APPENDIX J

Aboriginal cultural heritage test excavation report

Aboriginal cultural heritage test excavation report

Cobbora Coal Project

Prepared for Cobbora Holding Company Pty Limited | 25 January 2013

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Cobbora Coal Project

Final draft

Report J12087| Prepared for Cobbora Holding Company Pty Limited| 25 January 2013

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Document Control

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Executive Summary

This test excavation report prepared for the Cobbora Coal Project (the Project) as part of the Aboriginal Cultural Heritage Assessment (ACHA) by EMGA Mitchell McLennan Pty Limited (EMM) (June 2012). It forms part of the Environmental Assessment (EA) for the Project.

The excavation program was undertaken across a range of locations within the broader Project application area (PAA) located approximately 5 km south of Cobbora, 22 km south-west of Dunedoo, 64 km north-west of Mudgee and 60 km east of Dubbo in the central west of NSW.

A total of 45 locations were excavated, consisting of 36 test pits (each 3 m x 1 m) and 9 borehole test squares (each 1 m x 1 m). In total, 118 individual 1 m x 1 m squares were excavated. The results are summarised as follows:

- 791 Aboriginal stone artefacts were identified in 89 of the 118 individual 1 m x 1 m squares;
- the majority (94%) of stone artefacts related to debitage from stone tool manufacture;
- artefacts were mostly confined to the first 20 cm of soil (98% of artefacts). Occasionally artefacts were recovered from 20 – 40 cm, depending on specific soil profiles;
- artefact frequencies per 1 m x 1 m square ranged from 37 to zero. The median artefact frequency was four artefacts per 1 m x 1 m, and the average frequency was 6.7 artefacts per 1 m x 1 m;
- the highest densities of artefacts were associated with a minor valley elevation close to the confluence of Laheys Creek and its unnamed tributary — with 104 artefacts recovered from TP174/1, 80 from TP170/2 and 77 artefacts recovered from TP173/1 (according to their 3 m x 1 m sample size).
- Other tested areas — such as those associated with minor tributaries (e.g. test pits TP355/2-TP358/2) — revealed lower archaeological sensitivity, with eight test locations containing no artefacts;
- quartz dominated the assemblage, making up 85% of artefacts. Complete quartz flakes made up the majority of artefact types and was an abundant resource in the local landscape. Despite this, over half of the implements recovered were of other raw materials types;
- 17 diagnostic implement types were found. These included: Bondi points, scrapers, and a Geometric microlith; and
- the archaeologically sensitive areas hypothesized within the ACHA were confirmed by an extensive subsurface assemblage. Areas without artefacts were situated close to ephemeral minor tributaries.

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1 Introduction

1.1 Background to this report

This test excavation report was prepared as part of an Aboriginal Cultural Heritage Assessment (ACHA) by EMGA Mitchell McLennan Pty Limited (EMM) (June 2012) and forms part of the Environmental Assessment (EA) for the Cobbora Coal Project (the Project).

This report expands upon the previous archaeological investigation by EMM (June 2012) that surveyed and assessed the broader Project application area (PAA) for its Aboriginal heritage values as part of the ACHA.

The excavation program was undertaken across a range of locations within the PAA. The PAA is approximately 5 km south of Cobbora, 22 km south-west of Dunedoo, 64 km north-west of Mudgee and 60 km east of Dubbo in the central west of NSW (Figure 1.1).

The 2012 ACHA identified a number of “archaeologically sensitive areas” within the PAA, including highly sensitive areas along major creeks and moderately sensitive areas in certain valley edge and ridge landforms associated with reliable water sources. These areas were identified from the consistent presence of Aboriginal sites in highly sensitive areas and frequent presence of sites in moderately sensitive areas. Test excavations in comparable contexts in other regions provided support for the identification of the archaeologically sensitive areas. The test excavations within the PAA reported here provide a crucial confirmation of the model of archaeological sensitivity underpinning the ACHA.

This archaeological investigation contributes to the baseline description of the local archaeology. Descriptions of the local archaeology have previously depended on smaller artefact assemblages than reported here. Overall, the previous archaeological survey, together with this test excavation and the proposed salvage excavation and collection program will contribute to the description of the local and regional archaeology.

Test excavation fieldwork was conducted on 9 July–25 July 2012 and 2–18 October 2012. The locations of test excavations were governed by the required locations for geotechnical test pits and bore holes within the archaeologically sensitive areas previously mapped in the ACHA survey report.

1.2 Project description

The Project is an open cut coal mine that will be developed on approximately 4,300 ha of land. Most of the coal will be produced for Macquarie Generation, Origin Energy and Delta Electricity to generate electricity at four of the six large coal-fired power stations operating in NSW.”

Up to 9.5 million tonnes per annum (Mtpa) of coal is contracted to the companies and will be used for domestic power generation in NSW. In addition, up to 2.5 Mtpa will be produced for a combination of the export and spot domestic markets.

The Project's key elements are:

- an open cut mine;
- a coal handling and preparation plant (CHPP area);
- a train loading facility and rail spur;

- a mine infrastructure area (MIA); and
- supporting infrastructure including: access roads; water supply and storage; and electricity supply.

It is envisaged that construction activities will commence in mid-2013 with coal supplied to customers from the first half of 2015. A mine life of 21 years is proposed. Refer to Chapter 1 of the ACHA (EMM 2012) for further description of the proposed development.

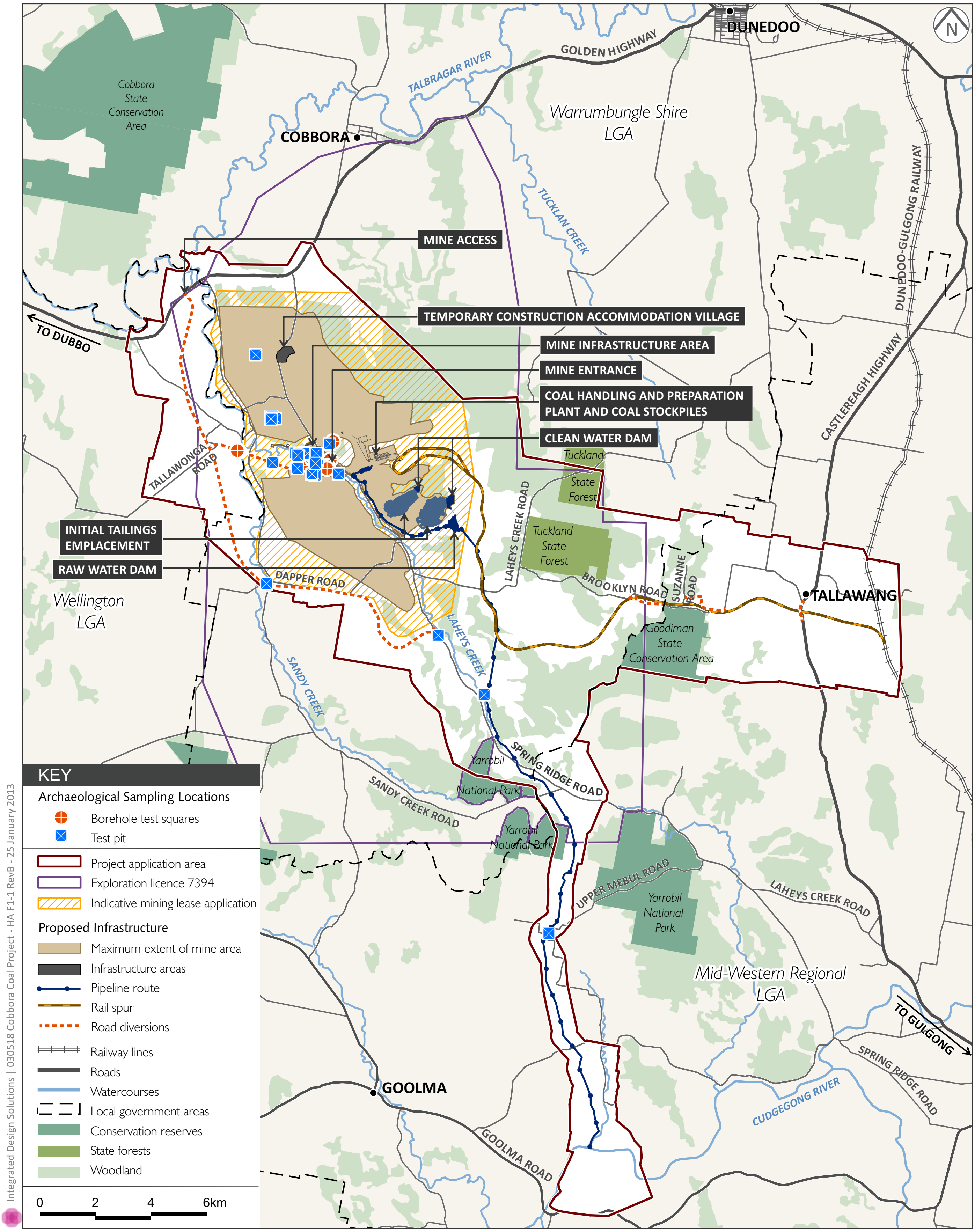
1.3 Planning context

- A Major Project application under Part 3A of the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act) was submitted to the NSW Department of Planning on 5 January 2010 (application number MP 10_0001). The Director General's environmental assessment requirements (DGRs) for the Project were issued on 4 March 2010. Revised DGRs were issued for the Project on 23 December 2011.

1.4 Authorship and acknowledgements

This report was prepared by EMM Archaeologist Ryan Desic ((BA hons) historic/prehistoric archaeology) and reviewed and revised by EMM Associate Director — Archaeologist Neville Baker ((BA hons) prehistory).

The archaeological excavation program was directed by Neville Baker and assisted by archaeologists Ryan Desic, Rebecca Moore, Craig Baxter and Eva Rankmore.



Proposed Development and Sampling Location

Cobbora Coal Project - Aboriginal Heritage Assessment (Test Excavation Report)

Figure 1.1

EMM Cobbora Holding Company Pty Limited

2 Aboriginal consultation and participation

2.1 Process

The statutory requirement for Aboriginal consultation for this study is set out in the DGRs for the Project. The Aboriginal heritage assessment was conducted in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (the guidelines – DEC 2005) which requires consultation with Aboriginal communities about the proposed development and management of Aboriginal heritage.

The consultation process is addressed in full in Chapter 2 of the ACHA. The following is an overview of the process leading up to the test excavation.

2.2 Aboriginal stakeholders

The local Aboriginal community has been involved in the assessment of the study area and supported recommendations for the test excavation program. Registered Aboriginal Parties for consultation (RAPs) for the Project were:

- Dubbo LALC (DLALC; contact - Uppannia Sullivan);
- Mudgee LALC (MLALC; contact - Aleshia Lonsdale);
- Warrabinga Native Title Claimants Aboriginal Corporation (WNTCAC; contact - Wendy Lewis);
- North-East Wiradjuri Co Ltd (NEWCO; contact - Lyn Syme);
- Wirrimbah Direct Descendants (WDD; contact - Stephen Ryan);
- Murong Gialinga Aboriginal & Torres Strait Islander Corporation (MGATSIC; contact - Debbie Foley and Larry Foley);
- Gallanggabang Aboriginal Corporation (GAC; contact - Joyce Williams, via Lee Thurlow);
- Mingaan Aboriginal Corporation (MAC; contact - Helen Riley);
- Jenny Williams (an individual person);
- Dorothy Stewart (trading as Binjang Wiradjuri Aboriginal Heritage Surveys); and
- Wellington Valley Wiradjuri Aboriginal Corporation (WVW - which was a new corporation established to replace GAC having the same membership as GAC).

Following previous RAP meetings in October 2009, February 2010, and October 2011 and archaeological survey 2011–2012, a draft ACHA by EMM was distributed on 15 March 2012 to each RAP for their review and comment. A further RAP meeting was held in April 2012 to discuss the draft ACHA and recommendations. The outcomes and comments of all RAP consultation are included within Appendix A of the ACHA (EMM 2012).

Each of the RAPs were contacted by letter for both phases of the excavation program — on 12 June 2012 for the first phase and 28 August 2012 for the second phase — to notify them of the excavation program within the PAA. EMM continued to directly liaise with RAPs via email and phone calls to coordinate the timing and specifics of the test excavation program. The excavation fieldwork involved participation from representatives of each RAP.

Aboriginal community fieldworkers included (in alphabetical order):

- Brenn Doherty (Wellington Valley Wiradjuri Aboriginal Corporation);
- Steven Flick (Murong Gialinga Aboriginal & Torres Strait island Corporation);
- Debbie Foley (Murong Gialinga Aboriginal & Torres Strait island Corporation);
- Larry Foley (Murong Gialinga Aboriginal & Torres Strait island Corporation);
- Shannon Foley (Murong Gialinga Aboriginal & Torres Strait island Corporation);
- Jamie Gray (Binjang Wellington Wiradjuri heritage survey);
- James Gray (Binjang Wellington Wiradjuri heritage survey);
- Fonua Havili (Binjang Wellington Wiradjuri heritage survey);
- Ashley Hill (Wirrimbah Direct Descendants Aboriginal Corporation);
- Robert Hill (Wirrimbah Direct Descendants Aboriginal Corporation);
- Wendy Ann Lewis (North-East Wiradjuri Co. Limited);
- Shaen Morgan (North-East Wiradjuri Co. Limited);
- John Newton (Mudgee Local Aboriginal Land Council);
- Gail Ratcliffe (North-East Wiradjuri Co. Limited);
- William Stanley (Wellington Valley Wiradjuri Aboriginal Corporation);
- Terry Toomey (Dubbo Local Aboriginal Land Council);
- Donna Whillock (Warrabinga Native Title Claimants Aboriginal Corporation);
- Coral Williams (North-East Wiradjuri Co. Limited);
- Jenny Williams;
- Kelsey Williams (Warrabinga Native Title Claimants Aboriginal Corporation);
- Kevin Williams (Warrabinga Native Title Claimants Aboriginal Corporation); and
- Elwin Wolfenden (Mingaan Aboriginal Corporation).

3 Environmental context

3.1 Landscape

The study area lies within the southern edge of the Brigalow Belt South (BBS) biogeographic region of NSW. The Sandy Creek catchment forms a southerly extending finger of the Talbragar Valley sub-system of the BBS. The BBS is characterised by primarily sedimentary geology and geomorphology derived largely from the eroding sandstone and conglomeritic geology.

The landform pattern is ridges, hills and sandy valleys. The majority of the study area is cleared paddocks, with some containing mature trees. The level of weed and native grass cover is high in most paddocks; however, sparsely vegetated sandy flats also occur. The study area is very gently inclined within a valley floor that slopes gently towards creek lines. The valley floor is interspersed with slight elevations that provide good outlook over the valley floors and major watercourses.

Soil in the area is predominantly fine sandy soil. Most of the study area is mapped as the Dubbo Soil Landscape. Red and brown Podzolic soils cover the majority of the Project area with alluvial soils found along certain areas adjacent to Laheys Creek and Sandy Creek.

The PAA lies at the eastern edge of the Murray-Darling Basin. Much of the land occurs within the catchment of the Talbragar River with the exception of the southern pipeline area which is within the Cudgegong River catchment.

Sandy Creek is a third order stream upstream of its junction with Laheys Creek, after which it becomes a fourth order stream flowing north to the Talbragar River just west of the proposed mine areas. Laheys Creek is a third order stream which flows between proposed Mining Areas A and B and joins Sandy Creek approximately 6 km south of the Talbragar River. Mebul Creek, a third order creek which joins the Cudgeong River, is located towards the southern area of the PAA. Conglomerate and sandstone rock outcrops and boulders occur along these creeks. Sandy Creek and Laheys Creek are the major watercourses running alongside the mining areas.

Unnamed minor tributary creeks flowing west to Laheys Creek and Sandy Creek in the northern half of the PAA pass through sandy valleys to form chains of ponds. Such chains of ponds are evident west of Spring Ridge Road and north of Laheys Creek. Although now somewhat altered by farm dam construction, a particularly good example occurs within the Danabar property in the north-west part of the PAA. Laheys Creek itself is more heavily entrenched and also would have included a series of waterholes providing reliable water.

3.2 Land-use and disturbance

Land-use in the PAA is typically cattle and sheep grazing with some wheat cropping. Forest and woodland areas generally occur in association with rock outcrops on the low hills and ridges. The broad flat areas which very gently slope down to the creeks have been cleared and ploughed regularly over many decades. The clearing of trees along watercourses has exacerbated erosion and increased salinity in some areas. Salt scalds are present within some low lying areas of the study area.

3.3 Implications for Aboriginal archaeology

Highly sensitive landscapes are mainly areas within 200 m of major creeks, such as Laheys Creek and Sandy Creek. Stone artefact sites and grinding grooves may occur.

Stone artefact sites may occur in minor tributaries where chains of ponds occur, or along drainage lines as very low density artefact distributions. This context is of moderate sensitivity.

Given that the woodland and forest areas have been subject to regular harvesting over the past century, mature trees which might carry the scars of Aboriginal implement manufacture (Aboriginal scarred trees) are rare across the area.

Soil erosion along creek edges has been the primary cause of Aboriginal stone artefact site discovery even though it is an ongoing form of disturbance to such sites. Even in areas where grass cover obscures the ground surface, the presence of Aboriginal artefacts within the topsoil near creeks may be inferred.

Erosion disturbance next to creeks contributes in some part to educational heritage value of such sites through making their contents visible.

The general disturbance across the cleared land through ploughing is typical of the Australian rural landscape. It is likely to cause minor displacement of Aboriginal stone artefacts where they occur in creek side contexts, but without totally diminishing the heritage value of such objects.

4 Archaeological background

4.1 Archaeological reports in the local area

There are no previous archaeological reports available that specifically address land solely within the PAA or the locality generally. The Dubbo-Tamworth gas pipeline Aboriginal heritage report (JMCHM 1998) deals with a linear pipeline development which passed through the north-western corner of the PAA. The 2009–2010 survey report summarizes several archaeological reports relevant to the broader area, outside the PAA.

Pearson's PhD thesis (Pearson 1981) addressed Aboriginal settlement in the Cudgegong Valley and noted the common occurrence of Aboriginal stone artefact sites along the major creeks. This is typical of archaeological patterning in eastern NSW. The trend of Aboriginal sites and their association with water was noted in Koettig's Aboriginal heritage study for Dubbo Council in 1986 (Koettig 1986). Although limited to travelling stock routes and state forests, Koettig's sample surveys had identified the trend already well established in regional studies within the Hunter Valley and Sydney's Cumberland Plain.

An Aboriginal cultural heritage assessment of the Brigalow Belt South (BBS) was undertaken by the National Parks and Wildlife Service (NPWS 2002). Archaeological surveys were conducted within the Goonoo and Pilliga State Forests in 2000 with the results reported in an Appendix to the BBS study. Goonoo State Forest is the closest to the PAA, located 20 km to the north-west (NPWS 2002).

A total of 107 sites were recorded within the Goonoo State Forest as part of the BBS survey. These sites were primarily stone artefact sites (N=74 sites) comprising one or more flaked stone artefacts, 29 scarred trees and one grinding grooves site. No Aboriginal rockshelter sites were recorded. Mention was made by an Aboriginal participant of a burial within the forest. One natural source of ochre was identified which, despite the lack of evidence for extraction, may have been a suitable source for cultural purposes.

Most of the sites in the BBS study were found within the alluvial landforms, primarily within 200 m of watercourses. Eighty four per cent of sites were recorded within 200 m with the remainder scattered across other parts of the landscape. The largest stone artefact site recorded during the survey was 800 m in length along a forest track exposure. Most stone artefact sites comprised less than 50 artefacts. Only one site had more than 500 artefacts.

Only four sites were recorded on rocky elevated landforms, the remainder on alluvial and colluvial landforms close to water. This may reflect reduced ground visibility with increased distance to water, but is more likely due to quartz stone artefacts being obtrusive against a rocky ground surface regardless of actual soil visibility. The observed trend is likely to be a reliable indicator of differential site occurrence: sites occurring predominantly within 200 m of watercourses and rarely on rocky elevated ground.

A major linear survey of the Dubbo to Tamworth gas pipeline in 1998—1999 provided a view of Aboriginal site distribution (JMCHM 1998, 1999). Archaeological survey was conducted along a 300 km pipeline construction corridor which passes through the north-west part of the PAA. Of the 98 Aboriginal sites recorded, 56 were stone artefact sites comprising one or more stone artefacts, the other major site type being Aboriginal scarred trees (N = 36). Similar to the Goonoo Forest survey, most Aboriginal sites were found in close association with watercourses with 56% of stone artefact sites occurring within 200 m of watercourses, and the remaining number distributed variously up to 2 km from watercourses. Grinding grooves were also found on watercourses but other site types were not strongly associated with a particular part of the landscape.

4.2 Previously recorded sites

Searches of the Aboriginal Heritage Information Management System (AHIMS) register were conducted by ERM for the 2009–2010 (ERM 2011) assessment and again by EMM for the 2011–2012 (EMM 2012) assessment for the PAA and nearby areas.

The AHIMS search results indicate patchy site patterning because of the scarcity of surveys. In general, 'open camp sites' are located near creek systems, whilst scarred trees are found along side roads amongst old growth timber.

Analysis of the 279 Aboriginal sites (excluding the non-site type 'PAD') in the region generally surrounding the PAA from AHIMS revealed that 86% of recorded sites comprised one or more stone artefacts (14% were isolated finds) and 9% were modified trees (presumably scarred trees given the rarity of carved trees). Only six grinding groove sites were recorded regionally. Three sites with art were recorded in addition to a waterhole/well site, a fish trap site and a quarry site. In summary, stone artefact sites dominate the archaeological record and grinding groove sites have been surprisingly rarely recorded.

Prior to 2009 only 14 Aboriginal sites had been registered as occurring within the PAA: nine open stone artefact sites and five scarred tree sites. Of these, most are on the periphery of the PAA in non-impacted areas.

Sites cards for Aboriginal sites and elements of Aboriginal sites from the 2009–2010 survey were submitted to AHIMS separately. This has resulted in separate AHIMS registered site records for a 'Stone Artefact Concentration' (SAC) and a 'hearth' even where the hearth occurs within the boundaries of the SAC.

As a result of ERM's 2009–2010 survey, a total of 126 Aboriginal sites (several of which are separate elements within a common area) were recorded within the present PAA. Additional Aboriginal sites were recorded outside of the PAA as part of a broader study area which included a pipeline route extending to the east. This pipeline is no longer part of the Project.

As a result of EMM's 2011–2012 survey, a total of 229 Aboriginal sites were recorded within the present PAA. The most common site type identified was the open stone artefact site. These are summarised in Table 4.1 . For further information on survey results, refer to Section 6.1 in this report and Chapter 6 in the ACHA (EMM 2012).

Table 4.1 Aboriginal site type frequency within PAA

Site type	Number of sites
Open stone artefact	164
Scarred tree	25
Grinding grooves	18
Hearth	15
Rockshelter with PAD**	6
Rockshelter with artefact	1
Total	229

*Notes: ** Rockshelters with Potential Archaeological Deposit (PAD)*

5 Predictive model of site location

Surveys within the PAA have shown the artificial and ephemeral nature of open stone artefact sites and site boundaries. Open stone artefact sites in archaeologically sensitive areas are simply artificial windows into larger, partially hidden stone artefact distributions. Subsurface excavation is a means to demonstrate a continuous artefact assemblage beneath and between superficial artefact exposures.

The observations of the 2011–2012 EMM survey (EMM 2012) were based on point-mapped artefact location data and provided the basis for inferring a general broad continuous distribution of artefacts within 200 m of major watercourses and within 30 m of minor water courses. These inferred extents were identified as 'areas of archaeological sensitivity'. The survey demonstrated that artefacts do not occur everywhere within the environment; instead they occur consistently along major creeks, sporadically along the edges of the valley floors and along minor creeks, and rarely on the rocky slopes, ridgelines and minor drainage lines.

The test locations of this study predominately cover areas within 200 m of major and minor water courses and were predicted to follow the results of the survey. Test locations within 200 m of Laheys Creek, Sandy Creek, and Mebul Creek were predicted to demonstrate consistent artefact frequencies. Test locations within 30 m of the tributaries to Laheys Creek, Sandy Creek and Mebul Creek were predicted to demonstrate sporadic artefact frequencies.

The distributional model employed for the ACHA and this study has been confirmed by previous archaeological investigation in other regions. The results of the Oran Park and Turner Road Phase 2 archaeological excavations (AECOM 2009) provide evidence for a broad continuous distribution of archaeological deposit associated with watercourses in the local area. In areas more that 100 m from second order creeks, 200 m from third order creeks and 300 m from fourth order and greater creeks, archaeological deposit is not expected to occur. Put simply, this means if one digs near a creek, artefacts will be found within the soil; if one digs beyond a certain distance from a creek, it is more likely that there will be no artefacts within the soil. These results challenge the common practice of identifying isolated areas as PADs.

The distributional approach adopted here is not new within the discipline of archaeology. Foley (1981) advocated a continuous distributional approach to the archaeological record as an outcome of his ethno-archaeological observations in eastern Africa. Dunnell (1992) has expressed frustrations with the inadequacy of 'the notion site' to account for observations of expanding artefact distributions following erosion events. The off-site archaeology literature has described the archaeological landscape in terms of a continuum for several decades (eg Ebert's 1992 major work *Distributional Archaeology*). EMM has applied this well-established approach by defining specific boundaries around the extent of the distribution.

6 Methodology

6.1 Previous field survey of the PAA

6.1.1 2009–2010 survey

ERM (Tim Owen with Angie So) directed fieldwork over 24 days in October 2009 to February 2010 (ERM 2011). Fieldwork was conducted in summer months where temperatures regularly exceeded 40°C and therefore survey transects were limited to a maximum of 10 km. While access was limited from some properties, the extensive survey coverage provides an adequate basis for identifying broad site location patterns. The survey also extended approximately 15 km beyond the PAA to the east towards Ulan along the corridor of a previously planned pipeline which no longer forms part of the Project. A series of test excavations were also conducted permitted under section 75U(4) of the EP&A Act. Further details are described in Section 6.3.8 of the ACHA.

As a result of the 2009–2010 survey a total of 126 Aboriginal sites (several of which are separate elements within a common area) were recorded within the present PAA. Additional Aboriginal sites were recorded outside of the PAA as part of a broader study area including the pipeline route to the east.

6.1.2 2011–2012 assessment

EMM (Neville Baker with Rebecca Moore) directed fieldwork over 12 days from 31 October–11 November 2011 and 21–22 March 2012. Up to nine members of the Aboriginal community participated on each day.

The 2011–2012 assessment fieldwork was comprised of primarily pedestrian field transects across defined landform types supplemented by targeted inspections to test hypotheses about site location patterns which emerged from the survey results. The survey inspected all areas of ground within survey transects which were generally covered by survey participants spread out across a 50 m wide path where possible. A total of 35 discrete transects, each within a separate landform, were walked. In total, over 41 km was walked.

For the 2011–2012 assessment, landforms were generally divided into:

- watercourses – generally second order (Strahler system) and above including their near banks;
- valley floor, within the Sandy Creek – Talbragar River catchment;
- rocky slopes including outcrop and colluvial scree slopes;
- ridge top; and
- undulating ground – in the water pipeline area through the Cudgegong River catchment and generally in the south-western impact area in Mining Area B.

6.1.3 2011–2012 survey results

Most Aboriginal sites were located along the major watercourses of Sandy Creek and Laheys Creek. Of the 229 Aboriginal sites recorded within the PAA, 164 were open stone artefact sites, 25 were scarred trees, 18 were grinding groove sites, 15 were hearths and seven were rockshelters. Several of the hearths had been recorded within the boundaries of open stone artefact sites. Aboriginal flaked stone artefacts were the most common type of Aboriginal object.

The results of the 2011–2012 survey — based on point mapped artefact location data — provided the basis for inferring a general broad continuous distribution of artefacts within 200 m of the major watercourses and within 30 m of minor water courses. The current excavation program used this method to determine archaeologically sensitive areas.

6.2 Test excavation strategy

6.2.1 Overview

The first phase fieldwork to excavate the proposed geotechnical test pit and borehole locations within archaeologically sensitive areas was conducted 9–25 July 2012. This was performed by three archaeologists and several Aboriginal representatives numbering up to nine on certain days. A successive excavation program was conducted 2–18 October 2012 in association with additional geotechnical testing within archaeologically sensitive areas. A total of 36 test pits and 10 borehole test squares were excavated over both phases of fieldwork. Test locations are shown in Figures 7.10 and 7.11.

6.2.2 Test pit and borehole test square layout

The majority of geotechnical test locations were situated close to Laheys Creek and its tributaries and Sandy Creek to assist the engineering design of road crossings and construction within the MIA. Locations that fell within areas of archaeological sensitivity were test excavated. Geotechnical testing involves either bore holes of around 10 cm diameter to determine soil types at different depths, or test pits of around 0.6 m x 2.5 m dug by small excavator bucket to examine soil sections and take samples.

A total of 36 test pits, each 3 m x 1 m, and nine borehole test squares, each 1 m x 1 m, were excavated. Figure 1.1 provides the general locations of the excavated test pit and borehole test squares.

The majority of test pits and borehole test squares were located within 200 m of waterways. Other locations were in areas of moderate archaeological sensitivity based on the previous 2011–12 EMM survey (see Figure 7.10 and 7.11).

The tested areas were located predominantly on valley floors fronting the meandering Laheys Creek or its tributaries, and Sandy Creek. These locations were situated on very gentle inclines or flats, with occasional elevated areas (as seen at TP174/1 and TP173/1). These elevated areas had the most advantageous outlook over the surrounding valley floors and major creeks. Two borehole test square squares (BH37/1 & BH40/1) were situated on alluvial terraces close to Laheys Creek and were characterised by homogenous soil profiles caused by aggrading alluvial deposition.

Vegetation varied greatly over the study area, from extensive grass coverage to bare sandy flats with sporadic bushes and trees. The area surrounding the proposed infrastructure area featured grassed paddocks with eroded areas closer to the creek lines. Sparsely distributed grasses amongst native trees were observed south of the proposed infrastructure area (TP296/2 and TP426/2), adjacent to Laheys Creek. Vegetation alongside the first order creek south of Danabar Road (Test pits 355/2–358/2) was characterised by sparse grasses and bushes along a sandy flat. One test pit (TP280/2) was located within an oats crop paddock adjacent to Sandy Creek and showed clear plough marks that indicated extensively mixed soils.

6.2.3 Fieldwork methodology

The 3 m x 1 m test pits were divided into North, Centre, and South 1 m x 1 m squares aligned mostly on a north-south axis (see Photograph 6.1). Each 1 m x 1 m square was excavated and recorded separately, with artefacts placed in individual bags according to square and spit number.

Excavation proceeded by machine excavator monitored by archaeologists. With some exceptions, test pits were excavated in 10 cm spits. Test pits were not excavated past their culturally sterile spit layers. Each spit was excavated by machine and finished by hand with spade and trowel to refine square boundaries and remove any remaining soil. All pits were backfilled.

Borehole locations were excavated solely by hand in 1 m x 1 m squares. Borehole squares were excavated in the same bulk or spit layer approach outlined for the test pits.

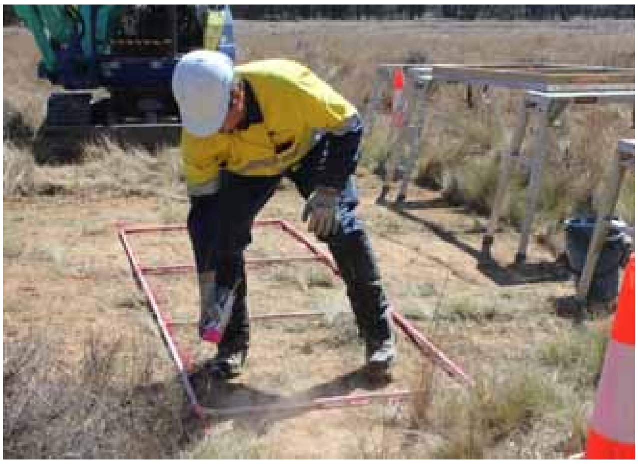
All excavated deposit was dry sieved through nested sieve screens of 5 mm aperture mesh. After sieving, all artefacts were washed and bagged on site for further recording.

Standard archaeological excavation and recording methodologies were also implemented during field excavation. These included:

- photographic recording of all phases of work on site, including soil profiles and general photographs of the landscape;
- soil profile drawings of each test pit; and
- the location, dimensions and characteristics of all test pit deposits recorded on standardised context recording sheets.

The excavation strategy was designed to detect the presence of Aboriginal stone artefacts within the topsoil of archaeologically sensitive areas, document artefact density per square metre, and identify the depth of artefacts within the soil.

The fieldwork photographs (Photograph 6.1 to Photograph 6.12) below illustrate stages in the test excavation process.



Photograph 6.1 **Test pit layout**

Photograph 6.2 **Excavating test pit**

Photograph 6.3 **Unloading to 5 mm sieve**

Photograph 6.4 **Hand excavation to finish spit**

Photograph 6.5 **Sieving**

Photograph 6.6 **Bagging artefacts**

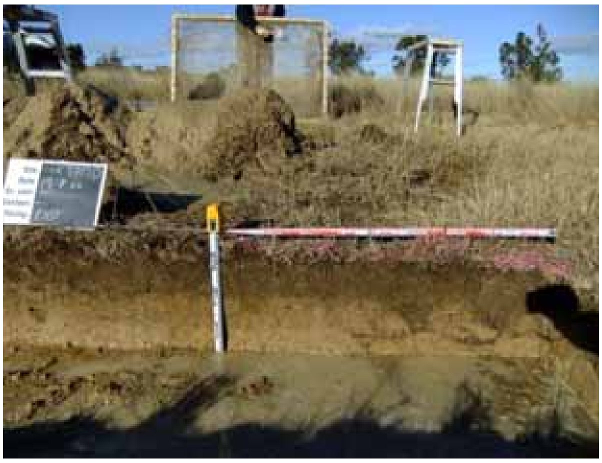
Photograph 6.7 Completed test pit

Photograph 6.8 Preparation for section drawing

Photograph 6.9 Soil sampling

Photograph 6.10 Backfilling

Photograph 6.11 Bore hole hand excavation



Photograph 6.12 Waterlogging in sandier pits

6.2.4 Identification of stone artefacts

Aboriginal stone artefacts were identified as stone objects with morphological features derived from past Aboriginal activity such as intentional fracture, abrasion or impact. Typically flaked stone artefacts are distinguished from naturally broken stone by recognition of certain fracture features. A clear marginal fracture initiation is normally observed on a flaked stone artefact (typically displayed in a bulb of force feature on the fracture surface, or distinct shattering at the point of impact) on highly siliceous stone types.

Context as well as morphology was considered to distinguish modern broken stone in machine impacted contexts. Morphological features included positive and negative flaking scars showing a distinct marginal point of force application. On brittle isotropic stone, such as chert, point of force applications were generally in the form of clear bulb of force emanating from a ring-crack sometimes with an eraillure scar and ripples on the surface of the flake that has been detached from the core (the ventral surface) (Figure 6.1). However, the majority of artefactual stone was quartz which, owing to its crystalline structure, is tough and mostly resists development of clear bulbs of force when flaked.

To ensure angular fragments of quartz were not identified as artefacts, specimens were mostly inspected for marginal fissures at fracture initiation points as well as signs of systematic flaking indicating that the object was the result of Aboriginal flaking rather than modern machine damage. Much of the quartz used for artefacts was distinguished from the background quartz gravel common through the area by its higher quality, with many artefacts of consistent glassy white, grey or grey quartz often sustaining good conchoidal fracture.

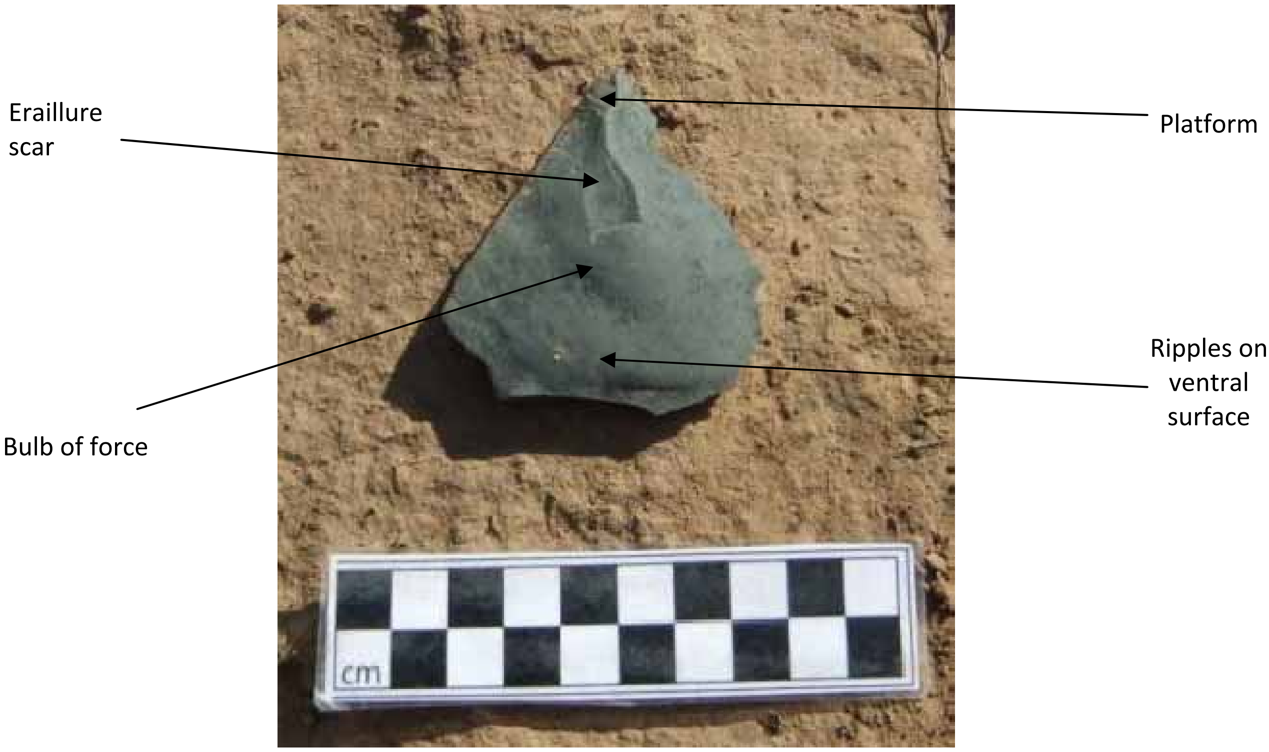


Figure 6.1 Characteristics of a typical stone flake

6.2.5 Aboriginal stone artefact recording and analysis

Stone artefact characteristics selected for recording were designed to contribute to a baseline description of the regional archaeology as outlined in the research themes of the ACHA (EMM 2012; Section 7.3.5). Basic artefact characteristics were a priority, including: artefact type, raw material type, maximum length, weight, and implement type if applicable. These variables sought to provide a general understanding of the archaeology that will assist in future archaeological investigation of the study area and region.

Aboriginal stone artefacts were recorded using a Microsoft Access database. Subsequent analysis involved querying the database of its records and rationalising data using Microsoft Excel pivot charts and tables. These methods allowed statistical representations of the artefacts to assist in describing general assemblage characteristics.

7 Test excavation results

7.1 Soils

Despite the test locations all occurring within the same landform, soils varied across the approximate 12 km stretch of land encountered during excavation. This section describes the soil profiles observed within test pits and borehole test squares. Labelled test locations are shown in Figures 7.10 and 7.11.

The soils in the test pits and borehole test square squares within the MIA typically comprised of homogenous topsoil overlying a clayey sand B horizon at approximately 30 cm depth. Topsoil was a moist, dark-brown silty-sand A1 horizon overlying a yellow grey sand A2 horizon with quartz and sandstone gravels throughout (Figure 7.1). At 30 cm depth, a sandy clay interface into the B horizon was often evident. Excavation down to true clay was not reached as the A and B horizon interface continued past the artefact bearing level. Rain events in the middle of 2012 (reaching 45 mm of precipitation) resulted in saturated soils during the July 2012 fieldwork, exacerbated by water flow though the topsoil which gradually filled test pits with water. October 2012 fieldwork did not encounter such saturation.

Tested locations in the southern extent of the MIA, south of an unnamed tributary leading into Laheys Creek (see TP170 to BH58/1 as an indication), were characterised by a dark-brown humic A1 horizon with a clear boundary onto yellow-brown A2 medium grained sand (Figure 7.2). Further south, TP84/1 was observed to have increasing quartz gravel content within its A2 horizon.

Four test pits (TP168/1, TP167/1, TP169/1, and TP381/2) were excavated south of Laheys Creek, adjacent to a minor tributary chain of ponds. Soil profiles were dark brown silty-sand topsoil, overlying a red-brown clayey-sand A2 horizon (Figure 7.3). Gravels of quartz and ironstone were found consistently from 20 cm of depth and suggested consistent saturation throughout.

TP166/1, located approximately one kilometre south-east of the MIA on the southern side of Laheys Creek, displayed soils that comprised of a silty sand topsoil with a gradual transition onto light brown sand (Figure 7.4). Quartz gravels were evident at 30 cm depth.

TP176/1, isolated from major creeks, was within a belt of moderate archaeological sensitivity that surrounded a portion of wooded area on a valley front. Soil profiles indicated silty sand topsoil overlying brown/grey mottled clayey sand with frequent gravels and degraded sandstone inclusions (Figure 7.5).

TP319/2 was isolated 800 m to the east of the MIA to the south of a bend of Laheys Creek. Ground surface was extremely compacted and comprised of a light brown clayey sand A horizon with 50% gravel inclusions. Clay and gravel content increased with depth, however true clay way not reached. TP320, 900 m to the east of TP319, demonstrated a similar soil profile.

TP426/2 was located in a strip of moderate archaeological sensitivity to the east of Spring Ridge Road. Soil was compact silty sand with moderate gravel content, charcoal inclusions, and degrading sandstone clusters forming towards the base of test pit.

TP280/2 was located within 200 m of Sandy Creek. The test pit was situated within an oats crop paddock with oat stalks ranging from 20–30 cm high above the surface. Topsoil here was a compact, light brown silty loam A horizon overlying a red brown B horizon at 30 cm depth. The topsoil here was extensively mixed as a result of field ploughing.

The cluster of four test pits (TP355/2 – TP358/2) to the north of the main infrastructure were also characterised by very dry light brown silty sand. Subsurface disturbance from large tree roots and burnt tree roots was evident in TP355/2 and TP358/2 (Figure 7.6). This area was characterised by extensive ground exposures with intermittent grasses, bushes, and trees.

TP444/2 was located in the southern portion of the PAA adjacent to Mebul Creek. Soils consisted of light brown silty sands with frequent large angular gravels ≤ 10 cm maximum length (Figure 7.7).

TP459/2 was located near tributary creek to Sandy Creek approximately 3.8 km northwest of the MIA. Topsoil here consisted of dark brown silty sand, changing to grey at 15 cm depth. The A and B horizon interface was encountered at 20 cm with soil colour changing from grey to orange. Charcoal flecks and bioturbation from grass roots were found consistently throughout the soil profile.

Alluvial deposits were encountered in BH40/1 and BH37/1. BH40/1 was situated on an alluvial terrace within 50 m of Sandy Creek and contained homogenous silty sands that continued beyond 40 cm of depth.

BH37/1 was located on an alluvial terrace adjacent to Laheys Creek and displayed a similar soil profile to BH40/1 (Figure 7.8). This contrasted with the nearby BH38/1 (corrected) that displayed an intact A horizon (Figure 7.9). BH38/1 was located on the opposite side of Laheys Creek to BH37/1 and did not show signs of extensive alluvial deposition such as that found in BH37/1.

7.2 Soil profiles

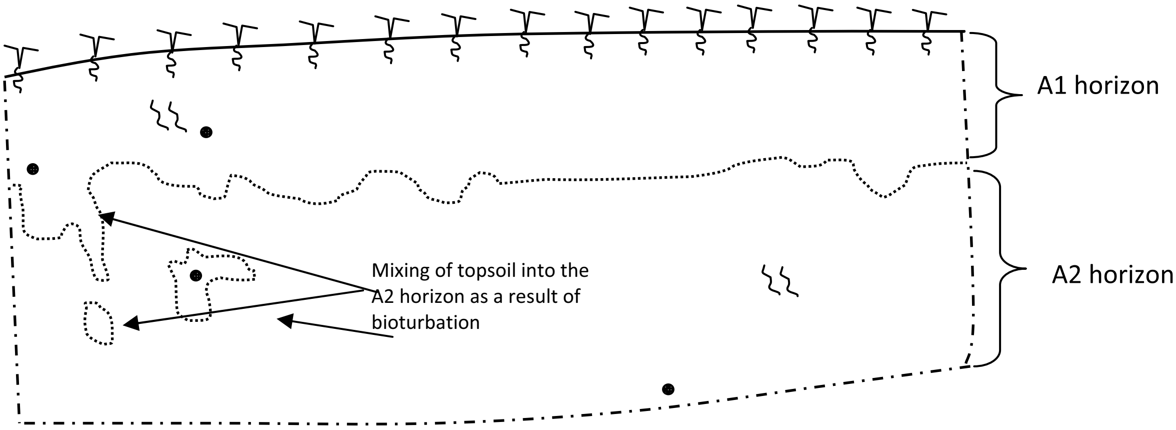


Figure 7.1 Soil profile of TP174/1. Typical soil profile of the MIA near Laheys Creek

Key

charcoal

Tree root

Grass

Grass roots

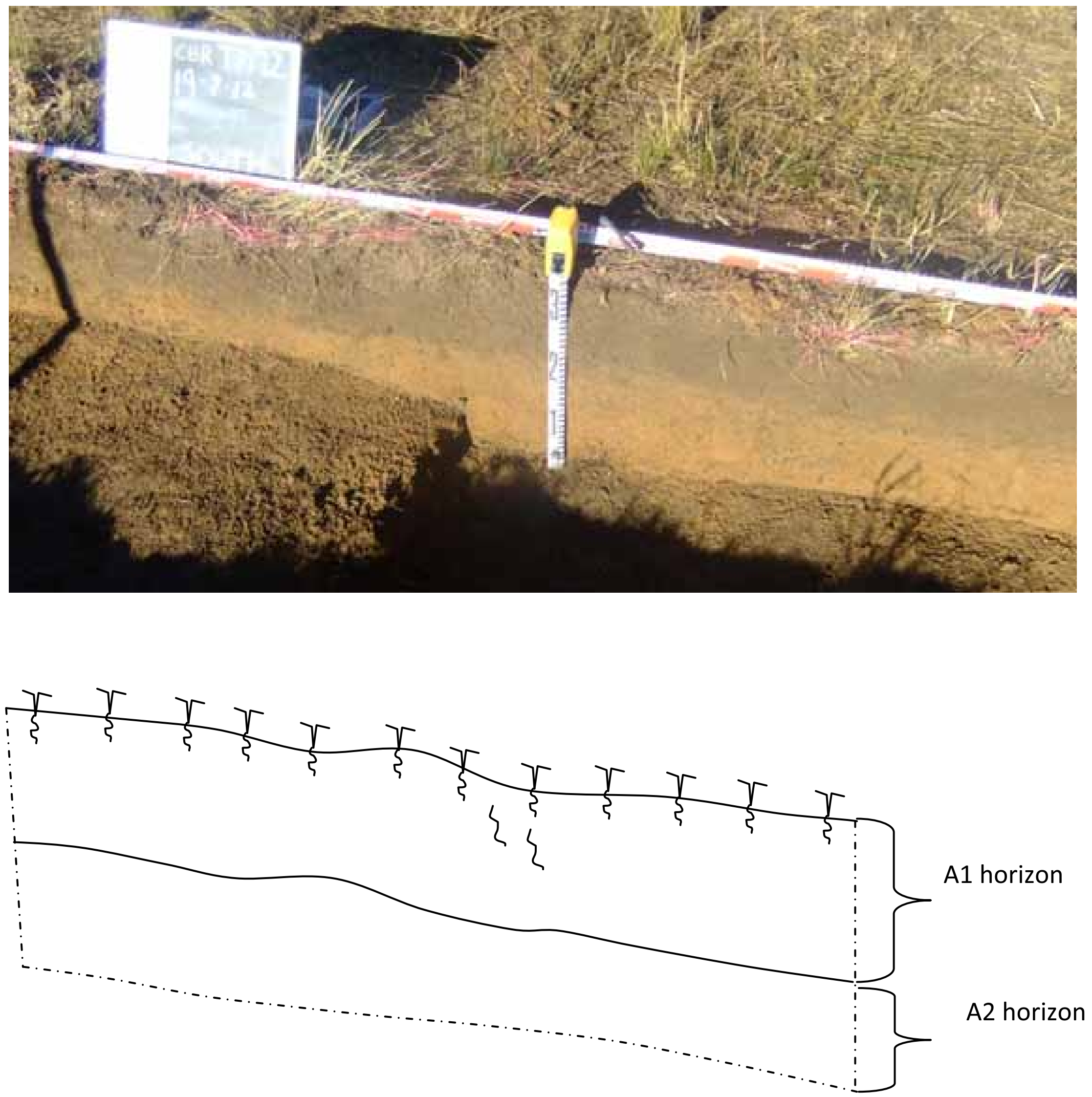


Figure 7.2 Soil profile of TP172/1. Note clear horizon of topsoil onto yellow-brown sand layer

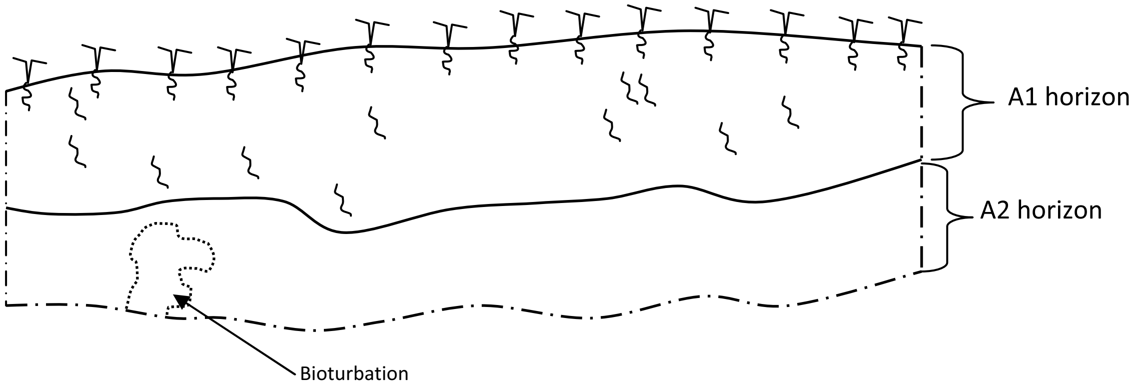


Figure 7.3 Soil profile of TP169/1

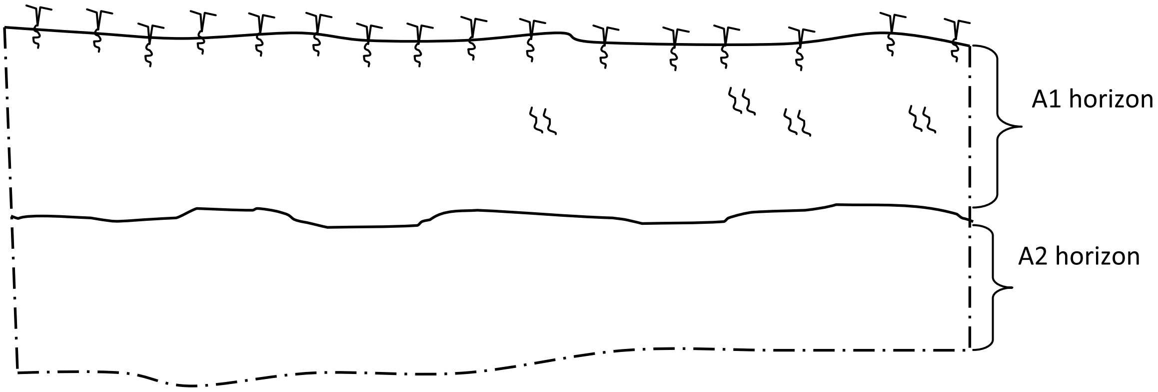


Figure 7.4 Soil profile of TP166/1

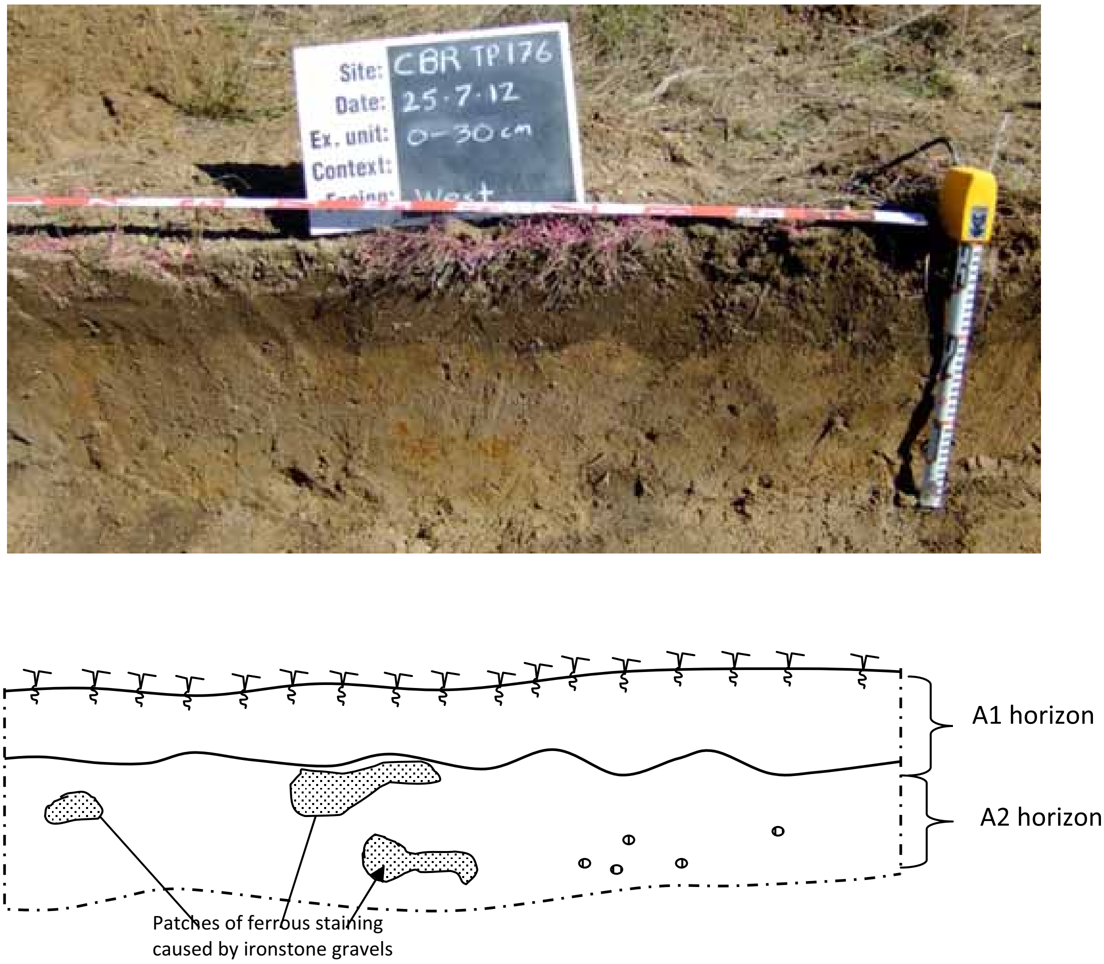


Figure 7.5 **Soil profile of TP176/1. Note the patches of ferrous staining caused by ironstone gravels throughout the A2 horizon**

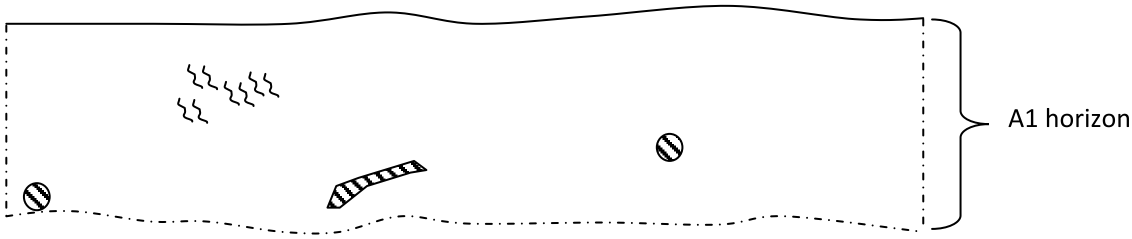


Figure 7.6 Soil profile of TP355. Note the frequent tree and grass roots disturbing the natural soil profile

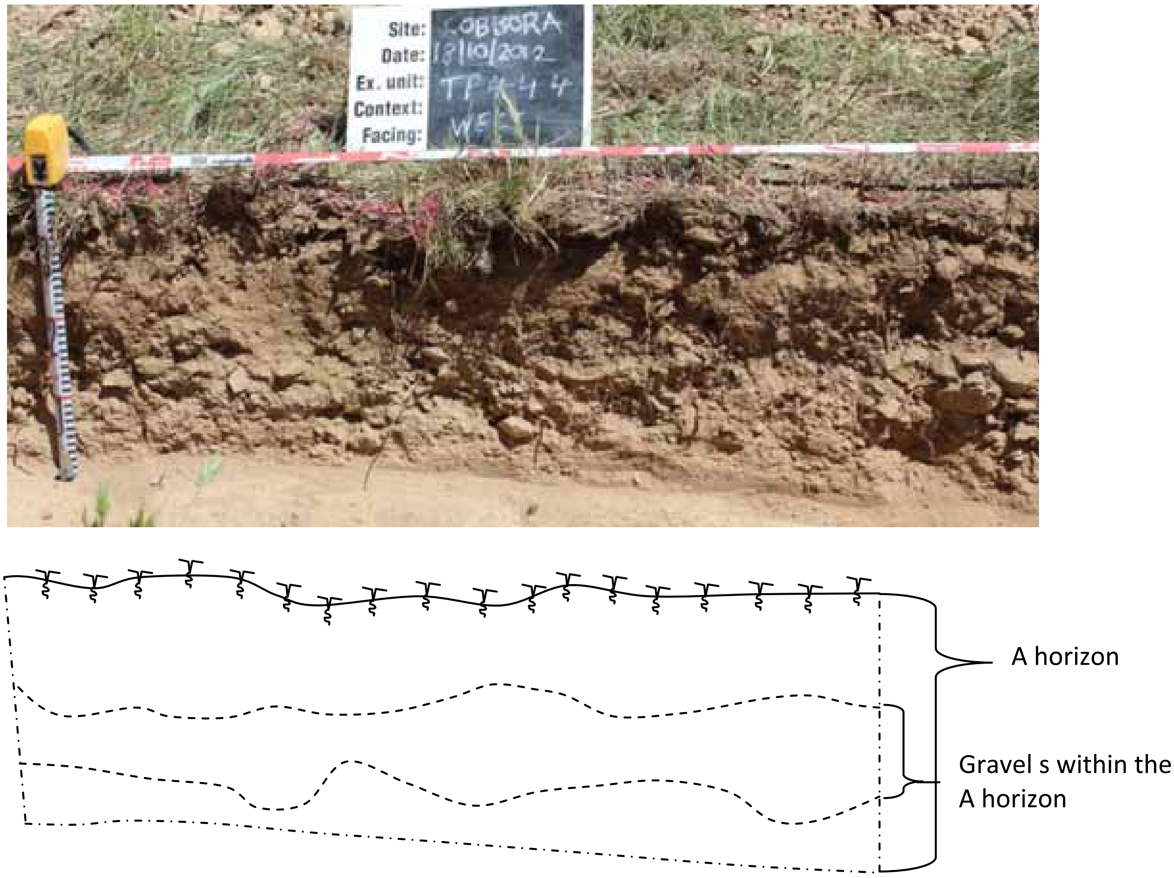


Figure 7.7 Soil profile of TP 444 showing frequent gravels within the soil matrix

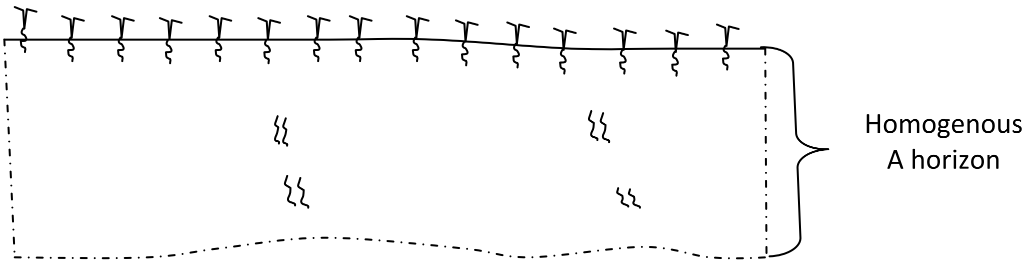


Figure 7.8 Soil profile of BH37/1. Note the homogenous A horizon that indicates an extensive alluvial deposit

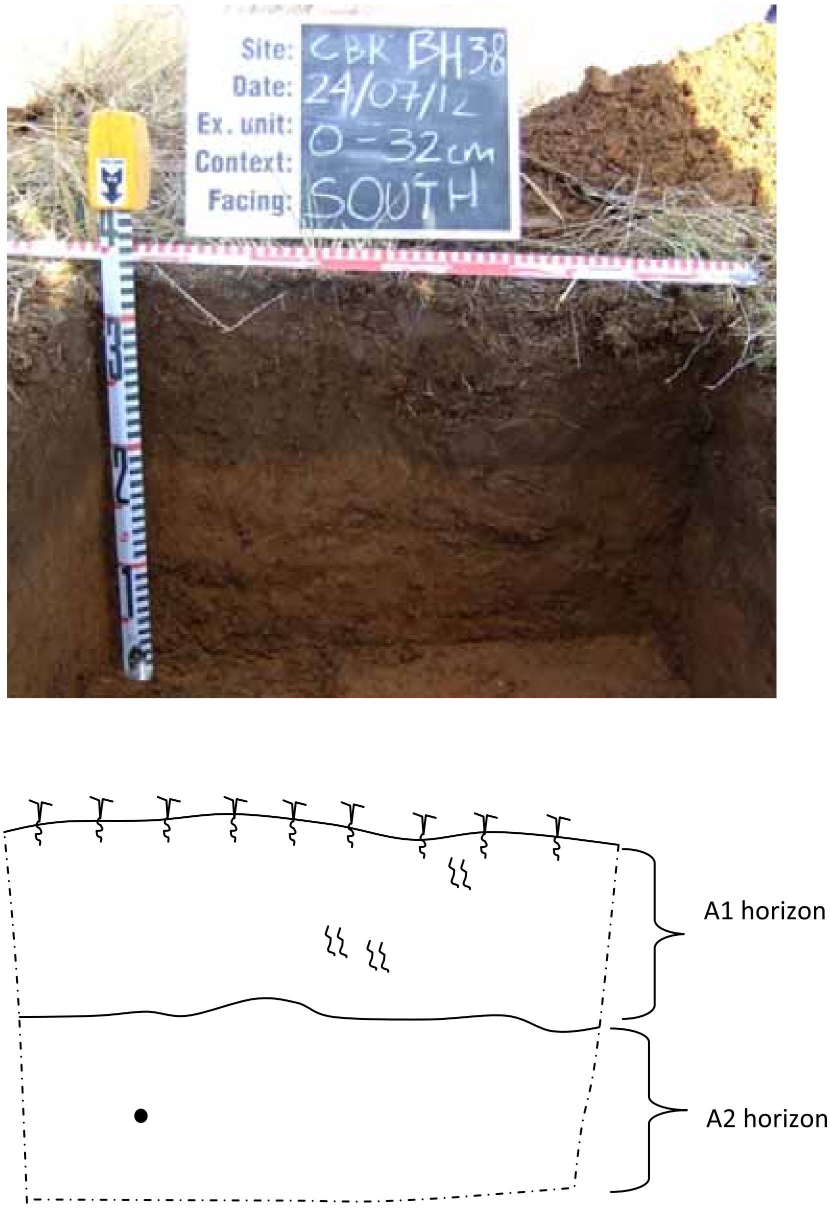


Figure 7.9 **Soil profile of BH38/1 (corrected). Note the clear horizontal boundary between A1 and A2 horizons**

7.3 Artefact frequencies

A total of 791 Aboriginal flaked stone artefacts were recovered, comprising of 745 from the 3 m x 1 m test pits and 46 from the borehole test squares. Artefacts were recovered from 32 of the 36 3 m x 1 m test pits excavated and from six of the 10 borehole test squares (comprised of nine 1 m x 1 m and one 50 cm x 50 cm test squares). As a whole, 89 of the 118 individual 1 m x 1 m squares excavated contained Aboriginal stone artefact/s. Figure 7.10 and Figure 7.11 provide test pit and borehole square locations and their artefact frequencies.

The majority of artefacts were recovered from the upper 20 cm of soil. Although excavation spits and final depths varied amongst individual squares, a total of 736 artefacts were recovered up to 20 cm depth, with the remainder of 55 artefacts recovered 20–40 cm depth. Overall, stone artefacts were largely confined to the topsoil, with excavation past 20 cm explored only if the artefact-bearing A horizon continued in depth.

Artefact frequencies within the 118 individual squares ranged from a minimum of zero artefacts to a maximum of 37 artefacts per 1 m x 1 m excavation unit. Test squares had an average of 6.7 artefacts and a median of four artefacts per 1 m x 1 m excavation unit. Table 7.1 provides the artefact frequencies for each 1 m x 1 m test square.

Table 7.1 Artefact frequency per 1 m x 1 m excavation unit

Location	Square	Artefact frequency	Total per location
TP84/1	Centre	1	
	North	3	
	South	4	8
TP79/2	Centre	8	
	North	10	
	South	10	**28**
TP79	Centre	6	
	North	11	
	South	15	**32**
TP77	Centre	4	
	North	3	
	South	13	**20**
TP71	Centre	4	
	North	4	
	South	6	**14**
TP70/2	Centre	3	
	North	2	
	South	4	**9**
TP69	Centre	6	
	North	11	
	South	15	**32**
TP68	Centre	6	
	North	10	
	South	8	**24**

Table 7.1 Artefact frequency per 1 m x 1 m excavation unit

Location	Square	Artefact frequency	Total per location
TP459/2	Centre	-	
	North	-	
	South	-	**-**
TP444/2	Centre	1	
	North	-	
	South	4	**5**
TP426/2	Centre	1	
	North	-	
	South	-	**1**
TP381/2	Centre	1	
	North	-	
	South	1	**2**
TP358/2	Centre	1	
	North	-	
	South	1	**2**
TP357/2	Centre	-	
	North	-	
	South	-	**-**
TP356/2	Centre	2	
	North	4	
	South	-	**6**
TP355/2	Centre	-	
	North	-	
	South	-	**-**
TP320/2	Centre	6	
	North	5	
	South	3	**14**
TP319/2	Centre	12	
	North	14	
	South	14	**40**
TP296/2	Centre	2	
	North	-	
	South	1	**3**
TP280/2	Centre	13	
	North	14	
	South	11	**38**
TP257/2	Centre	-	
	North	-	
	South	-	**-**

Table 7.1 Artefact frequency per 1 m x 1 m excavation unit

Location	Square	Artefact frequency	Total per location
TP176/1	Centre	4	
	North	4	
	South	-	**8**
TP175	Centre	16	
	North	6	
	South	5	**27**
TP174	Centre	37	
	North	33	
	South	34	**104**
TP173	Centre	27	
	North	29	
	South	21	**77**
TP172/2	Centre	2	
	North	3	
	South	7	**12**
TP172/1	Centre	-	
	North	-	
	South	2	**2**
TP171/1	Centre	3	
	North	2	
	South	-	**5**
TP170/1	Centre	10	
	North	5	
	South	15	**30**
TP169/1	Centre	4	
	North	7	
	South	4	**15**
TP168/1	Centre	4	
	North	4	
	South	5	**13**
TP167/1	Centre	5	
	North	1	
	South	-	**6**
TP166/1	Centre	26	
	North	31	
	South	17	**74**
TP112	Centre	1	
	North	1	
	South	10	**12**

Table 7.1 Artefact frequency per 1 m x 1 m excavation unit

Location	Square	Artefact frequency	Total per location
TP 171/2	Centre	-	
	North	-	
	South	2	**2**
TP 170/2	Centre	25	
	North	35	
	South	20	**80**
BH59/1	1 m x 1 m	3	**3**
BH58/1	1 m x 1 m	3	**3**
BH41/1	1 m x 1 m	8	**8**
BH40/1	1 m x 1 m	2	**2**
BH38/1 (Corrected)	50 cm x 50 cm	8	**8**
BH38/1	1 m x 1 m	-	**-**
BH37/1	1 m x 1 m	-	**-**
BH119/2	1 m x 1 m	-	**-**
BH117/2	1 m x 1 m	22	**22**
BH114/2	1 m x 1 m	-	**-**
	Total	**791**	
	Average frequency per 1 m x 1 m square	**7 (rounded)**	
	Median frequency per 1 m x 1 m square	**4**	
	Upper quartile frequency per 1 m x 1 m square	**10**	
	Lower quartile frequency per 1 m x 1 m square	**0 (rounded)**	

7.4 Artefact distribution across test locations

Artefact frequencies varied over the tested landscape. Artefact totals within each test pit and borehole square are described below.

A distinct concentration of artefacts was observed within the MIA on a slightly elevated rise close to the confluence of Laheys Creek and its unnamed tributary. Here the maximum frequency (104) of artefacts was found in TP174/1, followed by 80 artefacts in TP170/2 and 77 in TP173/1. Furthermore, BH117/2 (located between TP173/1 and TP174/1) contained 22 artefacts, well above the average of seven artefacts per square metre. All of the aforementioned test locations were situated within 100 m of each other on elevated areas and within 50 m of the confluence of Laheys Creek and its unnamed tributary.

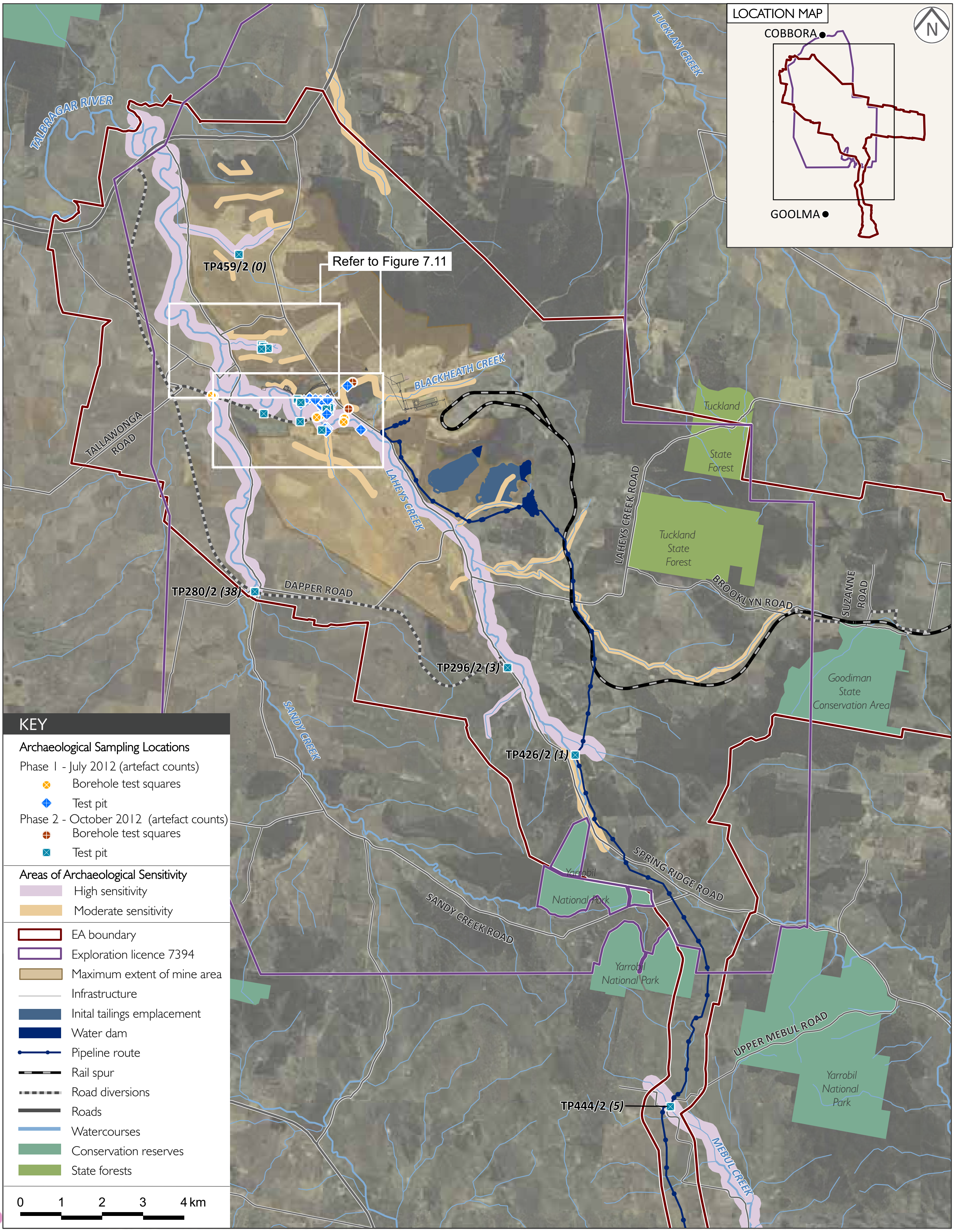
High artefact frequencies were not limited to one section of the study area. For example, TP166/1 (74 artefacts) and TP319/2 (40 artefacts) were isolated from the MIA but still within 200 m of Laheys Creek. TP280/2 (38 artefacts) — located within 100 m of Sandy Creek — contained 38 artefacts even though it was within the mixed soils of a ploughed oats crop paddock.

The borehole test square BH41/1 also contained above average artefact frequencies. This pit was located within 30 m of Sandy Creek and displayed a shallow and intact duplex soil profile. This contrasted with BH40/1 (two artefacts) located on an alluvial point bar feature within only 50 m on the opposite side of the creek. Here, the archaeological deposit had been disturbed by an aggrading alluvial deposit within an otherwise sensitive area (as indicated by BH41/1).

Low artefact densities below the average frequency of seven artefacts per 1 m x 1 m square were observed throughout the study area. Notably, testing along the first order creek south of Danabar Road (TP355/2-TP358/2) recovered considerably low artefact frequencies, with no artefacts recovered in TP357/2 and T355/2, and with six and two artefacts found in TP356 and TP358 respectively. Also, testing further south adjacent to Laheys Creek (TP296/2 and TP426/2), and Mebul Creek (TP444/2) retrieved similarly low frequencies of three, one, and five artefacts respectively.

There was a significant variation in artefact frequencies within a short distance in some test areas. For example, test pits TP84/1, TP172/1, TP172/2, and TP171/1 were within 200 m of the TP170/2 (which contained 80 artefacts) and yet contained artefacts well below the average frequency per 1 metre square (with these test pits not exceeding an average of four artefacts per 1 metre square. These pits were slightly further in distance from Laheys Creek, and clustered around its unnamed tributary. Such wide variation within a small area may be attributed to environmental factors such soil erosion from dynamic creek channels, variation in vegetation, or simply the preference of certain locations above others by past Aboriginal people.

Test excavation of the sandy soils north of Spring Ridge Road contained no artefacts (BH114/2 and BH119/2). Both these squares were located over 200 m away from of any major water course; however their archaeological sensitivity was assessed based on the 2011–2012 EMM survey, which suggested that artefacts occur irregularly in areas of moderate archaeological sensitivity.



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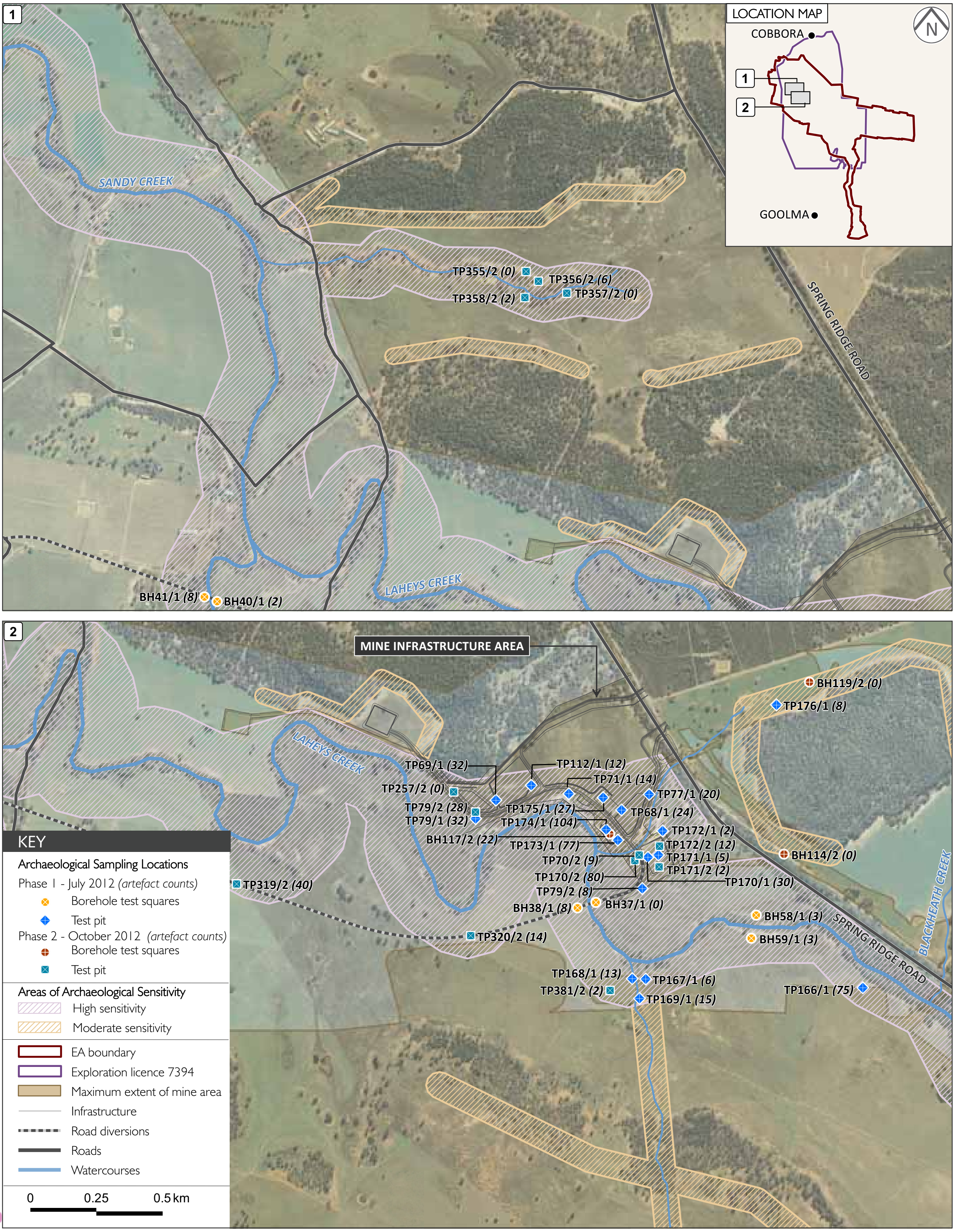
Archaeological Investigation Sites

Cobbora Coal Project - Aboriginal Heritage Assessment (Test Excavation Report)

Figure 7.10



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Archaeological Investigation Sites

Cobbora Coal Project - Aboriginal Heritage Assessment (Test Excavation Report)

Figure 7.11

7.5 Artefact raw materials

Quartz was the predominant raw material recovered from the study area, and made up 85% of artefacts in the test pits. The quality of the quartz material ranged from homogenous varieties that featured typical conchoidal fracture characteristics, to material characterized by numerous flaws and incipient fracture planes. Quartz colour ranged from white-opaque to clear crystal-like material (Photograph 7.1). Quartz is a locally available resource as eroded pebbles from the Dunedoo formation in many of the rocky ridge areas and locally as outcrop.

Photograph 7.1 **Quartz material in its varying qualities: from opaque with numerous fracture planes, to clear isotropic forms**

Indurated mudstone/tuff (IMT) made up 3.5% of recovered material. IMT material was typically of high quality, being isotropic and highly siliceous to the point of exhibiting a waxy surface in some instances. Chert artefacts were recovered in low quantities followed by chalcedony, quartzite, silcrete and volcanic material (see Photograph 7.2). Figure 7.12 provides artefact raw material types and their frequencies.

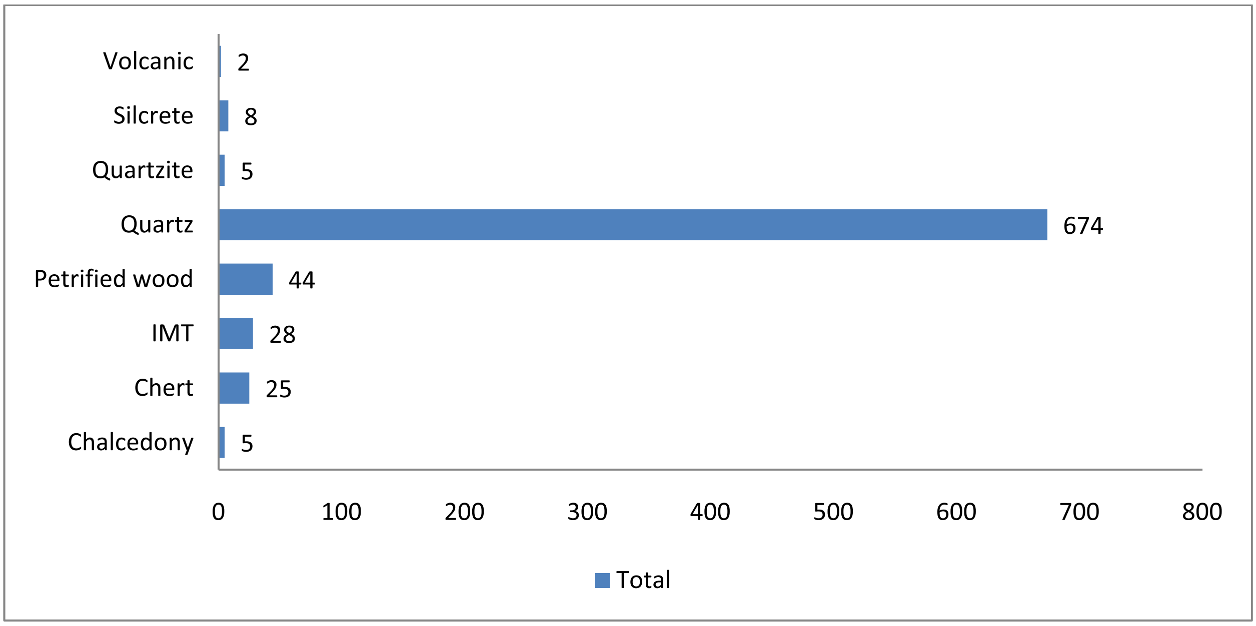

Figure 7.12 Raw material types

7.6 Artefact types

7.6.1 Technological types

Artefact types were primarily in the form of debitage as a by-product of stone tool manufacture. This included a range of broken flake fragments, cores, and complete flakes (see Photograph 7.5 for examples). Of the 791 artefacts recovered from test pits, 18 retouched flakes were identified (2.3%). The frequency of each artefact type across all test pits is provided in 7.13.

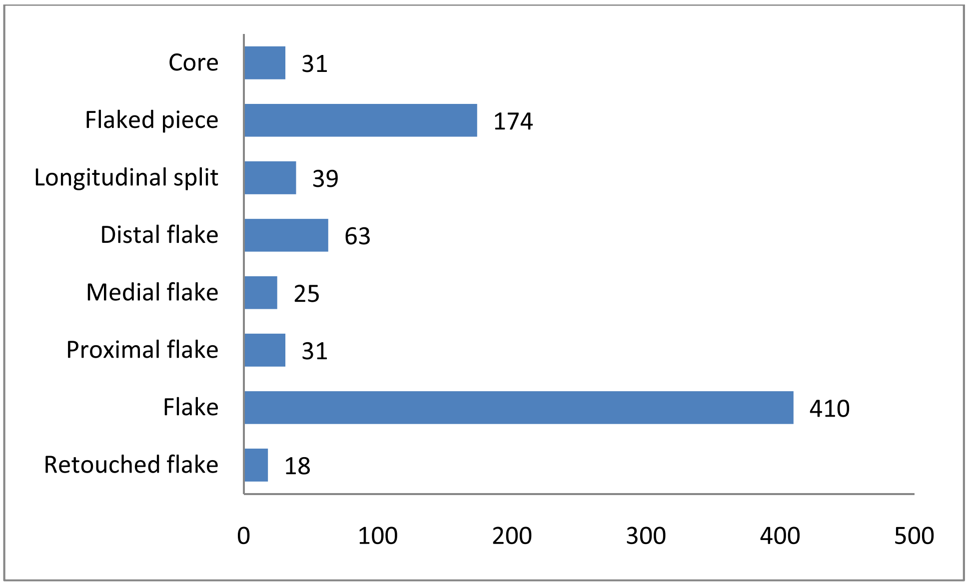

Figure 7.13 Artefact technological types

Photograph 7.2 Complete flakes of varying material types (from left to right: IMT, volcanic, IMT, quartz, chert, chalcedony and quartz)

Complete stone flakes were the predominant artefact type identified in the test pits (52%) followed by flaked pieces (23%). A flaked piece can broadly be described as 'flaking debris lacking features diagnostic or deliberate conchoidal or wedging fracture' (Holdaway & Stern 2004, p.113), ie manufactured stone material that cannot be placed within a more specific flake attribute category. This is usually determined by the inability to identify the last ventral surface on a stone artefact. The term 'flaked piece' is particularly applicable to some of the quartz recovered because of the materials' tendency to fracture in indistinct ways.

A total of 31 stone cores were identified, 23 of quartz and two of IMT. One IMT core of high quality (ID282) indicated extensive reduction with multidirectional flake scars (see Photograph 7.3 Photograph 7.4 for examples of cores).

Furthermore, complete flakes were the most common technological type for each raw material type. (Table 7.2). For example, half of the quartz artefacts (50%) recovered were complete flakes, while only 12% of the artefacts were broken flakes. Complete flakes were also the most frequent type of artefact in all other raw materials recovered.

Table 7.2 Raw material frequency for each technological type

	Core	Distal flake	Flake	Flaked piece	Longitudinal split	Medial flake	Proximal flake	Retouched flake	Total
Chalcedony	-	-	4	1	-	-	-	-	**5**
Chert	1	1	16	-	3	-	-	4	**25**
IMT	3	1	16	4	1	3	-	-	**28**
Petrified wood	1	3	28	4	3	2	-	3	**44**
Quartz	26	56	339	162	32	20	30	9	**674**
Quartzite	-	1	2	1	-	-	-	1	**5**
Silcrete	-	1	4	1	-	-	1	1	**8**
Volcanic	-	-	1	1	-	-	-	-	**2**
Total	**31**	**63**	**410**	**174**	**39**	**25**	**31**	**18**	**791**

Photograph 7.3 Examples of cores

An IMT core with a blade scar (left), a quartz core (centre) and a heavily reduced IMT core (right)

Photograph 7.4 IMT core and a quartz bipolar core

Photograph 7.5 Various forms of stone artefact debitage

7.6.2 Implement types

A total of 17 retouched implements were recovered from 10 test pits. Their occurrence generally corresponded to those test pits which had the highest overall artefact frequencies. A maximum frequency of four implements was recovered from TP166/1 and TP170/2, followed by three in TP174/1. The remaining test pits had two or less implements. Table 7.3 provides the frequency and distribution of implements across test locations.

Table 7.3 Frequency and distribution of implements

	Incomplete backed artefact	Bondi point	Geometric microlith	Scraper	Total
BH117/2	-	1	-	-	**1**
TP 170/2	-	2	-	2	**4**
TP166/1	-	2	-	1	**3**
TP168/1	-	1	-	-	**1**
TP173/1	-	-	-	1	**1**
TP174/1	1	-	1	-	**2**
TP280/2	1	-	-	-	**1**
TP319/2	-	1	-	-	**1**
TP320/2	-	1	-	-	**1**
TP444/2	-	1	-	-	**1**
TP68/1	-	-	-	1	**1**
Total	**2**	**9**	**1**	**5**	**17**

Over half of the implements were backed artefacts (Photograph 7.6), with Bondi points being the most common type. One Geometric microlith was located in TP174/1. Two flakes with signs of backing were identified, however could not be placed within a more specific category.

A total of five scrapers were identified from four of the test pits (Photograph 7.7). Scrapers were identified as flakes with one or more margins of continuous retouch. The scrapers can further be refined to steep-edged scrapers — characterised by short, robust edges that are both steep and stepped (Holdaway & Stern, 2004, p. 230).

Quartz material made up 52% of implements, followed by chert and petrified wood (Table 7.4). This contrasts with the overall assemblage ratios, as quartz comprised 85% of the test pit assemblage. It is possible that other more isotropic and siliceous materials (such as chert) were rarer in availability and therefore utilised more efficiently for the manufacture of implements. It was obvious that quartz was the most abundant resource in the area, as quartz pebbles were observed throughout the excavation program. Other material types did not appear as readily available resources throughout the landscape. This suggests that material types other than quartz were imported into the landscape from distant sources.

Table 7.4 Implement raw material types

	Chert	Petrified wood	Quartz	IMT	Total
Backed	1		1		**2**
Bondi point	1	2	5	1	**9**
Geometric microlith			1		**1**
Scraper	2	1	2		**5**
Total	**4**	**3**	**9**	**1**	**17**

Photograph 7.6 Examples of Bondi points and one Geometric microlith (right).

Photograph 7.7 Steep-edged scrapers of quartz and IMT material

7.7 Artefact size and weight

Artefact size and weight provide insight into the reduction stages of the stone tool manufacture process. High frequencies of small artefacts indicate extensive stone artefact reduction, while larger artefacts may indicate a stone artefact in its initial stages of reduction. Size and weight also indicate what types of implements were sought after during a knapping event. For example, numerous small blade flakes may indicate Bondi point production, while larger flakes may have been used to create tools such as scrapers.

Complete flakes recovered from test pits had a median length of 18 mm and a median weight of 1 g. Cores were typically larger, with a median length of 32 mm and a median weight of 16.3 g. Flaked pieces had a median length of 14 mm and a median weight of 0.6 g. The remaining broken artefacts — including flake fragments, and longitudinal splits — had a median length of 16 mm and a median weight of 0.7 g.

Implements had a median length of 20 mm and ranged from 10 mm to 39 mm. Implement weight ranged from 0.1 g to 21.9 g, with a median of 0.5 g. The larger implements were scrapers made of quartz and chert, while the smaller implements were comprised of backed artefacts including Bondi points and a Geometric microlith.

8 Discussion

8.1 Artefact distribution

Archaeological survey (involving only identification of surface artefacts) and excavation (involving subsurface investigation of artefacts) have provided data further contributing to the archaeological description of the PAA. Both the previous surveys and the test excavation found that the greatest concentrations of artefacts were centred on the MIA near Laheys Creek and Springs Ridge Road. Consequently, some of the following observations have considered both survey and excavation results.

Firstly, the excavation results confirm the survey observations of a quartz-rich stone artefact assemblage in the areas tested along valley floors close to major creeks. The archaeologically sensitive areas hypothesized from survey results were confirmed from test excavation. Archaeological reports in the local area also observed the common occurrence of artefacts along major creeks. In every instance, Aboriginal sites and stone artefact densities were at their highest frequency within 200 m of major watercourses, and the results from this investigation follows suit (Pearson 1981, Koettig 1986, NPWS 2002, JMCHM 1998, 1999).

Subsurface test excavation, however, has gone beyond surface-only survey observations in terms of the concept of 'spatially constrained sites.' As discussed in Chapter 6 of the ACHA, open stone artefact sites (those sites commonly identified by archaeological survey) in highly sensitive areas are simply artificial windows into a larger, partially hidden stone artefact distribution. The test excavation has demonstrated that an extensive subsurface assemblage of stone artefacts exists in the highly sensitive areas identified. The number of 'sites' gleaned from survey is therefore a poor guide to the richness or otherwise of Aboriginal heritage in an archaeologically sensitive area. The test excavation was only limited in its sampling strategy, which was predetermined by geotechnical testing locations. Nevertheless, it provided a means to confirm the presence of artefacts in sensitive areas.

8.2 Assemblage characteristics

Both survey and excavation results demonstrated a quartz-rich stone artefact assemblage distributed along major creeks and valley floors. The vast majority of artefacts related to debitage from stone tool manufacture, and it is therefore considered that the study area consists of extensive open camp sites. Although Quartz material dominated the assemblage, over half of the implements recovered were procured from petrified wood, IMT or chert. As no outcrops of these materials were noticed in the local area, it suggests that these materials may have been accessed through trade or importation.

Implements including backed tools and scrapers can be used as chronological markers for the local areas. In Australia, backed tools including Bondi points and Geometric microliths are typical of assemblages dating to the Holocene. The precise function of Bondi pints and other backed artefacts is not known, but one possible use was the replaceable components of armatures.

Evidence of scrapers was also identified from the assemblage. The presence of scrapers generally indicates the manufacture of tools for wood-working.

9 Conclusion

9.1 Summary of archaeology

The Aboriginal stone artefact assemblage be summarised thus:

- 791 Aboriginal stone artefacts were identified in 89 of the 118 individual 1 m x 1 m squares;
- the majority (94%) of stone artefacts related to debitage from stone tool manufacture;
- artefacts were mostly confined to the first 20 cm of soil (98% of artefacts). Occasionally artefacts were recovered from 20 – 40 cm, depending on specific soil profiles;
- artefact frequencies per 1 m x 1 m square ranged from 37 to zero. The median artefact frequency was four artefacts per 1 m x 1 m, and the average frequency was 6.7 artefacts per 1 m x 1 m;
- the highest densities of artefacts were associated with a minor valley elevation close to the confluence of Laheys Creek and its unnamed tributary — with 104 artefacts recovered from TP174/1, 80 from TP170/2 and 77 artefacts recovered from TP173/1 (according to their 3 m x 1 m sample size).
- Other tested areas, — such as those associated with minor tributaries (e.g. test pits TP355/2-TP358/2) — revealed lower archaeological sensitivity, with eight test locations containing no artefacts;
- quartz dominated the assemblage, making up 85% of artefacts. Complete quartz flakes made up the majority of artefact types and was an abundant resource in the local landscape. Despite this, over half of the implements recovered were of other raw materials types; and
- 17 diagnostic implement types were found. These included: Bondi points, scrapers, and a Geometric microlith.

9.2 Implications

The test excavations described here confirm the model of archaeologically sensitive areas developed in the ACHA. Prior to the test excavation the model had been hypothetical in nature, relying on archaeological inference based on a consistent occurrence of stone artefacts in ground exposures within certain parts of the landscape. The confirmation moves the model from *inferential* to *theoretical*. The model remains *theoretical* in nature because although it is supported by crucial confirmation, it remains capable of falsification as more is excavated.

The consistent occurrence of stone artefacts within the upper 20 cm of soil along areas of Laheys Creek investigated for this test excavation confirm the previous identified Aboriginal heritage significance of the area and, by implication, the comparable area associated with Sandy Creek. The patchy and inconsistent distribution within areas of moderate archaeological sensitivity is also confirmed by these results.

The extensive subsurface distributions identified in the area will be further investigated during the course of proposed salvage excavations described in a forthcoming Aboriginal Heritage Management Plan. The Aboriginal stone artefacts recovered will be stored in the proposed Keeping Place for the Project.

Perhaps the most critical implication of this work is the lie that it puts to the implicit notion so common in Aboriginal heritage assessment that *open stone artefact sites* are discrete entities, each with independent significance and values. The ACHA has adopted this approach for the sake of orthodoxy. However the ACHA also argues that stone artefacts occur in more or less continuous *distributions* associated with water and other strategic landscape contexts. If these stone artefact distributions may be compared to icebergs, then stone artefact “sites” are merely the tips of a much larger iceberg hidden below the surface. It follows from this analogy that Aboriginal heritage assessments, and the various economic or social impact assessments that follow, should consider more the value of the greater subsurface distribution, and focus less on quantifying numbers of sites impacted or not impacted – such numbers can vary depending on the state of erosion or degree of vegetation growth over an extensive artefact distribution. However, the view that “distributions” should be considered in preference to “sites” is currently less than orthodox given the continued reliance of archaeological assessment on surface archaeological survey over the more labour intensive and hence more expensive archaeological excavation.

Glossary of Terms

Aboriginal object: A physical manifestation of past Aboriginal activity. The legal term is defined in the *National Parks and Wildlife Act* 1974 section 5 as:

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

Typical examples include stone artefacts, grinding grooves, Aboriginal rockshelters which by definition include physical evidence of occupation, midden shell, hearths, stone arrangements and other landscape features which derive from past Aboriginal activity.

Aboriginal scarred tree: A tree of sufficient age to have been mature at the time of traditional Aboriginal hunter-gatherer life and therefore generally of more than 220 years age with evidence of bark or cambium wood removal for the purpose of implement manufacture, footholds, bark sheet removal for shelter, or extraction of animals or other food. Care must be taken to distinguish Aboriginal scars from the much more common natural causes of branch tear, insect attack, animal impact, lightning strike and dieback. Scarred tree recognition guidelines exist to distinguish these features. Naturally scarred trees are often misidentified as Aboriginal scarred trees.

Aboriginal site: The location where a person in the present day can observe one or more Aboriginal objects. The boundaries of a site are limited to the extent of the observed evidence. A 'site' does not include the assumed extent of unobserved Aboriginal objects (such as archaeological deposit).

Different archaeologists can have varying definitions of a 'site' and may use the term to reflect the assumed extent of past Aboriginal activity beyond visible Aboriginal objects. Such use of the term risks defining all of Australia as a single 'site'.

Aboriginal stone artefact: A stone object with morphological features derived from past Aboriginal activity such as intentional fracture, abrasion or impact. Artefacts are distinguished by morphology and context. Typically flaked stone artefacts are distinguished from naturally broken stone by recognition of clear marginal fracture initiation (typically herzian/conchoidal or wedging initiation) on highly siliceous stone types which can often be exotic to the area. Care must be taken to distinguish modern broken stone in machine impacted contexts and therefore context must be carefully considered as well as morphology.

AHIMS: Aboriginal Heritage Information Management System – a computer software system employed by the Office of Environment and Heritage to manage many aspects of Aboriginal site recording and permitting. AHIMS includes an Aboriginal sites database which can be accessed via an internet portal.

Archaeological deposit: Aboriginal objects occurring within one or more soil strata. The most common form of archaeological deposit relates to the presence of a single conflated layer of Aboriginal stone artefacts worked into the topsoil through bioturbation.

Backed artefact: A thin flake or blade-flake that has been shaped by secondary flaking (retouch) along one lateral margin. The retouched margin is typically steep and bipolar to form a blunt 'back' in the manner of a modern scalpel blade. Distinctive symmetrical and asymmetrical forms are typically found called Geometric microliths and Bondi points respectively. A thick symmetrical form, called an *elouera*, is typically the size of a mandarin segment.

Bondi point: See *backed artefact* definition.

Carved tree: A tree with carved designs in the bark or outer wood typically in contexts associated with ceremonial sites or burials. These are exceptionally rare.

Conchoidal: A term used in relation to fracture surfaces on Aboriginal stone artefacts **-** bulb-like in the manner of a bulbous protrusion on a bivalve shell.

Core: A nodule of siliceous rock in which flakes are removed from using a hammerstone. Cores are the primary material used in stone tool manufacture.

Cylcon: Cylindro-conical stone.

Debitage: Flaked stone material produced as a by-product of stone tool manufacture.

Distal flake: A broken flake that has retained its termination.

Elouera: See *backed artefact* definition.

Eraillure scar: The small flake scar on the dorsal side of a flake next to the platform. It is the result of rebounding force during percussion flaking.

Flake: A sharp edge sliver of stone primarily used to produce stone tools. Flakes are removed from cores by being struck with a harder stone known as a hammerstone. A flake can be divided into its proximal, medial and distal portions (see proximal flake, medial flake, and distal flake).

Flaked piece: 'Flaking debris lacking features diagnostic or deliberate conchoidal or wedging fracture' (Holdaway & Stern 2004, p.113), or to be put simply: manufactured stone material that cannot be placed within a more specific flake attribute category. This is usually determined by the inability to identify the last ventral surface on a stone artefact.

Geometric microlith: See *backed artefact* definition.

Grinding grooves: Grinding grooves typically derive from the sharpening of stone hatchet heads on sandstone rock. Grooves appear as elliptical depressions of around 25 cm length with smooth bases. Although mostly occurring in association with water to wash the abraded stone dust away from the groove, such sites have been recorded away from water. Narrow grooves or broad abraded areas may occur less commonly and may be derived from spear sharpening or other grinding activities.

Hammerstone: A rock or mineral used to detach a stone flake from a core. A hammerstone must be of a harder material than the subject core which it strikes to produce flaked material.

Holocene: A period of time generally 10,000 years, which marks the end of the last ice age, to the present.

Isotropic: Having a physical property that has the same value when measured in different directions. In relation to stone used for stone tools a fracture path is not hindered by layer boundaries or other favoured plane of cleavage.

IMT: The term IMT is used to describe material which can be either indurated mudstone or tuff. Until more is known about the range of lithologies in this group of rocks, and the ways are developed to distinguish them, the term 'IMT' is an acceptable alternative to the term 'mudstone' as description for fine-grained and fine-textured rocks (Hughes et al 2011).

Knap/Knapping: The act of striking a hammerstone against a core in the process of stone tool manufacture.

Longitudinal split: A stone flake that has been split along its axis of percussion during a knapping event.

Medial flake: A broken flake with evidence of right and left lateral margins, however lacking both a platform and termination.

Open stone artefact site/stone artefact site: An unenclosed area where Aboriginal stone artefacts occur – typically exposed from a topsoil archaeological deposit by erosion. Typically the term is used to refer to two or more artefacts although this is an arbitrary distinction. A general 'rule of thumb' boundary definition employed by archaeologists is that artefacts or features more than 50 m apart are regarded as separate sites, however there is no theoretical imperative dictating such as rule. (The 50 m separation rule is used for the most part in EMM's work).

Pleistocene: A period of time 2.6 million years ago to 10,000 years ago. Reference to 'Pleistocene sites' generally means reference to sites older than 10,000 years.

Potential archaeological deposit (PAD): An area where there is an inferred presence of Aboriginal objects within the soil based on the environmental context which is typically associated with discovery of Aboriginal objects in analogous areas. This is not strictly a 'site' type, although AHIMS records it as such for the purpose of associating Aboriginal heritage Impact Permits with geographical areas.

Proximal flake: A broken flake that has retained its striking platform (from where the fracture was initiated).

Retouched flake: A flake with evidence of successive flaking along one or more of its lateral margins. Retouched flakes are indicators of stone implement manufacture.

Scraper: A flake with steep unidirectional retouch around a convex working edge.

Well: Various features have been described as wells including isolated deep ground depressions dug out to provide reliable water or depressions in rock which have been artificially expanded by abrasion or pecking.

Acronyms

Abbreviation	Full term
ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
am	Morning
BBS	Brigalow Belt South biogeographic region
CHC	Cobbora Holding Company Pty Limited
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation
DECCW	Department of Environment, Climate Change and Water
DGRs	Director General's environmental assessment requirements
DLALC	Dubbo Local Aboriginal Land Council
EA	Environmental assessment
EMM	EMGA Mitchell McLennan Pty Limited
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ERM	Environmental Resources Management Australia Pty Ltd
g	Grams
GAC	Gallanggabang Aboriginal Corporation
GIS	Geographic Information System
GPS	Global Positioning System
ICOMOs	International Council on Monuments and Sites
km	Kilometres
m	Metres
mm	Millimetres
MAC	Mingaan Aboriginal Corporation
MGATSIC	Murong Gialinga Aboriginal & Torres Strait Islander Corporation
MIA	Mine Infrastructure Area
MLALC	Mudgee Local Aboriginal Land Council
NEWCO	North-East Wiraduri Co Ltd
NPWS	National Parks and Wildlife Service
NTSCorp	Native Title Services Corporation
OEH	Office of Environment and Heritage
PAA	Project Application Area
PAD	Potential archaeological deposit
PEA	Preliminary environmental assessment
pm	Afternoon
RAP	Registered Aboriginal party
SAC	Stone artefact concentration
SWS	South Western Slopes biogeographic region
The Project	Cobbora Coal Project
WDD	Wirrimbah Direct Descendants
WNTCAC	Warrabinga Native Title Claimants Aboriginal Corporation
WVW	Wellington Valley Wiradjuri Aboriginal Corporation

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