritage Impact Permit (AHIP).

No other recommendations or comments were received during the review process.

8.2 Aboriginal Cultural Heritage Management Plan (ACHMP)

Austar will prepare an ACHMP for the modified Stage 3 project, which will outline detailed management strategies for all identified Aboriginal heritage sites and PADs located within the project area. The ACHMP will also incorporate Aboriginal heritage management requirements from previous consents and approvals, to provide Austar Coal Mine with a framework for managing Aboriginal heritage responsibilities. The ACHMP will also clearly identify the responsibilities of all parties involved – Austar, Aboriginal stakeholders, archaeologists – and designate timeframes for required heritage management works. **Appendix D** outlines the requirements for preparation of the ACHMP.

The following sections outlines the principle recommendations for the development and implementation of the ACHMP at Austar Coal Mine. These recommendations include:

- an archaeological site monitoring program on accessible properties;
- the development of impact mitigation strategies for any future surface works;
- an offset strategy for ACM6;
- cultural heritage awareness training for relevant Austar Coal Mine personnel; and
- procedures to be followed in the event of archaeological objects or skeletal material are discovered in the course if future works.

8.2.1 Archaeological Site Monitoring Program

Predictions regarding subsidence impacts to known Aboriginal archaeological sites/PADs have been prepared by MSEC (2011), and have been summarised in **Section 7** of this report. To ensure potential impacts to known sites/PADs are detected and managed appropriately, it is recommended that Aboriginal archaeological sites/PADs on accessible properties are included in a monitoring program.

As part of the ACHMP, baseline records of archaeological sites/PADs on accessible properties should be generated prior to longwall mining by an archaeologist and representatives of the Registered Aboriginal Parties, to document existing content, condition and integrity. This baseline recording will allow changes to content, condition or integrity to be detected.

Monitoring following subsidence should be conducted by an archaeologist and a representatives of the Registered Aboriginal Parties, to detect any changes to existing ground surface and any changes in site/PAD condition or integrity. Advice from Austar will be required to determine the timing of monitoring, to be outlined in the ACHMP.

Should subsidence impacts be detected during the monitoring program, archaeological mitigation works required (if any) will be determined by an archaeologist and the Registered Aboriginal Parties following inspection. **Appendix E** contains a research design and methodology for the proposed Stage 3 Modification project, which outlines procedures for the management of archaeological sites and areas should future works, such as subsidence remediation works, be required.

It is noted that all known sites are on property not owned or managed by Austar, with eight sites recorded within the Werakata SCA and the remaining sites and PADs recorded on privately owned properties. Access to all known archaeological sites/PADs for baseline recording and monitoring is therefore reliant on approval from individual landholders prior to commencement of Stage 3 works and following the cessation of subsidence. Not all landholders allowed access for archaeological survey, consequently, there may be additional unknown archaeological sites that could be impacted by subsidence/subsidence remediation works. These sites are most likely to be small artefact scatters and isolated finds. It is noted that subsidence is unlikely to cause any harm to objects in these sites and that subsidence remediation (if required) poses a greater threat. Thus any areas not previously surveyed that require subsidence remediation should be inspected by an archaeologist and representatives of the Registered Aboriginal Parties. Management of any sites located should be included in the ACHMP.

8.2.2 Mitigation of Future Surface Works

As identified in **Section 7**, exploration drilling and minor surface infrastructure or subsidence remediation works may be required within the proposed Stage 3 Modification Area at future stages of the project. As outlined in **Section 7** however current subsidence predictions indicate that it is unlikely that remediation works in response to surface disturbance will be required above the proposed Stage 3 Modification Area.

- As no assessment of future surface works required (if any) to Aboriginal archaeological sites or PADs can be made at this time, the following procedure is recommended:

    1. if the property was not surveyed as part of this or the previous 2008 assessment (Umwelt 2008b), an archaeologist and Registered Aboriginal Party representative(s) will be required to inspect the works location to identify any potential Aboriginal heritage impacts;

    2. if the property was surveyed as part of this assessment or the previous 2008 assessment (Umwelt 2008b), and no archaeological sites/PADs were identified, no further Aboriginal heritage works will be required (refer to following sections); and

    3. if the property was surveyed as part of this assessment or the previous 2008 assessment (Umwelt 2008b), and an archaeological site/PAD was identified, an archaeologist and Registered Aboriginal Party representative(s) will be required to inspect the works location to identify any potential Aboriginal heritage impacts.

Should potential Aboriginal heritage impacts be identified as a result of future surface works, advice will be provided by the archaeologist and Registered Aboriginal Parties on appropriate management strategies. These strategies will consider the nature of the required works and the significance (both archaeological and cultural) of the identified site/PAD. Examples of likely outcomes include:

- relocation of the proposed surface works to avoid locations of sites/PADs where possible. It is noted that while relocation of surface works may be an option, remediation works for subsidence impacts cannot be relocated;

- archaeological test pitting or salvage should proposed surface works be situated within a site/PAD. In these areas, test pitting may be required to identify the nature and extent of any subsurface deposit and salvage may be required to recover the subsurface deposit; and

- surface artefact collection may be required for known sites with low archaeological potential.

Appendix E contains a research design and methodology for the proposed Stage 3 modified project, which outlines procedures for the management of archaeological sites and PADs should future works be required.

8.2.3 Location of previously unknown Sites or Objects

Should a previously unknown site be located within any part of the proposed Stage 3 Modification Area, an archaeologist and Registered Aboriginal Parties will be informed and the locality inspected to determine its Aboriginal heritage value and appropriate management. The OE&H will be supplied with an AHIMS site card for all new sites located (if any).

8.2.4 Procedure to be followed in the event of the Location of Human Skeletal Material

Should human/possible human skeletal material be uncovered during surface works or by natural erosion processes within any part of the proposed Stage 3 Modification Area, any surface works in that area will cease to allow for forensic assessment and management. If the remains are identified as forensic or non-Aboriginal, the local police are to be notified immediately. If the remains are identified as Aboriginal, the site is to be secured and Austar are to notify the OE&H, an archaeologist and all Aboriginal stakeholders. A physical or forensic anthropologist should be contacted to inspect the remains *in situ*, and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic). This process will allow appropriate management of the location/remains to be determined.

8.2.5 Cultural Heritage Awareness Training

It is recommended that relevant Austar personnel, particularly those working on surface infrastructure, attend a cultural heritage awareness training session, to be provided by Registered Aboriginal Parties and (if requested by Registered Aboriginal Parties) an archaeologist. This should be conducted prior to commencement of Stage 3 longwall mining or further infrastructure development.

8.3 Grinding Groove Offset

As described in Umwelt (2008b), Austar and Aboriginal stakeholders agreed upon an offset strategy for potential impacts from the Stage 3 mining on the grinding groove. This offset was a monetary contribution of $100,000 to an Aboriginal project or program (to be decided by Aboriginal stakeholders). While the predicted subsidence impacts on the grinding groove as a result of the proposed Stage 3 Modification have decreased compared with the Stage 3 mine plan as approved, Austar remains committed to the provision of a monetary contribution as an offset for potential impact to the grinding groove. Austar agreed to make the contribution when all necessary government approvals for the Stage 3 project were obtained. Aboriginal stakeholders have requested that no engineering works be conducted at the grinding groove site (Umwelt 2008b).

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APPENDIX A

Aboriginal Community Consultation Log

Appendix A

Summary of Aboriginal Stakeholder Involvement in the Austar project

Aboriginal Stakeholder Involvement in Archaeological Survey and Assessment

The following Aboriginal stakeholders registered an interest in the Stage 3 project during the 2008 Environmental Assessment, and were involved in archaeological survey undertaken for the Project both in 2008 and the recent 2011 survey: Aboriginal Native Title Consultants; Giwiirr Consultants; Hunter Valley Cultural Consultants; Hunter Valley Cultural Surveying; Lower Hunter Wonnarua Council; Lower Wonnarua Tribal Consultancy Pty Ltd; Mingga Consultants; Culturally Aware; Wonn 1 Consulting; Mindaribba Local Aboriginal Land Council; Upper Hunter Heritage Consultants; Wattaka Wonnarua Cultural Consultants Service; Wonnarua Culture Heritage; Wanaruah Custodians and Yarrawalk. In addition to the above groups, Yinarr Cultural Services submitted an expression of interest late in the project in 2011, attended meetings and was provided the draft of this report for comment.

The primary aim of the Aboriginal Cultural Heritage and Archaeological Assessments were to identify any visible surface archaeological materials or potential archaeological deposits (PADs) within the proposed Stage 3 Area in 2008 and the Stage 3 Modification Area in 2011. Further, the surveys aimed to document sufficient information on identified sites to inform the archaeological significance assessment. This is fundamental in determining appropriate management strategies for archaeological sites in the Stage 3 Modification Area. A survey strategy was developed in a workshop held with Registered Aboriginal Parties (RAP's) at Austar Coal mine on 15 February 2011. This workshop identified a number of priorities for the RAP's including the need to:

- attempt at a 100% survey of Austar Stage 3 Modification Area;
- seek approval from landowners to have all of the RAP's attend each property survey at same time; and
- have the survey be open ended so that maximum coverage would be achieved without time constraints.

The recent 2011 survey was undertaken over six days with all RAP's attending at the same time between 28 February 2011 and 8 March 2011 and ultimately covering 100% of available properties bringing effective survey coverage to 52.5% of the 1210 hectare area of potential surface impact(up from 6% in 2008).

Please refer to the Aboriginal Consultation log for detail regarding community input into this recent survey.

Suggested Management Strategies

As described in Umwelt (2008b), Austar and Aboriginal stakeholders agreed upon an offset strategy for potential impacts from the Stage 3 mining on the grinding groove. This offset was a monetary contribution of $100,000 to an Aboriginal project or program (to be decided by Aboriginal stakeholders). While the predicted subsidence impacts on the grinding groove as a result of the proposed Stage 3 Modification have decreased considerably compared with the Stage 3 mine plan as approved, Austar remains committed to the provision of a monetary contribution as an offset for the grinding groove. Austar agreed to make the

contribution when all necessary government approvals for the Stage 3 project were obtained. Aboriginal stakeholders have requested that no engineering works be conducted at the grinding groove site (Umwelt 2008b).

Other recommendations made by this report (Umwelt 2011) and Umwelt (2008b), as discussed between Umwelt and Registered Aboriginal Parties, include:

- that an Aboriginal Cultural Heritage Management Plan (ACHMP) be prepared for the Austar Coal Mine to outline all Aboriginal heritage management strategies for the project, responsibilities of all parties and the timeframe for required heritage works;

- that no Aboriginal archaeological site be visited, or have remediation works undertaken, without Registered Aboriginal Party representatives in attendance;

- that known sites on accessible properties are included in a monitoring program. This will involve recording each site before and after subsidence to identify any impacts. This will be done by an archaeologist and Registered Aboriginal Party representatives;

- that if any future surface works are needed on properties that have not been previously inspected, or that may affect a known site or area, an archaeologist and Registered Aboriginal Party representatives will inspect the area and provide advice on any Aboriginal heritage works needed;

- that if any artefacts are recovered as a result of future works, they will be stored in a Keeping Place to be provided by Austar Coal Mine within the Stage 3 surface infrastructure site following recording and analysis;

- that Registered Aboriginal Party representatives (and an archaeologist if requested by the Registered Aboriginal Parties) provide relevant Austar personnel with a cultural heritage awareness training session;

- that if any additional sites are found within the Stage 3 Modification Area, these will be inspected by an archaeologist and Registered Aboriginal Party representatives to assess the site and decide on how it should be managed; and

- that if any human or possible human skeletal remains are found during surface works, that works cease immediately to allow for forensic assessment and management.

Please note that specific comments from the Registered Aboriginal Parties can be gleaned from the consultation log that accompanies this document.

Appendix A – Consultation Log

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
2008	ANTC	Margaret Matthews	Please refer to Umwelt (July 2008) Aboriginal Heritage Assessment: Austar Coal Mine Project Stage 3 EA for initiation of consultation process. The groups and individuals listed to the left were identified during this process as per DECC Interim Community Consultation Requirements for Applicants 2004.	
	UHHC	Darryl Matthews, Victor Perry		
	LHWC	Lee-Anne Ball, Tom Miller		
	LWTC	Barry Anderson		
	WCH	Gordon Griffiths		
	Y	Barry French, Scott Franks, Barry McTaggart		
	GC	Michele Stair, Rodney Mathews		
	WWCCS	Des Hickey		
	HVCC	Luke Hickey, John Mathews, Christine Archibold, Colleen Stair		
	CA	Tracey Skene, Justin Govar		
	MLALC	Tom Miller, Steve Talbot		
	W1C	Arthur Fletcher		
	MC	Clifford Matthews		
	HVCS	Luke Hickey, Mark Hickey, Pansy Hickey		
	WC	Barbara Foot		
19/11/10	All RAPs		**Invitation to Project Inception Meeting**	Catherine Pepper
	WC	Barbara Foot	indicated she did not receive letter but would see who was coming	
	ANTC	John and Margaret Matthews	Accepted invitation	
	CA	Tracey Skene	Accepted invitation,	
	MLALC	Steve Talbot	Accepted invitation	
	W1C	Arthur Fletcher	Accepted invitation	
	WCH	Gordon Griffiths	Accepted invitation	
	Yarrawalk	Barry McTaggart	Accepted invitation	
	Yinarr	Kathleen Steward-Kinchela	Accepted invitation. Not officially registered until March 2011	
	MC	Clifford Matthews	Called by phone, not connected. New mobile number provided	

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	LHWC	Tom Miller	Message left	
	HVCS	Luke Hickey. Pansy Hickey.	Mistakenly not invited	
	GC	Rodney Matthews	No answer	
	LWTC	Barry Anderson	No answer	
	UHHC	Darrel Matthews	Message left	
	WWCCS	Des Hickey	Message left	
7/12/10	ANTC	Margaret Matthews	**Aboriginal Stakeholder Project Inception Meeting held at Austar Coal Mine office in Paxton** **Welcome to Country:** (Gordon Griffiths) Austar reintroduces **project**, where they are at and proposed changes: • Approvals process; • Current operations; • Overview; • Mining progress; • Subsidence; • Kitchener infrastructure; • Key approvals aspects; • Approvals and Community: prepare and implement ACHMP and Cultural Awareness training; • Community commitments: $100,000 Aboriginal community project. **Description of Stage 3 Modification** • Proposed modification outcomes; • Reasons behind modification; • Modification approval pathway • Environmental assessment elements; • Subsidence assessment summary.	Andy Roberts Catherine Pepper Peter Jamieson
	UHHC	Darryl Matthews		
	WCH	Gordon Griffiths		
	GC	Michele Stair Rodney Mathews		
	HVCC	John Mathews		
	CA	Justin Govar		
	MLALC	Steve Talbot		
	W1C	Arthur Fletcher		
	MC	Clifford Matthews		
	YCS	Kathleen Steward–Kinchela		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
			EA process (Catherine Pepper) Existing process and archaeological sites Adrian **Subsidence**: assessment outcomes to date. **Aboriginal Cultural Heritage and Archaeology** Catherine – Austar have had a preliminary chat with DoP and they have said Austar to continue to use the ICCRs. Andy Roberts – Shows mapping and what has happened in the past and the process to follow. We will send out the new methodology (have 28 days and a few weeks for Christmas) i.e. end of January to have another meeting. If everyone is satisfied with the methodology then fieldwork suggested timeframe would be around mid-late February. Would be 6 representatives/groups/day. May have access to properties haven't been to yet. 5-6 days. Commenting on assessment would be mid-late April with something to submit leading onto the management plan linked to cultural heritage training. Adrian – There is a meeting this weekend with landowners for **access**. We are trying to get better access, the process will continue. **Field visit** on bus and Adrian shows longwall direction from just off Quorrobolong Road. Gary shows south of track has additional impacts and areas where they want to gain access. **Survey Method Workshop** Gordon Griffiths requested that they have workshops to create methodology (i.e. have input into its drafting). Gordon – I would like to see the groups come up with the methodology rather than writing it up and giving it to the community, and the training programme with the community rather than just giving it to the community. Need to implement workshop, groups don't respond when you just ring around. The general group agrees that the workshop should be done at the Austar office toward the end of January (workshop sometime in January).	

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
7/2/11	MLALC	Steve Talbot	**Survey Strategy Meeting 1** **Time Meeting Open: 10:20am** • In previous minutes it was noted that decisions would be made at this meeting. • Difficulty with lack of stakeholders present and different representation of the same groups (sorry business). • Note in invite to next meeting that final decisions will be made at that meeting to progress project. • Full minutes not included as meeting postponed until 15 February. Austar to contact groups and request involvement. Meeting closed 11.15 am.	Andy Roberts, Catherine Pepper
	WCH	Gordon Griffiths		
	W1C	Arthur Fletcher		
	LHWC	Barry Anderson		
8/2/11			**Contact on 8/2/11 re-rescheduled meeting for 15/2/11**	Gary Mulhearn (Austar)
	ANTC	John Matthews	Fax. Letter. Phone: John Matthews contacted on mobile. His fax does not receive incoming transmissions. Will attend the 15/2 meeting. Clifford Matthews was with him at the time and will also attend. John will also inform the Muswellbrook groups.	
	UHHC	Darrel Matthews	Fax - unsuccessful. Letter. Phone: msg.	
	LHWC	Tom Miller	Fax - unsuccessful. Letter. Phone: no answer.	
	WC	Barbara Foot	Fax - unsuccessful. Letter. Phone: May come if she can arrange a lift with other groups.	
	LWTC	Barry Anderson	Fax - unsuccessful. Letter. Phone: Works at Mount Arthur Coal 60 hrs per week on a contract water cart on drill patterns, cannot attend meetings unless it is wet at MAC. Will remain as a registered Group. GM informed Barry of the proposed modification. Barry provided an apology for the upcoming meeting, but appreciated receiving information and being informed.	
	WCH	Gordon Griffiths	Fax - unsuccessful. Letter. Phone: Will attend.	
	Y	Barry Mc Taggart	Fax. Letter. Phone: Disappointed Barry French did not attend the 7/2 meeting. Will send a representative. Provided an email address, GM sent invitation by email also.	
	GC		Phone: no answer. Mobile disconnected. Email invitation sent requesting confirmation.	
	WWCCS	Des Hickey	Fax. Letter. Phone: msg. Accepted by fax.	
	HVCC	Christine Archibold	Fax. Letter. Phone: msg. Mobile: Fax does not work, provided her email address. Christine will send a representative - John Matthews likely. GM sent invite to email address.	
	CA	Tracey Skene	Fax. Letter. Phone: msg. Phone: Cannot rearrange work commitments. Provided an apology.	

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	MLALC	Steve Talbot	Fax - unsuccessful. Letter. Phone: no answer. Phone: Mindaribba office gave mobile no. Mobile: msg left. Steve returned call - didn't receive letters, hasn't been to the office. He or someone else will attend.	
	W1C	Arthur Fletcher	Fax. Letter. Phone: Cannot attend the 15/2 meeting, but will send a representative. Provided an email address, GM sent invitation by email also.	
	MC	Clifford Mathews	Fax - unsuccessful. Letter. Phone: Will attend.	
	HVCS	Mark Hickey	Were not invited - Umwelt had provided incorrect registered groups list on 18/11/10. Y Mark Hickey. Was not invited but showed up.	
15/2/11	WC	Margaret Matthews	**Survey Strategy Meeting 2** Please refer to meeting minutes 15/2/11 in **Section 2** of this Appendix. Summary. 1. Austar project (update) 2. Aboriginal Cultural Heritage Assessment of Project • (update of 2008 ACHA) • Aboriginal cultural values assessment • Archaeological Assessment 3. Survey Strategy Workshop 4. Where to from here? Main resolutions arrived at during Survey Strategy Workshop • Attempt 100% survey of accessible properties • Seek approval from landowners to have entire group undertaking survey at same time. • Project to begin on 28 February • Project duration is 6 days & open ended	Andy Roberts, Catherine Pepper
	UHHC	Darryl Matthews		
	LHWC	Tom Miller		
	WCH	Gordon Griffiths		
	Y	Barry French		
	WWCCS	Des Hickey		
	HVCC	John Mathews		
	MLALC	Steve Talbot		
	MC	Clifford Matthews		
	HVCS	Mark Hickey		
	YCS	Kathleen Steward –Kinchela (not yet registered)		
18/12			**Letter: Invitation for survey works for Stage 3 Mod.**	Gary Mulhearn (Austar) Andy Roberts
	ANTC	Margaret Matthews	Mobile: spoke to John. They are OK for Monday survey.	
	UHHC	Darryl Matthews, Victor Perry	Mobile: message left	
	LHWC	Lee-Anne Ball, Tom Miller	Mobile: has received letter and will send back completed form by fax.	
	LWTC	Barry Anderson	Mobile: will not be attending survey.	
	WCH	Gordon Griffiths	Mobile: Has received letter and will send back completed form.	

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	Y	Barry French, Scott Franks, Barry McTaggart	Fax received: Danny Franks will attend survey.	
	GC	Michele Stair, Rodney Mathews	Phone: no answer, Mobile: disconnected. Email: invitation sent.	
	WWCCS	Des Hickey	Mobile: has received letter. Will send back form.	
	HVCC	Luke Hickey, John Mathews, Christine Archibold, Colleen Stair	Mobile: hasn't received letter yet. Will look at info when received and get back to us. Email: invitation sent.	
	CA	Tracey Skene, Justin Govar	Mobile: Tracey requested email invitation for field survey. Email: invitation sent.	
	MLALC	Steve Talbot	Phone: Mindaribba Tamara to phone back re insurance docs. Mobile: Steve Talbot will be in office tomorrow to see forms.	
	W1C	Arthur Fletcher	Mobile: short notice for survey works. Will send back form.	
	MC	Clifford Matthews	Mobile: spoke to Cheryl Matthews (wife). Clifford has received our invitation for survey letter, and will respond tomorrow. They are waiting for insurance document to arrive by fax from insurers.	
	HVCS	Luke Hickey, Mark Hickey, Pansy Hickey	Mobile: asked for invitation and new supplier form to be emailed. Email: Invitation and New supplier form sent.	
	WC	Barbara Foot	Mobile: Would love to but can't make it to survey.	
	YCS	Kathleen Steward-Kinchela	Not a registered group. Has been included in consultation program by error in Umwelt registered Group list. Apologies extended, offered opportunity to register. Kathie thought she had already registered, but could not provide details of when. No record held by Umwelt. Not invited for survey works.	
21/2/11	WC	Margaret Matthews.	**Post out survey draft to 15 Registered Aboriginal Parties**	Andy Roberts
	UHHC	Darryl Matthews, Victor Perry		
	LHWC	Lee-Anne Ball, Tom Miller		
	LWTC	Barry Anderson		
	WCH	Gordon Griffiths		
	Y	Barry French, Scott Franks, Barry McTaggart		
	GC	Michele Stair, Rodney Mathews		
	WWCCS	Des Hickey		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	HVCC	Luke Hickey, John Mathews, Christine Archibold, Colleen Stair		
	CA	Tracey Skene, Justin Govar		
	MLALC	Tom Miller, Steve Talbot		
	W1C	Arthur Fletcher		
	MC	Clifford Matthews		
	HVCS	Luke Hickey, Mark Hickey, Pansy Hickey		
	WC	Barbara Foot		
	YCS	Kathleen Steward-Kinchela		
22/2/11	WC	Barbara Foot	Post out survey draft to remaining RAPs	Andy Roberts
22/2/11	YCS	Kathleen Steward-Kinchela	Post out 2008 report and cover letter re registration.	Andy Roberts
28/3/11	W1C	George Sampson	Attended survey of properties 1 & 2	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Clifford Matthews		
	MLALC	Tamika Matthews		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
1/3/11	W1C	Arthur Fletcher	Attended survey of properties 16, 11, 12	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	LHWC	Dean Miller		
	MC	Clifford Matthews		
	MLALC	Tamika Matthews		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
2/3/11	W1C	Arthur Fletcher	Attended survey of properties 5, 7, 10	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Clifford Matthews		
	MLALC	Christine Dever		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
3/3/11	W1C	Arthur Fletcher	Attended survey of properties 14,15,19,8	Andy Roberts/ Kirwan Williams
	LHWC	Dean Miller		
	MLALC	Christine Dever		
	Y	Danny Franks		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	CA	Katrina Cavanagh		
4/3/11	W1C	Arthur Fletcher	Attended survey of properties 17,18,13	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Gay Horton		
	MLALC	Carl McDonald		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
7/3/11	W1C	Arthur Fletcher	Attended survey of properties 9,10,6	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Gay Horton		
	MLALC	Adam Clark		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
8/3/11	W1C	Arthur Fletcher	Attended survey of properties 3,4 &20	Andy Roberts/ Kirwan Williams
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Clifford Matthews		
	MLALC	Adam Clark		
	UHHC	Adam Roberts		
	WCH	Shannon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
9/3/11	W1C	Arthur Fletcher	Attended meeting at Austar. No survey took place. Portion remaining Coney Creek Lane road easement. Meeting concluded 12.30pm.	Andy Roberts
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	John Matthews		
	LHWC	Dean Miller		
	MC	Clifford Matthews		
	MLALC	Steve Talbot		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Gordon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey		
	CA	Katrina Cavanagh		
11/3/11	(all groups)		Letter drafted to groups apologising for field error at ACM1 on 8/3/11.	

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
15/3/11	W1C	Arthur Fletcher	Rang to explain letter was in the mail explaining error made on Tuesday 8 March 2011. Specific comments made by Steven Talbot that it would be reasonable for groups to revisit sites located in 2007/2008. Gordon Griffiths advised it would be suitable to relocate site ACM1 at the earliest opportunity in company with stakeholder representatives. Arthur Fletcher expressed a similar statement to Gordon Griffiths. All other groups contacted expressed thanks for clarification.	Andy Roberts
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	Christine Archibold		
	LHWC	Tom Miller		
	MC	Clifford Matthews		
	MLALC	Steve Talbot		
	Y	Danny Franks		
	UHHC	Adam Roberts		
	WCH	Gordon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey(left message only)		
	CA	Katrina Cavanagh		
	LWTC	Barry Anderson		
	WC	Barbara Foot (not contacted)		
25/3/11	YCS	Kathleen Steward-Kinchela	Kathleen Steward-Kinchela faxed a letter to register an interest in the Stage 3 Modification project.	Andy Roberts
30/3/11	W1C	Arthur Fletcher	Report of survey results including site cards sent for comment and survey map with AHIMS site locations.	Andy Roberts
	ANTC	Margaret Matthews		
	GC	Colleen Stair		
	HVCC	Christine Archibold		
	LHWC	Tom Miller		
	MC	Clifford Matthews		
	MLALC	Steve Talbot		
	Y	Danny Franks		

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	UHHC	Adam Roberts		
	WCH	Gordon Griffiths		
	WWCCS	Mark Hickey		
	HVCS	Luke Hickey(left message only)		
	CA	Katrina Cavanagh		
	LWTC	Barry Anderson		
	WC	Barbara Foot		
3/8/11	ANTC	Margaret and John Matthews.	Message left to contact Umwelt if report not received	Andy Roberts
24/8/2011	UHHC	Darryl Matthews, Victor Perry	Message left if report not received please make contact with Umwelt	Andy Roberts
	LHWC	Lee-Anne Ball, Tom Miller	Phone contact made, has not seen it but will ring if it does not surface	Andy Roberts
	LWTC	Barry Anderson	Yes, report received	Andy Roberts
	WCH	Gordon Griffiths	Yes, report received	Andy Roberts
	Y	Barry French, Scott Franks, Barry MacTaggart	Yes, report received (Barry MacTaggart)	Andy Roberts
	GC	Michele Stair, Rodney Mathews	Message left to contact Umwelt if report not received	Andy Roberts
	WWCCS	Des Hickey	Yes, thinks received but will call if he can't find it	Andy Roberts
	HVCC	John Mathews, Christine Archibold, Colleen Stair	Phone contact made, yes report received	Andy Roberts
	CA	Tracey Skene, Justin Govar	Unsuccessful (dialled out)	Andy Roberts
	MLALC	Steve Talbot	Phone contact made with ST, yes report received	Andy Roberts

Appendix A – Consultation Log

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	W1C	Arthur Fletcher	Message left to contact Umwelt if report not received	Andy Roberts
	MC	Clifford Matthews	All numbers disconnected	Andy Roberts
	HVCS	Joseph Griffiths, Mark Hickey, Luke Hickey	Unsuccessful (dialled out)	Andy Roberts
	WC	Barbara Foot	Not contacted at this time due to reports of illness	Andy Roberts
	ANTC	Margaret and John Matthews	No further comments. Concerned that grinding grove site be protected sufficient to protect without fencing but with signage	Andy Roberts
25/8/11	UHHC	Darryl Matthews, Victor Perry	Message left 24/8	Andy Roberts
	LHWC	Lee-Anne Ball, Tom Miller	Lee-Anne contacted who requested an extension until 25/8/11, which was agreed to	Andy Roberts
	LWTC	Barry Anderson	Barry not contactable by phone (dialled out) email sent 24/8	Andy Roberts
	WCH	Gordon Griffiths	GG 24/8 any borehole and seismic works that are to be done will require participation from RAPs. Any areas identified of archaeological potential or where sites are potentially going to be destroyed will need an AHIP.	Andy Roberts
	Y	Barry French, Scott Franks, Barry MacTaggart	Contacted Barry MacTaggart who indicated Scott was best to talk to. Was given his mobile no, and message left 24/8. Scott made contact and indicated he would be sending an email through to us in regards to extension of time for consultation. Email not received as of 25/8 midday	Andy Roberts
	GC	Michele Stair, Rodney Mathews	Message left and email sent 24/8/11	Andy Roberts
	WWCCS	Des Hickey	Des contacted will send something tonight 24/8	Andy Roberts
	HVCC	John Mathews, Christine Archibold, Colleen Stair	24/8 Christine commented that community was busy with fieldwork and had no comments to make at this time	Andy Roberts
	CA	Tracey Skene, Justin Govar	Unsuccessful (dialled out) on 24/8/11, email sent requesting input. Email same afternoon saying she would send comments in on 25/8/11	Andy Roberts

Appendix A – Consultation Log

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	MLALC	Steve Talbot	Steven not answering, automatic text message sent 24/8	Andy Roberts
	W1C	Arthur Fletcher	Arthur will discuss with family and get back to us tomorrow	Andy Roberts
	MC	Clifford Matthews	Clifford Matthews contacted (his phone has been lost) working with Nic Roche at present. Has no further comments to make.	Andy Roberts
	HVCS	Joseph Griffiths, Mark Hickey, Luke Hickey	Phone turned off email sent 24/8	Andy Roberts
	WC	Barbara Foot	Contact made. She has had trouble reading report due to cataracts.	Andy Roberts
	YCS	Kathleen Steward-Kinchela	Message left 24/8 seeking comment	Andy Roberts
	HVCS	Luke Hickey	Phone contact, sent Executive Summary via email as requested. Luke indicated he would send something through tomorrow (25/8)	Andy Roberts
26/8/11	WWCCS	Des Hickey	Phone contact, Des gave verbal approval over the phone and stated that Wattaka agree to all of the recommendations in the recent Assessment	Andy Roberts
	MLC	Steve Talbott	Message left on mobile, MLALC landline rang out. Tried three times on mobile (not available)	Andy Roberts
	CA	Tracey Skene, Justin Govar	Phone contact; Tracey will send comments by end of day	Andy Roberts
	Y	Scott Franks	Phone contact; Will send email by end of day	Andy Roberts
	HVCS	Luke Hickey	Phone contact; Luke will send info by end of day	Andy Roberts
	W1C	Arthur Fletcher	Phone contact; Arthur is happy with results of assessment and has nothing further to add	Andy Roberts
	GC	Michele Stair, Rodney Mathews	Phone contact made. Rodney has not seen report and would like a copy sent. Emailed pdf version 4.19 pm Friday with request for comments by COB Monday	Andy Roberts
	LHWC	Lee-Anne Ball, Tom Miller	Contacted by Phone. Tom is attempting to get input by Monday 29/8	Andy Roberts

Appendix A – Consultation Log

Date	Stakeholder	Contact	Summary of Consultation	Umwelt Contact
	LWTC	Barry Anderson	Not possible to reach Barry by phone (dialled out)	Andy Roberts
	UHHC	Darryl Matthews, Victor Perry	Unavailable message left	Andy Roberts
	WC	Barbara Foot	Contacted on landline and briefly explained the findings of the Assessment and that we would like to talk with her at some future stage about the management of sites on the Austar Coal Mine. She was happy to continue to be involved.	Andy Roberts
	YCS	Kathleen Steward-Kinchela	Phone call not answered, message left	Andy Roberts
29/8/11	GC	Michele Stair, Rodney Mathews	Unavailable, message left	Catherine Pepper
	HVCS	Luke Hickey	Phone contact; no further comments to make	Andy Roberts

APPENDIX B

Native Title and OEH AHIMS Search Results

(Restricted Document – NOT FOR PUBLIC DISPLAY)

APPENDIX C

Previous Archaeological Research for Cessnock LGA

Appendix C – Previous Archaeological Research in the Cessnock LGA

Review of previous archaeological research in a wider context is critical to the understanding of Aboriginal heritage within the local region, specifically archaeological site patterning. The following sections discuss previous archaeological research within or adjacent to the Austar Coal Mine Stage 3 Modification Area, and then provide a review of archaeological research for the broader Central Lowlands of the Hunter Valley.

Austar, Ellalong and Southland Collieries

Two archaeological assessments have been conducted within or adjacent to the Austar Coal Mine, as listed in **Table 1**.

Table 1 - Previous Archaeological Research

Author	Date	Assessment Type	Assessment Area	Results
Brayshaw	1987	Survey	Southland Colliery	Survey of <100 hectares (ha). Two sites recorded: a small artefact scatter (7 artefacts) and 1 isolated find.
HLA-Envirosciences	1995b	Survey	Ellalong Colliery (Austar Stage 1)	Survey of 16 ha area, within 95 ha surface infrastructure areas. One site recorded: an isolated find.

Both studies were commissioned to identify and manage any Aboriginal heritage constraints affecting mining in the area, with Brayshaw (1987) surveying the Southland Colliery lease area and HLA-Envirosciences (1995) surveying the Ellalong Colliery lease area. Both lease areas extend into the Stage 3 Modification Area, with the Southland Colliery lease area extending into the north-west portion of the Stage 3 Modification Area (including the surface infrastructure location) and the Ellalong Colliery lease extending to the east of Sandy Creek.

The above studies identified three archaeological sites:

- Quorrobolong-1: an artefact scatter located on a spur of Broken Back Range approximately 300 metres north of Quorrobolong Creek. Seven stone artefacts were located in an erosion scour approximately 80 metres by 25 metres. Maximum artefact density was four artefacts per m^2. Artefacts included three mudstone flakes (one with retouch), one silcrete flake, one quartzite flake, one quartzite flaked piece and one silcrete core;

- IF-1: an isolated find located on Pelton Road, along a fire trail within the Werakata State Conservation Area. The find was located 1.6 kilometres to the north of Quorrobolong-1, found on range saddle. The site contained one silcrete core; and

- EL-1: an isolated find located to the north of Paxton. No detailed site information is available for this find. The significance of the site was assessed as low, but it was noted that representatives of Mindaribba Local Aboriginal Land Council considered the site important but not of major significance (1995:11).

A further four studies undertaken by Umwelt and are discussed in detail in Section 3.2.2 of the Stage 3 Modification Archaeological Report. These comprise an Aboriginal heritage

assessment (Umwelt 2008b) and due diligence assessments for 33kV lines, seismic survey lines and exploration boreholes (Umwelt 2010a, 2011b & 2011).

Following review of relevant literature, HLA-Envirosciences (1995:3-4) generated a general predictive model for the Ellalong Colliery, which concluded:

- open camp sites and isolated finds are the only known sites within the region, and are predicted to occur within the Austar Coal Mine area;
- scarred trees could possibly be found within the area provided that post-contact vegetation clearance was not too intensive;
- site density and complexity increases close to water and wetlands, probably due to increased biodiversity. More complex sites could therefore occur within 100 metres of major watercourses and wetlands. Site density and complexity would decrease away from major watercourses and wetlands;
- sites are expected adjacent to Quorrobolong Creek, and artefacts found at these sites may indicate a complex range of functions; and
- away from major streams and wetlands, sites would become less dense and more specialised, evidenced by small stone artefact scatters and isolated finds.

Cessnock LGA

A significant number of archaeological studies have been conducted in the Central Lowlands of the Hunter Valley, and these further our understanding of the age of Aboriginal occupation of the region, and archaeological site patterning and significance throughout the region.

A search of the AHIMS report database in October 2007 using the keywords Quorrobolong, Kitchener, Cessnock, Ellalong, Bellbird and Paxton identified a total of 26 previous archaeological studies. Of these, 18 were conducted in Cessnock, three in Rothbury, two in the Paxton-Bellbird area, one in Bellbird and one in Nulkaba. These studies consist of 21 archaeological surveys, four test excavations and one monitoring program.

Table 2 lists a number of these relevant archaeological studies conducted in the Cessnock LGA.

Table 2 - Previous Archaeological Research, Cessnock LGA

Author	Date	Assessment Type	Assessment Area	Results
Appleton, J	1993	Survey	Paxton to Bellbird via Ellalong	Survey of 8 km cable route. One site recorded: an isolated find.
Besant, Angela	*undated*	Survey	Lot 4 DP 867713, Cessnock	Surveyed an area for proposed residential units. One site recorded: an isolated find, 2 heat shatter (non-artefactual) also noted with artefact.
Besant, Angela	2002a	Survey	Allandale (Lot 156 DP 755252) and Nulkaba (Lot 101 DP 803192)	Surveyed an area outlined for substation infrastructure. One site recorded in Allandale: an isolated find.

Table 2 - Previous Archaeological Research, Cessnock LGA (cont)

Author	Date	Assessment Type	Assessment Area	Results
Besant, Angela	2002b	Survey	Vineyard Grove, Cessnock	Surveyed 17 ha for urban residential subdivision. One site recorded: artefact scatter of 3 silcrete flakes located on a broad ridge.
Brayshaw, Helen	1981	Survey	Cessnock	Surveyed an area for urban expansion. One site recorded: an isolated find (quartzite flake).
Brayshaw, Helen	1982	Survey	Weston	Surveyed an area for residential development. No sites were recorded.
ERM	2003	Excavation	Cessnock	Test excavation for employment zone development. Excavation of 138 m^2 in three areas, each with two transects. Total of 132 artefacts recovered. Six discrete sites defined by results.
Gay, Louise	1999	Survey	George Booth Drive, Cessnock	Survey of small area (0.475 ha) near two bridges. No Aboriginal sites were recorded.
McCardle, Cultural Heritage	2005	Desktop	Ellalong to Millfield	Evaluation of pipeline alignment. Footslopes and valley floors with duplex soils may be archaeologically important – interaction between colluvial and alluvial soils can result in the formation of sealed deposits. Site density predicted to be greatest in undisturbed areas with access to concentrated water resources.
Stedinger Associates	2003	Survey	Mt View Road, Cessnock	Survey of 29 ha for residential development. Eight sites recorded: five artefacts and three isolated finds. Total of 51 artefacts recorded. Test excavation recommended.
Stedinger Associates	2004	Test Excavation	Mt View Road, Cessnock	Testing consisted of grader scrapes and collection of surface artefact finds. Testing identified Mount View 8, a large site. Permit varied to allow open area excavation.
Stedinger Associates	2005	Excavation	Mt View Road, Cessnock	Open area excavation of Mount View 8 site. 3777 artefact fragments (minimum of 2686 artefacts) recovered from 365 squares within 650 m^2. Minimum number artefacts calculated as 2686. Distribution and nature of assemblage indicates artefact manufacture occurring on site. Large number of non-artefactual fragments found (40% of artefact weight), may represent concentrations of heat shattered artefacts.

As identified above, archaeological surveys have dominated previous investigations of the region, with eight of the above 12 listed studies being survey and assessments. The remaining studies consist of three excavations and one desktop study. Assessment areas have generally been small, with only one of eight surveys evaluating an area greater than 20 ha. Surveys have generally identified a small number of sites, with five of the eight identifying only one site and two identifying no sites. The remaining survey identified eight

sites within a 29 ha survey area. Recorded sites have generally contained low artefact numbers, with the majority containing no more than three artefacts.

Larger, more complex sites have been infrequently found in the Cessnock LGA, and those found have been identified by excavations at Cessnock by ERM (2003) and Stedinger Associates (2004, 2005). The largest excavation in the region was conducted by Stedinger Associates (2005) on lower hillslopes near 3rd and 4th order streams of Black Creek at Mount View Road in Cessnock, in advance of a residential development. The project involved archaeological survey in 2003, subsurface testing (grader scrape monitoring) in 2004, and open area excavation in 2005 of Mount View 8, a site identified by the 2004 testing program. Open area excavation consisted of excavation of 365 squares within the site area (650 m^2). Of these, 270 test pits contained artefacts and a total of 3777 artefactual pieces were recovered. Artefacts recovered per square metre were highly variable, with artefact weights ranging from 0.1 g to 262.2 g per square metre.

Of the recovered artefacts, 3302 were flakes, 265 were retouched flakes, 92 were cores, and 118 were flaked pieces. Raw materials utilised included silcrete (3152), fine grained siliceous (468), chert (66), volcanic (41), quartzite (25), quartz (19), petrified wood (5), and unidentifiable (1). In addition, three hammerstones were collected, being unflaked water worn pebbles with evidence of pitting or crushing (Stendinger Associates 2005:92).

Breakage was high within the assemblage, with 50.8 per cent of all recovered artefacts broken. Following analysis of the assemblage, the minimum number of artefacts was calculated at 2686, indicating that the total find number of 3777 is misleading regarding actual artefact numbers (Stendinger Associates 2005:87). Evidence from conjoined artefacts, flake size and breakage during manufacture indicates that artefact production was undertaken at the Mount View site. There is also evidence for the production of backed artefacts (Stendinger Associates 2005:99). Marked concentrations of artefacts at several points in the excavation area may relate to knapping locations characterised by large numbers of small unretouched flakes of the same material and conjoined flakes (Stendinger Associates 2005:115).

A large amount of non-artefactual fragments were also identified – 3499.5 grams, which is 40 per cent by weight of artefacts (Stendinger Associates 2005:99). Following artefact analysis, it was concluded that these clusters of non-artefactual fragments may represent concentrations of heat shattered artefacts (Stendinger Associates 2005:154).

The only other excavation in the Cessnock area was conducted by ERM (2003) in advance of the Hunter Employment Zone development. This test excavation targeted three landform areas (stream banks, terraces and ridgelines) of 138 m^2 in three areas, with individual test pits measuring 2 m^2 in size. A total of 132 artefacts were recovered, defined as six discrete sites by the results.

Although excavations have been limited in number in the Cessnock LGA, they have provided valuable information regarding subsurface archaeological deposits that can be used to inform our understanding of the local area. Further, the larger body of archaeological investigation within the Central Lowlands of the Hunter Valley provides a framework for the archaeological assessment.

Age of Occupation

Very few archaeological sites within the Lower Hunter region have been directly dated by radiocarbon or thermoluminescence dating, as there are limitations in applying this technology to the open sites that dominate the archaeological resource of the region. Dean-Jones and Mitchell (1993) noted that one of the main problems in applying radio-carbon

dating to open sites is the association between the dated sample and cultural materials may not be provable, unless the sample comprises an intact hearth.

Although the above constraints are noted, previous archaeological investigations within the Hunter Valley have provided dates of occupation for several sites that inform our understanding of the age of occupation of the region, including:

- Glennies Creek (Falbrook) north of Singleton, where a hearth located on a buried alluvial terrace provided radiocarbon dates of between 13020±360 and 34580 ±650 BP (Koettig 1986, 1987);

- Wollombi Brook (west of Singleton), where artefacts identified on a terrace in a clay horizon were dated to the late Pleistocene (between 18,000 and 30,000 years) by a geomorphologist (Kuskie 2002);

- Moffats Swamp near Medowie (close to Port Stephens), where radiocarbon dating of a charcoal fragment recovered from the base of a dune provided an uncalibrated date of 14,750 BP (Baker 1994); and

- Bobadeen (Moore 1970) near Cassilis, where excavation of a rockshelter provided a date of 7750±120BP (Moore 1970).

Other Pleistocene dates in neighbouring regions include Lime Springs on the Liverpool Plains, Capertee in the Blue Mountains and Mangrove Swamp, south-east of the Hunter Valley. All of these sites indicate that Aboriginal occupation was present during the Pleistocene and spans a period of at least 20,000 years (ERM 2004:73).

Consideration of technological attributes of stone artefacts also provides an indication of the age of occupation, and is most beneficial in excavations of open sites where there is no chronological stratigraphy and datable material. Excavations throughout south-east Australia provide evidence for the appearance of backed artefacts during the Early Holocene period and their proliferation ca 3,000 BP (Hiscock and Attenbrow 2004). These artefacts have therefore been used as a distinguishing feature of Holocene occupation deposits, and on this basis, many sites are considered to be Holocene in age. However, it is recognised that the use of artefact types to date surface assemblages is limited in its usefulness as the time periods involved span thousands of years and therefore cannot be used to make confident assessments of age and site connectedness.

Other material culture also appears in south-east Australia the mid-late Holocene period, such as edge ground axes, hatchets and adzes. Edge grinding has been present in the archaeological record of northern Australia since the late Pleistocene; however, the antiquity of edge grinding in south-eastern Australia appears limited to the mid-Holocene to recent period. The earliest accepted date for a flake from the cutting edge of an edge ground axe in south-eastern Australia comes from a rockshelter excavation at Graman near Inverell. McBryde and Binns (1972: 65) report that the flake had an antiquity of around 4000 years.

Models for Aboriginal Occupation

Developing occupation models for past Aboriginal use of the landscape is a key research theme in past archaeological investigations throughout the Hunter Valley, given its relevance to the identification of archaeological sites in the modern landscape.

A large body of research has investigated patterns of hunter-gatherer occupation and strategies for survival, which can be used to provide basic principles for Aboriginal occupation and use of the landscape. One key model used by archaeologists in past research in the Hunter region was developed by Foley (1981), whose model assumes that

human behaviour occurred continuously across the landscape, and settlements are points where higher frequency of activity occurred. This model draws heavily on ecological theories to discuss the relationship between population and subsistence resources, and defines the landscape as having core areas, seasonal ranges, annual ranges and lifetime ranges (Foley 1981:2). Foley (1981:5) outlines the variable archaeological characteristics of areas within the home range based on behavioural patterns, specifically:

- home base: primary focus for behaviour and discard. High artefact density expected;
- home base periphery: area adjacent to home base as focus for many activities and discard. Discard (loss) during transit, and as a function of extended living areas and peripheral working areas;
- secondary home range foci: beyond the home base and periphery discard relating to specific activities which occur at repeatedly visited points in the landscape (such as hunting and transitory camps);
- occasional home range foci: discard at points visited occasionally as part of subsistence activities (particularly hunting); and
- extra home range loci: discard beyond the routine home range boundary (particularly for raw material procurement, exchange or ceremonial activities).

Foley (1981:4-7) argues that behaviour and discard within the home range is influenced by the following five environmental factors:

- topography: in areas of low relief, home ranges will be larger, resources more evenly distributed, less chance of secondary home range development, and more chance of occasional discard;
- productivity: the availability of resources;
- climate: seasonal effects of climate change on resources and water supply;
- habitat: where habitats are irregular, artefact distribution may be clustered and discontinuous. On the boundaries between habitats (ecotones), there often occur areas of high resource potential, and consequent frequent activity and discard; and
- diet and subsistence strategy: effects of human behaviour.

The implication of this theory for archaeological studies is that the archaeological record is assumed to be spatially continuous, but artefact density will vary according to the pattern of resource utilisation (Kuskie and Kamminga 2000:255).

Foley's model has been used by archaeologists in the Hunter Valley, such as by Effenberger and Baker (1996) as a model of occupation for the Black Hill locality, to explain the assemblages identified at the Black Hill 2 and Woods Gully sites. Although recognised to provide valuable concepts applicable to hunter gatherer models of occupation, several models specific to Aboriginal occupation in NSW (with particular reference to the Hunter Valley) have been developed by past studies. These include:

- Dean-Jones and Mitchell (1993) suggest that various landforms were used to avoid climatic extremes and associated problems, to take advantage of resource-rich areas, and for ease of travel through the landscape. They also suggest that the saline groundwater associated with Permian Coal Measures may have influenced the

seasonality of occupation in some areas and so the pattern of archaeological evidence (as summarised by Kuskie 2000:33-34);

- Koettig (1994) argues that the location of camps and the patterning within them was determined by rules based on the location of water sources, the demographics of the group and length of stay. The number of occupational episodes may therefore be interpreted through the spacing and distribution of features within a camp. The frequency of these episodes was probably influenced by the availability of resources (as summarised by Kuskie 2000:33-34);

- Rich (1995) argues that technological strategies enabled people to manage resources in the landscape and social strategies enabled management of the uncertainty and risk involved in hunting and gathering. Within the Bayswater catchment, Rich (1992) established a model of archaeological site location which states that the major evidence of Aboriginal occupation of the area, are stone artefact scatters which are most densely identified along major stream valleys. Site densities decrease uphill away from the streams, in minor tributaries and other terrain units including slopes, crests and hilltops. Additionally, sites close to major watercourses contain a greater number of functionally specific features such as knapping floors and heat treatment areas compared to other terrain units (as summarised by Kuskie 2000:33-34);

- Witter (1995) argues that the long-term base camps were located on the Hunter River and its major tributaries, and other open campsites in the region were peripheral to these (as summarised by Kuskie 2000:33-34); and

- Kuskie and Kamminga (2004) argued that occupation focused where multiple resource zones were present (primary zones), and that the larger and more reliable the resource base was, the more frequent and longer the occupation episodes became (2004:604). In areas outside of primary resource zones (secondary zones), occupation became more sporadic and focused within 50 metres of higher order watercourses and associated level to very gently inclined valley flats (2004:605). These areas were more likely to be utilised seasonally and camp sites were occupied by small groups of people for varying lengths of time (but of typically short duration). In areas outside of primary and secondary zones, Aboriginal use tended to involve hunting and gathering activities by small parties of men and/or women and children, along with transitory movement between locations and procurement of stone materials (2004:605).

These models reflect the key influences on occupation identified by Foley (1981), but identify that Aboriginal occupation of the Hunter Valley is more likely to be characterised by large numbers of small short term camp sites utilised by small groups of hunter-gatherers (usually families). Long-term base camps or camps used by large groups of hunter-gatherers could only be situated at places of high resource diversity and permanent water and thus would be much rarer in the landscape.

Implications for Archaeological Patterning and Site Survival

This section discusses the implications of the environmental, ethnohistoric and archaeological research presented in the above sections for the Stage 3 Modification Area, with specific reference to pre- and post-contact Aboriginal land use and occupation, archaeological site patterning, site survival and detection.

Review of geological information indicates that:

- a significant portion of the assessment area is contained within sandstone geological units, excluding the narrow band of shale beneath the steep slopes of the Broken Back Range and the alluvium of the Sandy and Cony Creeks. Surface outcrops of sandstone

may occur within the Branxton Formation and the Muree Sandstone geological units, occurring as either horizontal platforms in creeklines or as shelters or overhangs in steep terrain areas. Archaeological site types such as axe grinding grooves, engraving sites, and shelters (with art and/or deposit) may therefore be found within the assessment area;

- sources of ochre or fine grained siliceous rock are not known within the assessment area, so quarry sites are considered unlikely to occur;

- conglomerates occur in all bedrock geological units of the assessment area, and surface outcrops of conglomerate may contain a range of fine grained stone materials, such as chert and quartz. Raw material may therefore have been opportunistically sourced and utilised within the assessment area; and

- Cony and Sandy Creeks are unlikely to contain suitable raw materials for artefact manufacture, as the only known location for silcrete and mudstone – the dominant raw materials of the region – sourcing is the Hunter River.

Review of soil information indicates that:

- duplex soils occur throughout the assessment area, and surface layers of duplex soils (A horizons) may be quite young, and are more likely to be about 200-3000 years old rather than 3,000-20,000 years old (Dean-Jones and Mitchell 1993:67). Artefacts recorded in surface deposits are therefore unlikely to be of significant age;

- geomorphic and archaeological studies (such as Dean-Jones 1993) have demonstrated that the development of stone layers between A and B horizons is a common feature of duplex soils as a result of rainwash and bioturbation. Stone artefacts are therefore most likely to be buried in the subsoil, rather than occur on the surface, but the downward movement of artefacts indicates that open sites will have limited stratigraphic integrity;

- soils of the assessment area are dominantly classified as highly dispersible and erodible and are highly susceptible to sheet and gully erosion. This is particularly relevant for the steep slopes of the Broken Back Range, where slopes of up to 30 per cent in gradient experience high levels of sheetwash and erosion. In these areas, post-depositional movement of stone artefacts is likely to occur, with artefacts moved to lower landform contexts. In the valley lowlands, post-depositional movement of artefacts is likely to be less, given the gentler slope;

- the floodplains of Cony and Sandy Creeks are aggrading soil landscapes, so there is potential for artefacts to be found in subsurface deposits, although geomorphic processes suggest that the stratigraphic and spatial integrity of such deposits may be limited; and

- the soil pH throughout the Stage 3 Modification Area varies from slightly acidic to alkaline (pH 5 to 6.5). Those areas with neutral soils (pH 7) will have greater potential for the preservation of organic materials, including bone, than those of an acidic or highly alkaline nature. Given this, the potential for organic and skeletal material to survive within assessment area is low.

Review of landform and creek order information indicates that:

- the landscape of the Stage 3 Modification Area is diverse, ranging from gently undulating alluvial landforms to steep slopes of the Broken Back Range. Flora and fauna species vary between landscape areas, therefore providing a diversity of resources within the area;

- the Stage 3 Modification Area has numerous watercourses, of relevance as previous archaeological investigations have strongly correlated availability of water and Aboriginal camp locations. Low-gradient landforms (such as flats and lower slopes) surrounding these watercourses would provide suitable camping locations, particularly when associated with creek confluences. However, the majority of watercourses are ephemeral, so would periodically but not permanently provide sufficient fresh water to support temporary campsites. Cony and Sandy Creeks would have provided the more permanent water sources within the Stage 3 Modification Area, and therefore may have been more intensively used, which could be evidenced by higher site and artefact densities;

- natural ponds within ephemeral creek systems, such as those recorded along Black Creek, would retain water in drier times, thereby forming focal points for camping, and through attracting local fauna, may have provided a focus for hunting;

- Sandy Creek and the eastern section of Cony Creek (to the east of its junction with Sandy Creek) contain areas classified as floodplain and swamps (wetlands). Wetland areas are characterised by increased biodiversity, and are likely to have been subject to more intensive and frequent use than other landscape areas, which is expected to be reflected in the archaeological record of the surrounding landforms (the high terraces and hillslopes that provide camp locations in proximity to wetland resources);

- higher landforms such as spurs and ridge crests offer broad outlooks over the landscape, particularly in the Broken Back Range to the north. These landforms may have been used as travel routes or camp sites when there is a requirement to watch out for approaching allies/enemies; or to plan a hunt or take advantage of a cooling breeze. Archaeological sites may be found in these landforms reflecting such transient land use; and

- the steep slopes adjoining crests in the Broken Back Range are not suitable for Aboriginal camp site locations due to their gradient, so use of these landforms, and therefore deposition of archaeological materials, was most probably limited to transient hunting and gathering. Further, some downslope movement of artefactual material is expected given the gradient of the landforms.

Little information is available on the likely flora and fauna resources of the Quorrobolong valley prior to contact, so it is difficult to reconstruct Aboriginal use patterns within the region. However, review of contemporary flora and fauna resources of the area indicates that:

- a variety of animals hunted and plants utilised in the past (as food, economic and medicine) do occur within the area, which could have supported past Aboriginal use. However, these resources are not significant and would therefore not have supported a larger, more permanent Aboriginal population;

- areas with higher diversity of flora and fauna resources are likely to have been subject to more intensive and/or repeated use. Within the assessment area, this suggests that Cony Creek and Sandy Creek would have been subject to greater resource exploitation than surrounding landscape areas. This increased use is likely to be reflected in the archaeological record; and

- aquatic resources are limited within the project area due to the dominance of ephemeral drainage lines, indicating minimal opportunities for aquatic resource exploitation. To the east, Ellalong Lagoon would provide a key aquatic habitat and a permanent source of water, making it a likely regional focus for occupation.

Review of climate information indicates that:

- the region receives most of its annual rainfall in summer, including in a number of high intensity storms. Heavy rain within the assessment area will result in topsoil erosion, particularly in those areas that are highly erodible and dispersible, and possible post-depositional artefactual movement, especially following European land clearance and grazing;

- various forms of weathering may impact archaeological sites, including chemical, thermal and mechanical. Weathering affects archaeological materials in varying ways, and in particular, organic materials such as bone and shell will tend not to be preserved in open archaeological sites. Chemical weathering can also affect stone artefactual materials after deposition, such as unintentional heating and exfoliation causing shattering;

- flooding of landforms along Cony and Sandy Creeks may have affected archaeological sites, with discarded artefacts being subject to both spatial and stratigraphic post-depositional movement; and

- any weirs or rock fishtraps erected in streams are unlikely to have survived with time, particularly in flood prone areas.

Review of land use information indicates that:

- clearance of vegetation throughout the Stage 3 Modification Area has been widespread, with little mature, native vegetation remaining. Vegetated areas in the modern landscape are predominantly regrowth, with few trees over 50 years in age observed within the assessment area. Clearance of vegetation can result in disturbance to the upper soil horizons through removal of tree stumps and roots. Archaeological sites are likely to survive in these areas, although their spatial and stratigraphic integrity may be affected;

- pastoralism has been the dominant land use of the Stage 3 Modification Area, and has further resulted in introduction of foreign grasses and areas of localised earthworks for pastoral infrastructure. Dense, introduced grasses can obscure surface archaeological deposits in pastoral areas, and any archaeological sites within localised earthwork areas are likely to have been destroyed or highly disturbed. Grazing stock animals in pastoral areas may also create areas of exposure along creek banks and along stock trails, providing opportunities for archaeological detection;

- residential and primary industrial development within the Stage 3 Modification Area, such as roads, houses and chicken sheds, has resulted in areas of high impact, and archaeological sites in these areas are likely to have been destroyed or highly disturbed;

- agriculturalism has been limited in the area, but it was and is present on a number of private properties. In these areas, archaeological sites are likely to have been affected by ploughing and cultivation, with these processes known to redistribute artefacts spatially and move stone to the surface (Dean-Jones and Mitchell 1993:47);

- stream morphology and hydrology throughout the Hunter Valley has changed significantly since European settlement, with common changes including incision of tributary streams, extension of gullies; and erosion and sedimentation during major floods (Dean-Jones and Mitchell 1993:4). As a result, modern stream alignments may not represent pre-contact alignments, particularly in low lying areas where streams could be easily redirected through such processes. Archaeological sites originally found near streams may therefore be removed by some distance within adjacent landforms; and

- construction of dams along the streams of the Stage 3 Modification Area is common, and in these areas, sites are expected to be highly disturbed or destroyed.

Review of ethnohistoric information indicates that:

- the availability of fresh water was a determining factor in the location of Aboriginal camp sites, and that locations that provided good vantage points were also favoured as camp sites. This should be reflected in the archaeological record, with site density increasing near watercourses and on vantage points. Raised land adjacent a water course, fulfilling both criteria, is highly likely to have been utilised in the past;

- Aboriginal people utilised all landscape areas to take advantage of a range of resources. Larger, more permanent camp sites would have been found in places with a permanent water supply and a range of flora and fauna resources, such as along the Hunter River and at Ellalong Lagoon. Smaller camp sites would be found throughout the region reflecting transient hunter and gatherer movement, with the intensity of use influenced by the range and reliability of resources;

- Aboriginal people removed bark from trees to make containers and shields and evidence of bark removal may be exhibited by mature native trees if they survived natural death and European land clearance;

- camp sites are likely in the same areas initially targeted for homesteads by Europeans. These are usually where there is a good freshwater supply;

- post-contact sites (sites that contain evidence suggesting they were used after European settlement) are likely to be rare due to the rapid pace of European settlement in the Hunter Valley, with traditional Aboriginal groups being affected by disease and driven away from traditional lands by pastoralists; and

- ethnohistoric references to two burial sites and one ceremonial site in the Quorrobolong Valley indicate these site types may be found within the Stage 3 Modification Area; however, it is likely that a ceremonial site would instead be associated with Ellalong Lagoon that could provide sufficient water and flora and fauna resources to support an influx of people to a ceremonial site. Carved trees – such as the registered carved tree once recorded along Sandy Creek (noted as destroyed on the AHIMS site card) – are commonly associated with burial or ceremonial sites and could indicate a culturally significant place.

Review of AHIMS archaeological site information indicates that:

- site types recorded within the Quorrobolong Valley area include artefact scatters, isolated finds, shelter sites (art and/or deposit and/or engraving), burials, potential archaeological deposits, axe grinding grooves, carved trees, mythological (natural) sites and ceremonial sites (bora). Dominant site types are artefact scatters and isolated finds, reflecting trends throughout the Hunter Valley; and

- two archaeological sites are known within the Stage 3 Modification Area, being two isolated finds to the north of the surface infrastructure site. The lack of additional sites throughout the area is considered to represent lack of archaeological survey coverage rather than absence of archaeological sites.

Review of previous archaeological research indicates that:

- archaeological survey within the Stage 3 Modification Area has been limited, with the vast majority of the area not subject to previous archaeological investigation;

- archaeological research in the region has predominantly consisted of surveys, with few excavations providing information on the subsurface deposits of the region. Archaeological excavation in the Cessnock area (ERM 2003, Stedinger Associates 2005) has identified subsurface deposits in areas containing few or no surface artefacts. One site near Black creek identified through excavation alone – Mount View 8 – contained 2687 artefacts;

- archaeological research in the Central Lowlands of the Hunter Valley has been extensive and provides the context for this assessment. Archaeological investigations have included both survey and excavation, and have identified sites in all landforms while identifying that site density and complexity increases close to water and wetlands, probably due to increased biodiversity. More complex sites could therefore occur within 100 metres of major watercourses and wetlands, on terraces, flats or lower hillslopes;

- artefact scatters and isolated finds are the dominant site types at both local and regional levels. Sandstone archaeological sites such as grinding grooves or rockshelter sites do occur in areas of suitable geology, and other site types such as scarred or carved trees would only occur in areas where mature, native vegetation survives;

- artefact assemblages generally consist of flakes, broken flakes, retouched flakes, flaked pieces and cores. The dominant raw material is generally indurated mudstone and silcrete with porcellanite, silicified sandstone, hornfels, basalt, quartz, quartzite and chert commonly making up a minor component of the assemblages; and

- longer term Aboriginal occupation results in the discard of more cultural material, making these areas more obvious archaeologically than areas subject to transient use, where few artefacts are discarded.

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APPENDIX D

Aboriginal Cultural Heritage Management Plan Requirements

Appendix D - Aboriginal Cultural Heritage Management Plan Requirements

Introduction

It is recommended that Austar prepare an Aboriginal Cultural Heritage Management Plan (ACHMP) for Stage 3 of the Austar Coal Mine project. The ACHMP will provide for the management of Aboriginal heritage sites and areas located within the Stage 3 project area (including the proposed Modification Area), as identified by this report, and will provide management strategies for any future surface works required within the overall Stage 3 project area. The ACHMP will also incorporate Aboriginal heritage management requirements from previous consents and approvals, to provide Austar Coal Mine with a framework for managing Aboriginal heritage responsibilities for all approved operations.

Management Plan Requirements

The ACHMP will be prepared prior to the commencement of Stage 3 second workings (longwall extraction). The ACHMP will be prepared in consultation with Office of Environment and Heritage (OEH) and Registered Aboriginal Parties, as identified below, and will address the Conditions of Consent detailed in the Project Approval for Stage 3 of the Austar Coal Mine project and the *Austar Coal Mine (Stage 3) Environmental Assessment*; specifically the management recommendations detailed in the *Archaeological Assessment*.

The ACHMP will be designed to provide guidance to Austar Coal Mine in relation to management requirements for all Aboriginal sites and areas within the Stage 3 project area. The ACHMP will also detail a timeframe for the necessary tasks and clearly indicate the roles and responsibilities of Austar management and employees to ensure the appropriate management of Aboriginal heritage within the Stage 3 project area.

The ACHMP will address all Conditions of Consent within the Project Approval, including but not limited to:

1. grinding groove offset strategy as developed by Austar and Aboriginal stakeholders;

2. management requirements for all known sites within the Stage 3 project area (on accessible properties);

3. management strategies for future surface works or remediation works (if required);

4. management strategies for any artefacts recovered from the Stage 3 project area as a result of future works (if required);

5. Aboriginal Cultural Heritage Awareness Training for relevant Austar employees and subcontractors;

6. reporting schedule for completion of ACHMP tasks; and

7. involvement of archaeologists and Registered Aboriginal Parties in the preparation and implementation of the ACHMP.

8. Management strategies for any new sites or skeletal remains uncovered during the course of surface works

An outline of ACHMP requirements for each of the above is provided below.

Management Requirements – Known Archaeological Sites

To ensure that any impacts to known archaeological sites from subsidence, are identified and appropriately managed, the *Archaeological Assessment* has recommended that Aboriginal archaeological sites on accessible properties are included in a monitoring program. This monitoring program will involve baseline recording of archaeological sites on accessible properties prior to commencement of Stage 3 second workings to document existing content, condition and integrity, and then monitoring of the sites following subsidence.

The ACHMP will outline the requirements of the monitoring program in detail, including identification of sites on accessible properties, recording standards for baseline recording and monitoring following subsidence and timing of works. Archaeological methods for this task are outlined in the *Research Design and Methodology* attached as **Appendix E**.

Management Strategies – Future Surface Works (If Required)

Current subsidence predictions indicate that remediation works in response to surface disturbance are unlikely; however, to ensure that potential impacts on Aboriginal heritage as a result of future surface works (if required) are managed appropriately, the *Archaeological Assessmen*t has recommended a procedure for identification and management of potential impacts.

The ACHMP will outline the procedure for the identification and mitigation of potential impacts on Aboriginal heritage as a result of future surface works (if required). Archaeological methods for this task are outlined in the *Research Design and Methodology* attached as **Appendix E**.

Management Strategies – Recovered Artefacts (If Required)

Should artefacts be recovered from the Stage 3 project area as a result of salvage prior to future archaeological impact mitigation works, the artefacts will temporarily be provided to a qualified archaeologist for recording and analysis. Following this, artefacts will be stored in a Keeping Place to be provided by Austar Coal Mine in the Stage 3 surface infrastructure site. This Keeping Place will take the form of a small secure shed with lockable cabinets for the storage of all recovered artefacts, with the assemblage able to be accessed by Registered Aboriginal Parties and archaeologists.

The ACHMP will outline the management of any artefacts recovered from the Stage 3 project area. Archaeological methods for this task are outlined in the *Research Design and Methodology* attached as **Appendix E**.

Management Strategies: Human skeletal material (If Required)

The Archaeological Assessment recommends that the ACHMP should outline explicit procedures required should human/possible human skeletal material be uncovered during surface works or by natural erosion processes within any part of the proposed Stage 3 Modification Area. This includes immediate cessation of surface works in that area to allow for forensic assessment and management and notification to the local police and OEH. This process will allow appropriate management of the location/remains to be determined.

Aboriginal Cultural Heritage Awareness Training

The *Archaeological Assessment* recommends that relevant Austar representatives attend a cultural heritage awareness training session, to be provided by Registered Aboriginal Parties and (if requested) an archaeologist. This training will be conducted prior to commencement of Stage 3 second workings, with details to be included in the ACHMP.

Aboriginal Stakeholder Involvement

The following Aboriginal stakeholders registered an interest in Stage 3 Modification of the Austar Coal Mine project, and should be involved in preparation of the ACHMP and implementation of all Aboriginal heritage management strategies:

- Aboriginal Native Title Consultants;
- Giwiirr Consultants;
- Wonn1 Contracting;
- Hunter Valley Cultural Consultants;
- Hunter Valley Cultural Surveying;
- Lower Hunter Wonnarua Council;
- Lower Wonnarua Tribal Consultancy Pty Ltd;
- Mindaribba Local Aboriginal Land Council;
- Mingga Consultants;
- Tracey Skene (Culturally Aware);
- Upper Hunter Heritage Consultants;
- Wattaka Wonnarua Cultural Consultants Service;
- Wonnarua Culture Heritage;
- Wanaruah Custodians;
- Yarrawalk; and
- Yinarr (registered in March 2011).

Registered Aboriginal Parties involvement should specifically include review of the draft ACHMP, opportunity to participate in any future Aboriginal heritage fieldwork such as baseline recording and monitoring of known sites on accessible properties, and (if required) activities such as inspection of surface work locations, surface artefact collection and archaeological excavation.

APPENDIX E

Research Design and Methodology

Appendix E - Research Design and Methodology

1.0 Introduction

The Austar Coal Mines *Stage 3 Modification Area Archaeological Assessment* recommends baseline recording and monitoring of known sites on accessible properties within the Stage 3 Modification Area, and identifies that future archaeological works such as survey, surface artefact collection, excavation and monitoring may be required should future surface works such as remediation be necessary. This document outlines a draft research design and methodology for the range of future archaeological works that may possibly be required for the Stage 3 Modification Area and also outlines the processes by which the appropriate archaeological mitigation work(s) will be determined. The actual research design and methodology for the ACHMP will be prepared in consultation with the Registered Aboriginal Parties and the OEH.

2.0 Background Information

The *Stage 3 Modification Area Archaeological Assessment* builds on the *Aboriginal Cultural Heritage Assessment* (Umwelt 2008b) and provides the required context for this research design and methodology, specifically Section 3 (archaeological, environmental and ethnohistoric context and identified Aboriginal heritage sites and areas), Section 6 (the archaeological and cultural significance of known Aboriginal archaeological sites), Section 7 (heritage impact assessment) and Section 8 (management context).

3.0 Registered Aboriginal Party Consultation and Involvement

Aboriginal people are the primary determinants of the significance of their heritage (DEC 2004:3), and therefore should have a direct and central role in in the identification, assessment and management of Aboriginal heritage sites and places. The following Aboriginal parties have registered an interest in the original Austar Coal Mine Stage 3 Project, and should therefore be directly involved in the decision making process for all future Aboriginal heritage works identified in Section 7.

- Aboriginal Native Title Consultants;
- Wonn1 Sites Consulting;
- Giwiirr Consultants;
- Hunter Valley Cultural Consultants;
- Hunter Valley Cultural Surveying;
- Lower Hunter Wonnarua Council;
- Lower Wonnarua Tribal Consultancy Pty Ltd;
- Mindaribba Local Aboriginal Land Council;
- Mingga Consultants;

- Tracey Skene (Culturally Aware);
- Upper Hunter Heritage Consultants;
- Wanaruah Custodians;
- Wattaka Wonnarua Cultural Consultants Service;
- Wonnarua Culture Heritage; and
- Yarrawalk.

Other Aboriginal parties are welcome to register an interest in the Austar Project. Such Aboriginal parties will be afforded the opportunity to review and comment on any Aboriginal cultural heritage documents prepared for the project.

The following additional Aboriginal party has registered an interest in the Austar Project:

- Yinarr (registered March 2011).

4.0 Research Design

Should archaeological works be required in the future to mitigate potential impacts from surface works, this research design will provide a framework for the analysis of results and therefore the recovery of valuable information regarding past Aboriginal occupation and use of the Stage 3 Modification Area.

The aim of the works outlined below is to recover information on past Aboriginal occupation of the Stage 3 Modification Area, through excavation of sites with archaeological research potential, and to recover archaeological materials (stone artefacts) of cultural value to Registered Aboriginal Parties.

The following research questions reflect key research themes in the Hunter Valley and aim to recover valuable data regarding when, how and why Aboriginal hunter-gatherers used the landscape of the Stage 3 Modification Area, and further, how this may differ from other areas within the Hunter Valley.

1. What resources – water, food and stone – were available to the Aboriginal people using the Sandy Creek and Cony Creek catchments within the Stage 3 project area?

2. What stone resources were transported into the Stage 3 Modification Area and from where?

3. Are the assemblages found within the Stage 3 Modification Area similar or different to those assemblages previously found in the Cessnock area?

4. Do the differences/similarities in the assemblages found in the Stage 3 Modification Area and in the Cessnock area suggest different or similar patterns of landscape and resource utilisation?

5. Is there evidence that Aboriginal people were heat treating/using heat treated stone in the Stage 3 Modification Area?

6. Can seasonal use of the Stage 3 Modification Area be determined from plant residues on artefacts salvaged from this area?

7. Are there features such as hearths, heat treatment pits or ovens in the Stage 3 Modification Area that can provide absolute dates for Aboriginal occupation of the area? If so, how does this date/these dates compare with those from the broader Hunter Valley?

8. If there are hearths, do they contain remains (animal/plant) that may indicate what people were cooking/eating?

Note that the ability to respond to each of the above research questions is dependent on the recovery of information through subsurface testing and/or archaeological salvage, and the nature of any assemblage recovered by these works. Further, the potentially staged nature of Stage 3 mitigation works (if required) may limit the potential of individual assemblages to respond to the general research questions posed above.

5.0 Methods

The following sections outline field methods for the management of Aboriginal heritage sites and areas within the Stage 3 project area, spanning: baseline recording and monitoring of known archaeological sites on accessible properties; surface artefact collection; subsurface testing; salvage; and management of recovered artefacts. At this stage, there is no recognised need for activities such as surface collection, archaeological testing or salvage, as current subsidence predictions indicate that surface disturbance and remediation works are unlikely to be needed. However, should archaeological mitigation works be required at any stage, the following sections also outline procedures to enable the future identification, assessment and management of Aboriginal heritage sites and places.

5.1 Baseline Recording and Monitoring

The *Archaeological Assessment* recommends that known Aboriginal archaeological sites within the Stage 3 area, on accessible properties, are included in a monitoring program to ensure potential impacts to site content, condition or integrity from subsidence are detected and managed appropriately. **Table 1** lists all known Aboriginal archaeological sites recorded in the Austar Stage 3 and Stage 3 Modification areas.

Table 1 - Known Aboriginal Archaeological Sites

Site #	Site Type	MGA		Artefacts Recorded		Site Area[1], m^2
		Easting	Northing	#	Type/Material	
ACM1	Artefact Scatter	346839	6359248	3	2 silcrete broken flakes. 1 silcrete core	48
ACM 2	Artefact Scatter	346773	6359341	2	1 mudstone flake	40
		346761	6359363		1 mudstone broken flake	
ACM 3	Isolated Find	347652	6359360	1	1 mudstone broken flake	1 (15)
ACM 4	Isolated Find	347502	6359377	1	1 silcrete broken flake	1 (15)
ACM 5	Isolated Find	347448	6359253	1	1 silcrete broken flake	1 (4)

[1] The site area for all isolated finds is 1 m^2 based on archaeological distribution. Where the isolated find occurs within an exposure, the exposed area is listed in brackets.

Site #	Site Type	MGA		Artefacts Recorded		Site Area[1], m^2
		Easting	Northing	#	Type/Material	
ACM 6	Grinding Groove & Isolated Find	347447	6359320	1	1 grinding grove	90
		347444	6359333		1 mudstone broken flake	
ACM 7	Isolated Find	348432	6359652	1	1 mudstone flake	1 (9)
ACM 8	Artefact Scatter	348008	6359291	4	3 mudstone flakes. 1 mudstone broken flake	60
ACM 9	Isolated Find	348446	6357420	1	1 mudstone flake	1 (3)
ACM 10	Artefact Scatter	348473	6357540	2	1 mudstone flake. 1 mudstone flaked piece.	28
ACM 11	Isolated Find	348350	6358807	1	1 quartzite flake	1 (100)
ACM 12	Artefact Scatter	349465	6358623	2	1 retouched chert flake. 1 silcrete core	54
ACM 13	Isolated Find	348365	6358707	1	1 mudstone flake used as a core	1 (6)
ACM 14	Artefact Scatter	350706	6357134	24	3 silcrete broken flakes. 2 mudstone flakes 1 mudstone broken flake 2 silcrete flakes. 1 mudstone flaked piece 3 silcrete flakes. 1 silcrete core. 1 silcrete broken flake. 1 mudstone broken flake 1 mudstone broken flake. 1 mudstone flake. 1 silcrete flake 1 silcrete flake. 1 silcrete core 4 quartzite broken flakes	7000
ACM 15	Isolated Find	350131	6357455	1	1 mudstone broken flake	1 (16)
ACM 16	Artefact Scatter	350308	6357302	2	1 mudstone flake. 1 chert core	10
ACM 17	Isolated Find	350503	6358035	1	1 quartz flake	1 (24)
ACM18	Artefact Scatter	347234	6359108	6	1 quartzite core 1 quartzite broken flake 2 mudstone broken flakes	28
ACM19	Isolated Find	346514	6358771	1	1 quartzite cobble	1
ACM20	Isolated Find	346304	6359149	1	1 silcrete flake	1
ACM21	Potential modified tree	347435	6357976	na	na	10
ACM22	Isolated Find	347378	6357798	1	1 quartzite hammersone	1
ACM23	Artefact Scatter	347980	6358385	1	1 quartzite muller 1 quartzite hammerstone	1

Site #	Site Type	MGA		Artefacts Recorded		Site Area[1], m^2
		Easting	Northing	#	Type/Material	
ACM24	Artefact Scatter	349236	6357063	12	10 mudstone flakes and broken flakes 1 silcrete backed blade 1 silcrete hammerstone	21
ACM25	PAD	348268	6356671	na	na	1600
ACM26	PAD	348043	6357097	na	na	400
ACM27	Isolated Find	347946	6357608	1	1 silcrete flake	1
ACM28	Artefact Scatter	349586	6357228	12	11 mudstone flakes and broken flakes 1 silcrete broken flake	8
ACM29	PAD	347592	6357052	na	na	3000
ACM30	PAD	348691	6356172	na	na	1250
ACM31	Isolated Find	348618	6356407	1	1 mudstone broken flake	1
ACM32	Artefact Scatter	349164	6357188	6	6 mudstone flakes	10
ACM33	Artefact Scatter	347743	6357385	2	1 mudstone flake 1 (broken) silcrete backed artefact	2
ACM34	Isolated Find	346517	6359138	1	1 mudstone flake	1

It is noted that all sites listed in **Table 1** are on property not owned or managed by Austar, with 12 sites recorded within the Werakata State Conservation Area that is managed by NSW National Parks and Wildlife Service and 22 sites recorded on privately owned properties. Access to all known archaeological sites for baseline recording and monitoring is therefore reliant upon approval from individual landholders. Access to sites listed in **Table 1** will need to be revisited prior to monitoring taking place.

It is envisaged that mining in Stage 3 will begin in 2013, commencing with Longwall A7 and will progress in accordance with the numerical order to Longwall A19. At least six months prior to the commencement of Stage 3 second workings (longwall extraction), baseline recording of known archaeological sites on accessible properties within the relevant longwall angle of draw will be conducted. The timing of monitoring of known sites on accessible properties will be determined by the mining schedule, with monitoring of sites within the angle of draw of individual longwalls able to begin at a minimum of three months after longwall extraction.

Methodology for baseline recording is as follows:

- inspection of the known site areas by a field team consisting of an archaeologist and Registered Aboriginal Party representative(s). To ensure thorough coverage, the known site area should be inspected in systematic transects with survey team members no more than five metres apart;

- flagging of all surface artefacts with high visibility survey markers;

    - it should be noted that previously recorded artefacts may not be located due to changes in the site since recording (i.e. post depositional artefact movement) or varying ground surface visibility. However, these processes may expose additional artefacts not identified in the original recording;

- recording of surface artefact locations using a handheld GPS, with a record of each artefact made (artefact type and raw material). Photographs of each individual artefact will also be taken;

- production of a scaled site plan identifying the location of all surface artefacts; and

- photographic records of the site location, with artefact locations identified by high visibility survey markers.

Methodology for monitoring is as follows:

- inspection of the known site area by a field team consisting of an archaeologist and Registered Aboriginal Party representative(s). To ensure thorough coverage, the area should be inspected in systematic transects with survey team members no more than five metres apart;

- flagging of all surface artefacts with high visibility survey markers;

- recording of surface artefact locations using a handheld GPS, with a record of each artefact made (artefact type and raw material). Photographs of each individual artefact will also be taken;

- production of a scaled site plan identifying the location of all surface artefacts;

- photographic records of the site location, with artefact locations identified by high visibility survey markers; and

- on-site and off-site analysis of movement of surface artefacts, and any other changes in the site area, since baseline recording.

Should movement of surface artefacts or other changes to the site be detected, the survey team (archaeologist and Registered Aboriginal representative(s)) will discuss the nature of changes detected and the how these changes affect the scientific and cultural value of the site. On this basis, the need for archaeological mitigation works (and selection of appropriate mitigation works) will be identified. Should not all Registered Aboriginal Parties be present at the site inspection, a brief letter report on the inspection and discussion results will be prepared and provided to all Registered Aboriginal Parties, with ten days provided for review and return of comments. **Sections 5.3** to **5.5** identify archaeological methods for tasks that may be required, such as surface artefact collection, subsurface testing and salvage.

It is noted that artefacts are subject to natural geomorphic processes such as erosion and bioturbation, and that changes to known sites may be detected during the monitoring program as a result of these processes. However, as the aim of the monitoring program is to identify and mitigate any subsidence impacts, movement of stone artefacts resulting from erosion and bioturbation will not trigger mitigation works.

5.2 Archaeological Survey

The purpose of further archaeological survey (if required) will be to identify Aboriginal archaeological sites or areas that may be impacted by future surface works.

The need for archaeological survey will be identified as a result of the following process:

1. if the surface work location was not surveyed as part of the 2008 *Stage 3 Aboriginal Heritage Assessment or the 2011 Archaeological Assessment (this document)*, an archaeologist and Registered Aboriginal Party representative(s) will be required to inspect the works location to identify any potential Aboriginal heritage impacts prior to the commencement of works;

2. if the surface work location was surveyed as part of the 2008 *Stage 3 Aboriginal Heritage Assessment or the 2011 Archaeological Assessment* and no archaeological sites/areas were identified, no further Aboriginal heritage works will be required prior to the commencement of works; and

3. if the surface work location was surveyed as part of the 2008 *Stage 3 Aboriginal Heritage Assessment* or the 2011 *Archaeological Assessment*, and an archaeological site or potential archaeological deposit was identified, an archaeologist and a Registered Aboriginal Party representative(s) will be required to inspect the works location to identify any potential Aboriginal heritage impacts prior to the commencement of works.

Should an inspection of the works locality be required, Registered Aboriginal Parties will be notified at least 10 days prior to the inspection and invited to participate.

The following field methodology is proposed:

- inspection of the entire works area by a field team consisting of an archaeologist and Registered Aboriginal Party representative(s);

- to ensure thorough coverage, the area should be inspected in systematic transects with survey team members no more than five metres apart;

- flagging of all identified surface artefacts with high visibility survey markers;

- inspection of all mature, native vegetation observed to identify any cultural scarring;

- inspection of all creek beds to identify any sandstone exposures or rockbars, which may have been used for ground edge implement production or reduction; and

- recording of the area inspected and any artefacts identified, including written descriptions, photographic records and a site plan.

Following survey, an evaluation of the significance of the identified site/s should be made by a qualified archaeologist and Registered Aboriginal Parties, which will inform the determination of appropriate management of the site/s. A brief letter report on the inspection and discussion results will be prepared and provided to all Registered Aboriginal Parties, with 10 days provided for review and return of comments. However, it is possible that subsurface testing may be required to obtain further information about the site/s to determine their significance prior to determining appropriate management. If this requirement is identified by the archaeologist and/or Registered Aboriginal Parties the process outlined in **Section 5.4** will be undertaken.

5.3 Surface Artefact Collection

The purpose of surface artefact collection (if required) will be to recover Aboriginal archaeological material of scientific and cultural significance that may be impacted by future surface works. The need for this would be determined by a qualified archaeologist and

Registered Aboriginal Parties following site inspection, based on impacts posed from surface works required and the significance of the site/area. Surface artefact collection would be a suitable mitigation strategy for a heavily disturbed or eroded site/area with little to no potential for subsurface deposits that would retain stratigraphic or spatial integrity. However, should the site also have potential for subsurface archaeological materials that may retain stratigraphic or spatial integrity or that may by their study add to the current understanding of the Aboriginal use of the landscape (as identified by a qualified archaeologist and Registered Aboriginal Parties), surface collection may be conducted in conjunction with subsurface testing and/or subsurface salvage.

Methodology for surface artefact collection (if required) is as follows:

- inspection of the designated collection area by a field team consisting of an archaeologist and Registered Aboriginal Party representative(s). To ensure thorough coverage, the area should be inspected in systematic transects with survey team members no more than five metres apart;

- flagging of all identified surface artefacts with high visibility survey markers;

- recording of surface artefact locations using a handheld GPS. A site plan will also be made to document distribution of artefacts within the collection area;

- photographic records of the site location, with artefact locations identified by high visibility survey markers; and

- bagging and labelling all collected artefacts on site.

5.4 Archaeological Subsurface Testing

The purpose of subsurface testing (if required) will be to determine the extent and nature of archaeological sites within the Stage 3 Modification Area that will be affected by surface works. Subsurface testing may further aim to establish the geomorphic context and therefore archaeological integrity and/or antiquity of individual sites. This information will be used to determine the most appropriate salvage strategy to be used for archaeological sites that may be impacted by future surface works (if required).

The need for subsurface testing would be determined by a qualified archaeologist and Registered Aboriginal Parties following site inspection. The extent of the subsurface testing will be based on the nature and extent of the impacts posed from the surface works required, the area assessed as having potential for subsurface archaeological deposits and the significance of the site/area. Subsurface testing would be a suitable mitigation strategy for a site/area with potential for subsurface archaeological materials that may retain stratigraphic or spatial integrity or artefact assemblages that by their study may add to the understanding of the use of the landscape by Aboriginal people.

The exact methodology to be utilised for subsurface testing at individual sites will be influenced by factors such as the presence or absence of surface artefacts, the integrity of the locality and the predicted area of subsurface archaeological potential. Accordingly, the appropriate testing methodology can only be identified by archaeologists and Registered Aboriginal Parties at the time of impacts from surface works being identified. To ensure the archaeological subsurface testing methodology proposed is suitable, it will be formulated in consultation with the Office of Environment and Heritage (OEH).

5.5 Archaeological Salvage

The purpose of salvage excavation (if required) will be to recover the archaeological resource of a site prior to impact from surface works. The need for archaeological salvage would be determined by a qualified archaeologist and Registered Aboriginal Parties following subsurface testing, based on the extent of and nature of the identified subsurface deposit, the impacts posed from surface works required, and the significance of the site/area. Salvage would be a suitable mitigation strategy for a site/area with cultural or scientific value, such as sites with stratigraphic integrity and/or spatial integrity, sites with a high density subsurface archaeological material or containing datable cultural features such as hearths.

The exact methodology to be utilised for archaeological salvage at individual sites will be influenced by factors such as the nature of the archaeological deposit, the density of archaeological material, the research potential of the site and the cultural value of the site. Accordingly, the appropriate salvage methodology can not be determined at this time. To ensure any future salvage methodology proposed is suitable, it will be prepared in consultation with the OEH.

5.6 Recovered Artefact Management

Should artefacts be recovered from the Stage 3 Modification Area as a result of salvage prior to future impact mitigation works, the following management of recovered artefacts is proposed:

- following recovery, artefacts will be provided to a qualified archaeologist for recording and analysis. A catalogue of recovered artefacts will be developed by the archaeologist, a copy of which is to be provided to OEH, Austar and Registered Aboriginal Parties for their records; and

- following recording and cataloguing, artefacts will be stored in a Keeping Place to be provided by Austar Coal Mine in the Stage 3 surface infrastructure site. This Keeping Place will take the form of a small secure shed with lockable cabinets for the storage of all recovered artefacts, with the assemblage able to be accessed by Registered Aboriginal Parties and archaeologists.

- following completion of mining activities at the SIS the proponent will enter into discussions with Registered Aboriginal Parties and OEH as to the future storage of the recovered artefacts.

6.0 Evaluation and Reporting

A qualified archaeologist will conduct the technical recording and analysis of all stone artefacts recovered form the Stage 3 project area ahead of impact by mitigation works. Stone artefact analysis will record artefact type, raw material and the technological attributes of flakes, cores and retouched artefacts.

As mitigation works may be required over a period of many years, it is proposed that an annual report is generated for Austar and Registered Aboriginal Parties identifying all archaeological works (if any) conducted and the methods and results of those works undertaken in the preceding year. Comment on the evaluation of archaeological results against the research questions posed in **Section 3** could be provided in this annual report, but as previously stated, the ability to respond to research questions relies on the nature of works conducted and the nature of the assemblage recovered. If there has been no

requirement for any mitigation works related to Aboriginal sites in the preceding year then there will be no requirement for a report.

7.0 Procedure for Handling Human Remains

The potential for Aboriginal burial sites and/or skeletal remains to occur within the Stage 3 project area is recognised by this assessment, although the likelihood of these sites being found is considered remote. This section outlines the procedure for handling human remains in accordance with the *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS 1997).

In the event that human skeletal material is exposed within the Stage 3 Modification Area, the following procedure is to be followed:

1. as soon as remains are exposed, work is to halt immediately to allow assessment and management;

2. contact police;

3. contact OEH and the Heritage Office;

4. a physical or forensic anthropologist should inspect the remains *in situ*, and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or forensic);

5. if the remains are identified as forensic the area is deemed as crime scene; or

6. if the remains are identified as Aboriginal, the site is to be secured and OEH and all Registered Aboriginal Parties are to be notified in writing; or

7. if the remains are as non-Aboriginal (historical) remains, the site is to be secured and the Heritage Office is to be contacted.

The above process functions only to appropriately identify the remains and secure the site. From this time, the management of the remains is to be determined through liaison with OEH and Registered Aboriginal Parties.