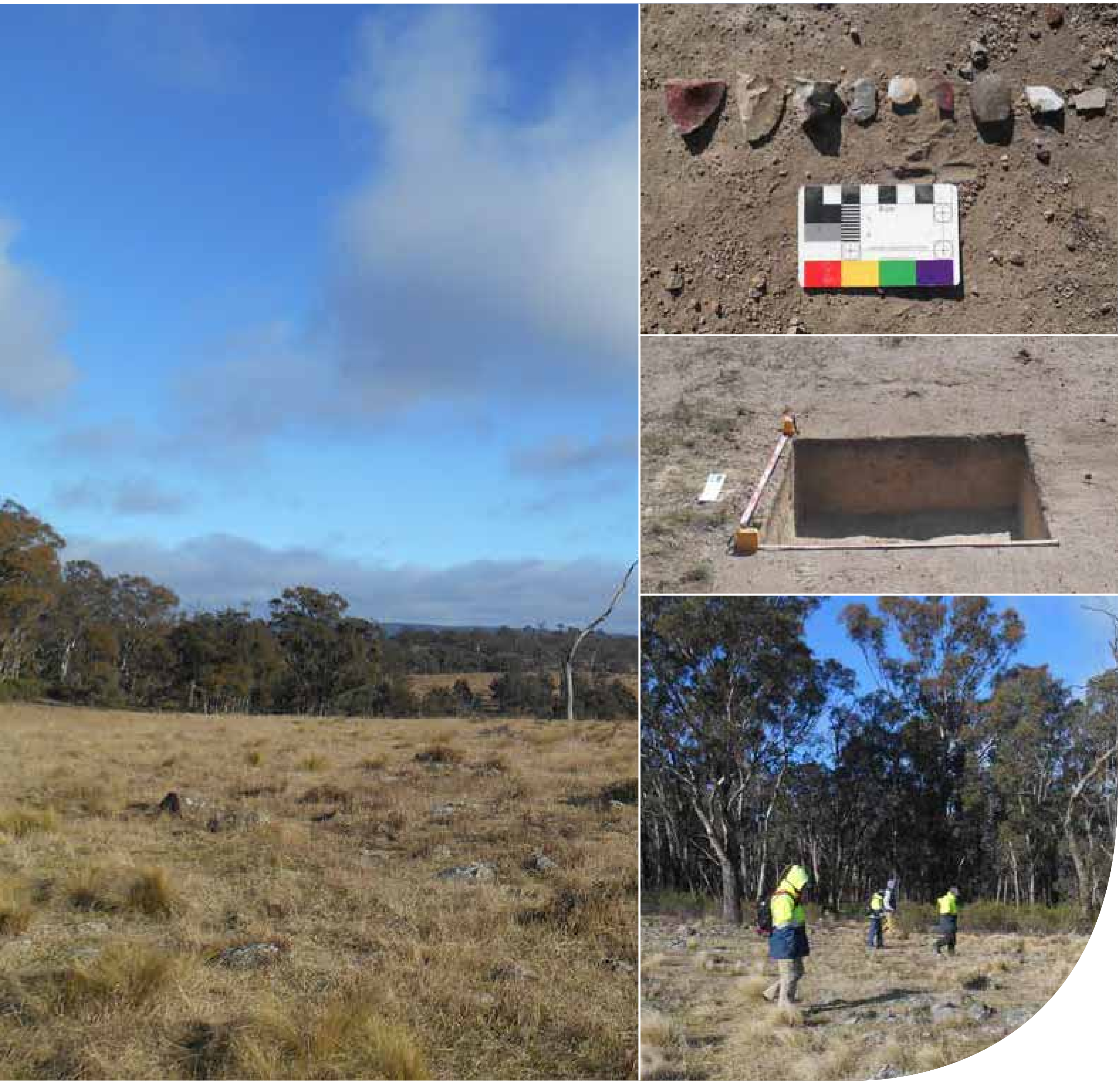
Gunlake Quarry Extension Project

Aboriginal cultural heritage assessment | including the results of an archaeological test excavation

Prepared for Gunlake Quarries Pty Ltd | 2 February 2016



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Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

www.emmconsulting.com.au

Gunlake Quarry Extension Project

Final

Report J14119RP1 | Prepared for Gunlake Quarries Pty Ltd | 2 February 2016

Prepared by	**Ryan Desic**	Approved by	**Pamela Kottaras**
Position	Senior Archaeologist	Position	Heritage Services Manager
Signature		Signature	
Date	2 February 2016	Date	2 February 2016

Document Control

Version	Date	Prepared by	Reviewed by
1	4 December 2015	Ryan Desic	Pamela Kottaras, Phillip Towler
2	2 February 2016	Ryan Desic	Phillip Towler

EMM

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

www.emmconsulting.com.au

Executive Summary

Gunlake Quarry is a hard rock quarry operated by Gunlake Quarries Pty Limited (Gunlake). It is located approximately 7 kilometres (km) north-west of Marulan in the Goulburn Mulwaree local government area (LGA), approximately 160 km south-west of Sydney (Figure 1.1). The Gunlake Quarry Extension Project (the project) seeks to enable an increased rate of extraction at Gunlake Quarry to assist to meet the identified demand for construction materials, including quarried aggregate, in the local area and Sydney. The Department of Planning and Environment (DPE) has determined that Marulan is a suitable area for the future supply of heavy construction materials for Sydney. The proposal will be State significant development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 and an application will be lodged under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This Aboriginal cultural heritage assessment (ACHA) has been prepared for the development application and accompanying environmental impact statement (EIS) for the extension area (Figure 1.2). It addresses specific requirements provided in the Secretary's environmental assessment requirements (SEARs) issued on 3 July 2015. The aim of the ACHA is to assess the Aboriginal cultural heritage values within the extension area in accordance with the SEARS. The ACHA methods involved:

- Aboriginal consultation in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010);
- background environmental, historic and archaeological research;
- a survey of the extension area by archaeologists and registered Aboriginal parties (RAPs); and
- an archaeological test excavation program.

The survey covered the entire extension area and was divided into 15 transects covering hill spur crests, hill slopes, foot slopes and stream channels (Figure 6.1). Effective ground coverage (an assessment to calculate the effectiveness of the survey in identifying Aboriginal objects) was generally high, but the proposed pit extension was characterised by lower ground surface visibility.

The survey team identified 15 Aboriginal sites. All of the Aboriginal sites were comprised of stone artefacts, made up of 12 open stone artefact sites and three isolated finds. The highest artefact frequencies were identified on a hill spur crest in the proposed embankment area and comprised sites GL14a, b, c and d where 281 artefacts were counted (Figure 6.2). The remaining sites contained less than 20 artefacts each and were found on hill spur crest, foot slope and stream bank landform elements.

The archaeological test excavation program aimed to characterise the subsurface archaeological deposit of known surface sites and surrounding landforms in the extension area that had limited ground surface visibility. The excavation comprised eight test pit transects made up of 1 m x 1 m test pits (Figures 7.10 and 7.11). In total, 42 m^2 was excavated. Eighty-nine artefacts were recovered from the 42 test pits which equates to an average frequency of 2.12 artefacts per m^2. One third of test pits contained one or more artefacts and the majority of artefacts (92%) were recovered from the top 20 cm of soil. Artefact frequencies per 1 m x 1 m square ranged from zero to 35. The highest densities of artefacts were recovered from the hill spur crest in the proposed embankment area in association with sites GL14a, b, c and d. Conversely, only three artefacts were recovered away from these sites and were associated with site GL5.

The paucity of subsurface artefact frequencies in all tested areas was attributed to the poor integrity of the soil deposit, which was severely truncated by erosion. It was concluded that the surface artefact distributions offered a better representation of the local archaeological record.

All of Aboriginal sites identified, except one, were assessed to have low archaeological significance. Sites GL14a, b, c and d were assessed to be fragmented parts of a larger distribution and were assessed to have moderate archaeological significance. This was because these sites are extensive artefact scatters on a common site landform with good examples of artefact types and raw materials. However, they lack archaeological integrity because of the highly eroded skeletal soils occurring in this landscape.

Eleven of the 15 sites will be impacted to some degree by the project (Figure 10.1). It is recommended that all of the 11 impacted sites be salvaged by surface artefact collection and detailed recording. The remaining four sites will be avoided. No salvage excavation is recommended because of the low archaeological potential identified in the extension area. Furthermore, the extensive surface collection would retrieve an adequate sample of archaeological material.

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1 Introduction

1.1 Overview

Gunlake Quarry is a hard rock quarry operated by Gunlake Quarries Pty Limited (Gunlake). It is located approximately 7 kilometres (km) north-west of Marulan in the Goulburn Mulwaree local government area (LGA), approximately 160 km south-west of Sydney (Figure 1.1).

Gunlake Quarry has been operating since 2009 and is proposing to expand its operations. The quarry produces material suitable for use in a wide range of applications, including concrete and sealing aggregates, rail ballast, manufactured sand and road base. These products are used by Gunlake for concrete production in its own operations in Sydney as well as for other markets. Gunlake is in the process of establishing concrete plants in the Sydney region and has three plants currently in operation at Smeaton Grange, Glendenning and Silverwater.

1.2 Approval process

This Aboriginal cultural heritage assessment (ACHA) has been prepared for the development application and accompanying environmental impact statement (EIS) for the proposed quarry extension.

Gunlake Quarry currently operates under Project Approval 07-0074 (the project approval), issued by the Minister for Planning in September 2008, under Part 3A of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

This original approval included approval for daily truck movements equivalent to about 500,000 tonnes per annum of saleable product until 2038.

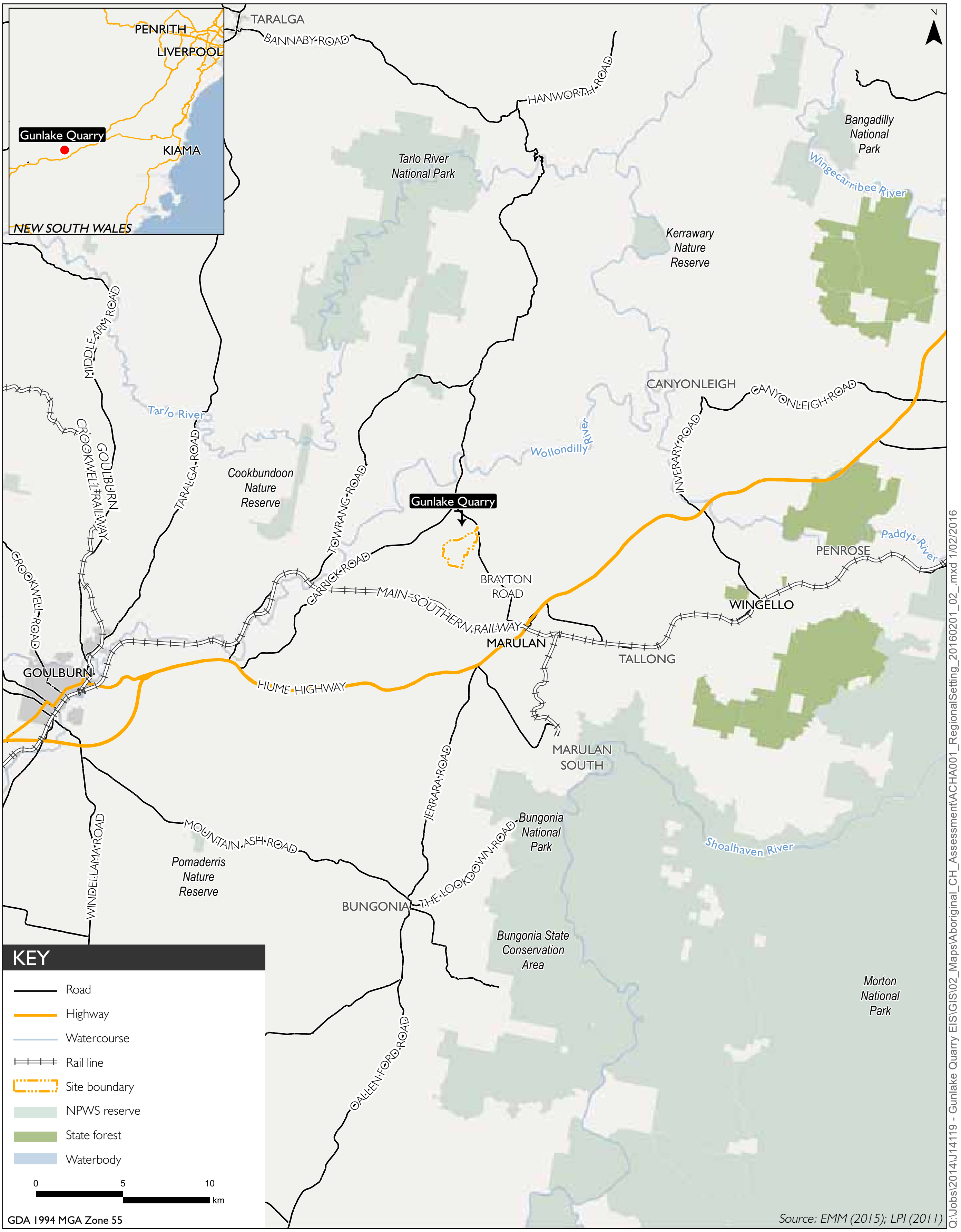
Three modifications have been approved:

- Modification 1 — Stage 2 southbound access;
- Modification 2 — quarry expansion; and
- Modification 3 — truck movements.

Modifications 1 and 3 were minor modifications to alter the transport routes and daily truck numbers related to the quarry. Modification 2 included expansion of the quarry pit and overburden embankment, an increase to the daily truck movements for 750,000 tonnes per annum production and alteration of the approved hours of operation.

The Gunlake Quarry Extension Project (the project) seeks to enable an increased rate of extraction at Gunlake Quarry to assist to meet the identified demand for construction materials, including quarried aggregate, in the local area and Sydney. The Department of Planning and Environment (DPE) has determined that Marulan is a suitable area for the future supply of heavy construction materials for Sydney.

The proposal will be State significant development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 and an application will be lodged under Division 4.1 of Part 4 of the EP&A Act.



Regional setting

Gunlake Quarry

Aboriginal Cultural Heritage Assessment

Figure 1.1

1.3 Secretary's environmental assessment requirements

This ACHA has been prepared to address specific requirements provided in the Secretary's environmental assessment requirements (SEARs) issued on 3 July 2015. Relevant agency requirements from the Office of Environment and Heritage (OEH) which have also informed the SEARs are also addressed in the ACHA. The relevant SEARS and EMM's responsive approach are presented in Table 1.1.

Table 1.1 Relevant SEARs

Aboriginal heritage	Relevant report section and comment
SEARs requirements	
Heritage — including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to OEH's requirements (see Attachment 2).	Whole report. This report only includes matters relating to Aboriginal cultural heritage and not historic heritage.
OEH requirements	
1. The EIS must identify and describe the tangible and intangible Aboriginal cultural heritage values that exist across the whole area that will be affected by the project and document these in the EIS. This must include a surface survey conducted by a qualified archaeologist. The result of the surface survey is to inform the need for targeted test excavation in areas with potential for subsurface Aboriginal deposits to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the EIS. The identification of cultural heritage values should be guided by *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW 2011) and consultation with OEH regional officers.	Chapter 3–9
2. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal Cultural Heritage consultation requirements for proponents 2010* (DECCW) The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.	Chapters 2 and 10
3. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must: a. demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. b. where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. c. outline procedures to be followed if Aboriginal objects are found at any stage of the life of the Project to formulate appropriate measures to mange unforseen impacts d. outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	Chapters 11 and 12
4. Any Aboriginal objects recorded as part of the assessment must be document and notified to OEH. Copies of the relevant Archaeological report and Aboriginal cultural heritage assessment report must also be forwarded to OEH.	Appendix B

1.4 Project description

1.4.1 Project overview

The project application seeks a quarry life of 30 years from the date of the new project approval. However, there is sufficient resource for over 100 years of operations.

The project will require an expanded pit and some modification of quarry infrastructure. The increased quarry production rates will primarily require an increase in the size (numbers) of the truck transport fleet.

Increased production at the quarry will ramp up over a number of years (up to ten years).

1.4.2 Existing infrastructure

Gunlake Quarry has been supplying the local region and the greater Sydney Metropolitan area with hard rock supplies since 2009. The quarry has approval to extract 750,000 tonnes of saleable product and is a significant supplier of heavy construction materials in NSW.

Key components of the existing quarry include:

- a quarry pit providing hard rock resources;
- overburden and excess product embankment areas;
- drilling and blasting to release the rock material;
- crushing and screening of the quarried rock;
- truck loading and transport of hard rock; and
- ancillary infrastructure to support operations including offices, amenity buildings and other minor infrastructure.

1.4.3 Gunlake extension project

Gunlake seeks a new development consent that allows:

- 2 million tonnes per annum (Mtpa) of saleable products to be produced;
- extension of the quarry pit footprint to approximately 49 ha;
- 24 hour per day primary crushing;
- an increase in truck movements to an average of 440 movements per day (ie 220 laden trucks) and a maximum rate of 690 movements per day (all of the additional quarry truck movements would travel via the Bypass Road route);
- additional overburden embankment to accommodate the increase in production; and
- blasting twice weekly.

In addition, Gunlake seeks to maintain the approval for all aspects of the existing operations for Gunlake Quarry under Project Approval 07-0074. A summary of the project is provided in Table 1.2.

Table 1.2 Project summary

Project element	Currently approved	Proposed
Quarrying method	Hard rock quarrying by open cut methods.	No change.
Resource	Approximately 180 million tonnes.	No change.
Saleable product	750,000 tonnes per annum.	Increase to 2 Mtpa.
Quarry life	30 years.	30 years from approval. There is sufficient resource (180 Mt) for quarrying to continue at 2 Mtpa for 90 years.
Beneficiation	Onsite crushing and stockpiling of quarried rock.	No change.
Infrastructure	As outlined in Section 3.3.	Upgrade infrastructure as required to produce 2 Mtpa of products.
Product transport	An average of 164 truck movements per day.	Increase truck movements to an average of 440 movements per day and a maximum of 690 movements per day.
Operational workforce	25 on-site employees and 25 to 38 truck drivers (full-time equivalent).	Increase of approximately 27 on-site employees and truck drivers.
Hours of operation	6:00 am Monday to 6:00 pm Saturday, including crushing between 7:00 am and 6:00 pm, Monday to Saturday and maintenance at any time, Monday to Saturday.	Modify existing hours of operation to allow crushing 24 hours a day (except Sundays and public holidays) and maintenance anytime (including Sundays and public holidays).

1.5 Extension area

The extension area referenced throughout this report is defined as the proposed extension area shown in Figure 1.2. It comprises the proposed pit extension and proposed embankment areas. Reference is made either to the extension area on a general level or the proposed pit extension and proposed embankment for more specific detail.

1.6 Objectives of this assessment

The aim of the ACHA is to assess the Aboriginal cultural heritage values within the extension area in accordance with the SEARS. It is prepared as a technical study appended to the EIS for the project.

The objectives of the assessment are to:

- identify Aboriginal cultural heritage values relevant to the extension area which may entail:
  - Aboriginal objects and sites;
  - Aboriginal socio-cultural values which might not be related to Aboriginal objects; and
  - areas of archaeological sensitivity;
- assess the significance of Aboriginal objects, sites and places identified in the course of archaeological investigations and through Aboriginal community consultation;

- assess the impact of the project on the identified Aboriginal cultural heritage values; and
- identify appropriate management measures for potentially impacted Aboriginal cultural heritage values in response to the assessed significance of those values and potential impacts.

1.7 Authorship

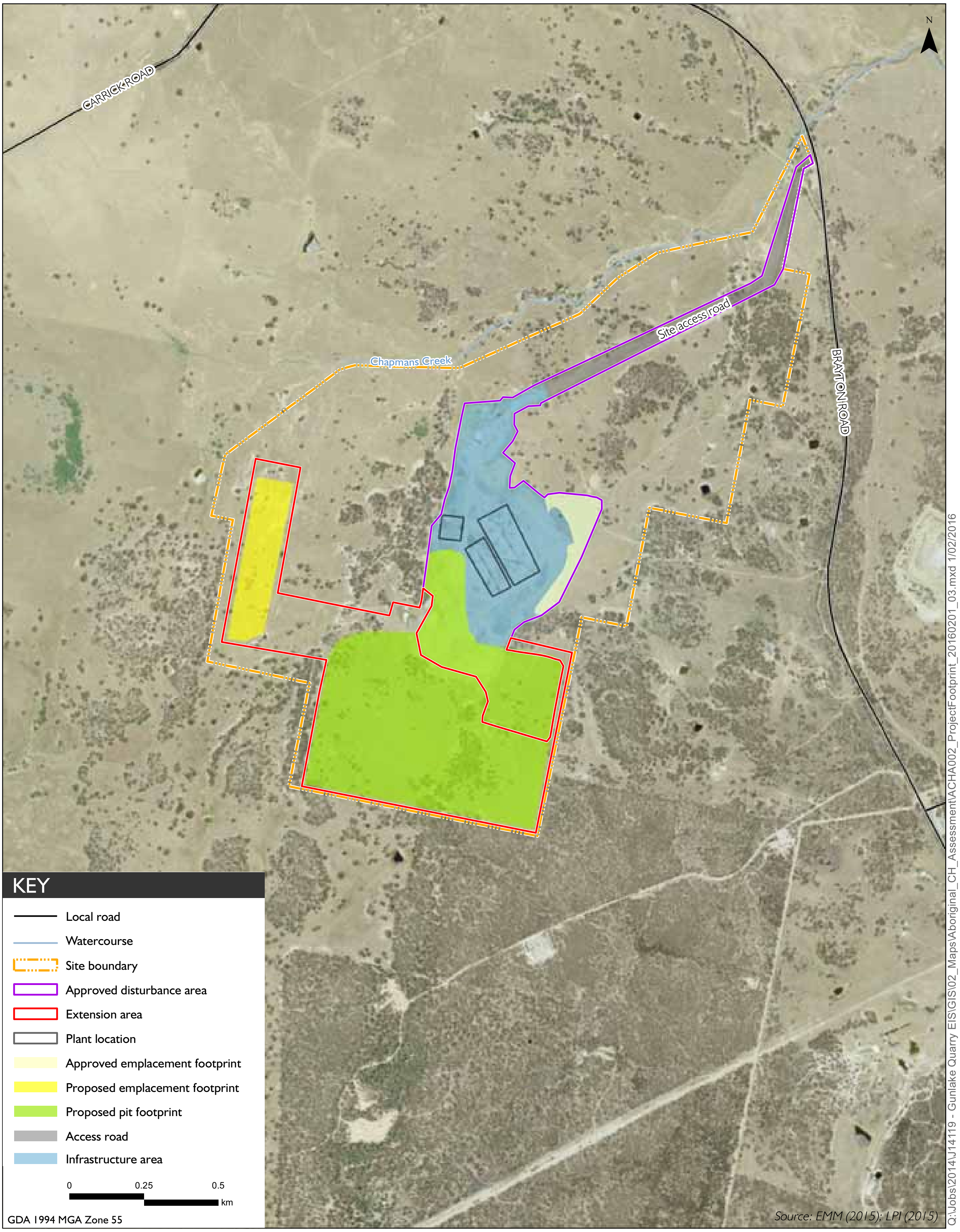
This report was written by Ryan Desic BA (hons Prehistoric/Historical Archaeology), Senior Archaeologist, EMM and reviewed by Pamela Kottaras BA (hons Prehistoric/Historical Archaeology), Heritage Services Manager, EMM.

1.8 Acknowledgments

The following are acknowledged in the preparation of this report:

- Pamela Kottaras and Rebecca Newell (EMM) as test excavation trench supervisors;
- Pamela Chauvel excavation for assistance and assistance with test excavation results sections including artefact cataloguing and analysis; and
- Andrew Crisp for excavation assistance.

EMM would like to thank all Aboriginal community members involved in the project for their participation in correspondence and fieldwork.



Project footprint

Gunlake Quarry

Aboriginal Cultural Heritage Assessment

Figure 1.2

2 Aboriginal consultation

2.1 Consultation process

2.1.1 Statutory basis

The SEARs stipulate the use of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010) for the project.

In accordance with the 2010 guidelines (DECCW 2010), each private Aboriginal organisation or individual who responded with a written request to be registered for consultation is referred to as a *registered Aboriginal party* (RAP).

Full consultation documentation is provided in Appendix A.

2.2 Stage 1 — identification of registered Aboriginal parties

2.2.1 Agency contact

EMM issued a letter requesting advice on which Aboriginal parties to invite for consultation, and advice on all known heritage matters to be taken into consideration, to the following groups on 2 April 2015:

- the Office of Environment and Heritage (OEH) South East Region;
- Pejar Local Aboriginal Land Council (PLALC);
- Goulburn Mulwaree Shire Council;
- South East Local Land Service (replacing the Catchment Management Authority);
- National Native Title Tribunal;
- the office of the Registrar of Aboriginal Owners; and
- NTSCorp.

Responses were received from all agencies and are included in Appendix A.

2.2.2 Press advertisement

A public notice was placed in the *Goulburn Post* newspaper on 8 April 2015 seeking registrations of interest from Aboriginal parties. A copy of the notice is in Appendix A.

2.2.3 Aboriginal group invitation to register

Letters were sent via post and email to the parties listed by the government agencies, inviting written registration on 20 April 2015. Those letters which did not receive a response were followed up with a phone call and email where these details were provided.

2.3 Registered Aboriginal parties

Table 2.1 presents the Aboriginal parties who registered an interest in being consulted for the project. Twenty-nine RAPs registered their interest in the project.

Table 2.1 List of RAPs for the project

Organisation	Registered date
Gulgunya Ngunawal Heritage Aboriginal Consultancy	10-Apr-15
Wullung	20-Apr-15
Nundagurri Aboriginal Corporation	20-Apr-15
Pejar LALC	20-Apr-15
Walbunja Aboriginal Corporation	20-Apr-15
Gunyuu	20-Apr-15
Gundungurra Aboriginal Heritage Association Inc	20-Apr-15
Badu	20-Apr-15
Peter Falk Consultancy	20-Apr-15
Merrigarn Aboriginal Corporation	22-Apr-15
Murri Bidgee Mullangari Aboriginal Corporation	23-Apr-15
Duncan Falk Consultancy	24-Apr-15
Gunjeewong Cultural Heritage Aboriginal Corporation	28-Apr-05
Karrial	29-Apr-15
Buru Ngunawal Aboriginal Corporation	20-Apr-15
Koomurri Ngunawal Aboriginal Corporation	03-May-15
Corroboree Aboriginal Corporation	11-May-15
Goobah Development Pty Ltd	11-May-15
Gangangarra	12-May-15
Wandandian	13-May-15
Ngunawal	13-May-15
EORA	12-May-15
Ngunawal Heritage Aboriginal Corporation	11-May 15

2.4 Stage 2 — presentation of project and method information

2.4.1 Assessment method and survey

A letter was issued to RAPs on 25 May 2015 presenting information about the project and describing the proposed ACHA method, including the proposed survey strategy and a request for cultural information. No comments were received regarding the cultural significance of the extension area specifically, and no comments were received in relation to the proposed assessment method.

2.4.2 Test excavation method

Archaeological test excavation was not initially proposed in the first project information letter. This was because previous investigations at Gunlake Quarry identified the landscape to generally be of low archaeological potential. However, after surveying the extension area and identifying high artefact concentrations (ie sites GL14, a, b, c and d), it was established that further investigation using archaeological test excavation was warranted.

A letter was issued to the RAPs on 4 September 2015 presenting a summary of the survey and a proposed test excavation method for their review and comment. Summaries of RAP comments and EMM's responses are provided in Table 2.2. Full comments and initial responses by EMM are provided in Appendix A. Detailed information about the test excavation method is provided in Section 7.

Table 2.2 Responses to test excavation method

RAP	Comment	Response (updated after test excavation was completed)
Murra Bidgee Mullangari Aboriginal Corporation	Agreed with method	N/A
Corroboree Aboriginal Corporation	Agreed with method	N/A
Peter Falk Consultancy	Requested that test pits be dug in 50 cm x 50 cm units.	1 m x 1 m test pits were still used for the test excavation. This test pit size was suitable for the test excavation and any reduction in the size of the excavation units was not likely to result in a noticeable variation of the results. The predicted disturbed nature of the deposits did not warrant a more cautious excavation approach.
	Requested that test pit numbers in Transect 5 and 6 be extended. Also for Transect 6 to be extended outside the embankment area.	The test excavation generally did not extend past the proposed impact area. Transect 6 was extended beyond its original layout to further investigate the landform. This also included the addition of Transect 4 (relocated from original position) and Transect 8. The limited excavation initially planned for the land associated with sites GL14a, b, c and d was in response to the predicted high frequency of artefacts being recovered. However, more test pits were added in the area when relatively low frequencies were recovered from the initial layout of Transects 5, 6, 7 and 12. The rationale was that further investigation was required to better characterise the deposit.
	Requested that test pits in Transect 7 be extended into site GL14a.	Testing in the site boundary of G14a was achieved by extending Transect 6 further down the hill slope.
	Requested that all other test excavation transects to be excavated according to the method unless 'large deposits of artefacts are found then expansion of sites will be required'.	Noted. No 'large' deposits were identified as the soils were highly eroded and truncated.

2.5 Stage 3 — review of draft Aboriginal cultural heritage assessment

2.5.1 Distribution of draft report

A draft report and summary cover letter was issued to RAPs by email on 4 December 2015. A five-week time frame for review was issued with the draft assessment report including one extra week of review time outside the 28 day mandatory timeframe to allow for the holiday break.

2.5.2 Response to comments

The issues raised in response to the draft report are provided in the RAP letters and in response letters from EMM in Appendix A. Comments, requests or concerns in response correspondence from RAPs and the manner in which those concerns are addressed are summarised in Table 2.3

Table 2.3 Responses to test excavation method

RAP	Comment (summarised)	Response
Corroboree Aboriginal Corporation	Found the ACHA consistent with their views.	N/A
Gunlgunya Ngunawal heritage Aboriginal Consultancy and Koomurri Ngunawal Aboriginal Corporation	Reference to sites GL14a, b, c and d possibly being the place of a former ceremonial ground. This was attributed to its proximity to several ground springs and the low frequency of subsurface artefacts identified in particular locations. A request was made to excavate a specific area – GL14b – to identify 'carbon deposits which may give positive results in regards of Aboriginal Social practices of Cultural significance in this area.'	Ryan Desic called Glen Freeman on 8 January 2015 to discuss this matter further. It was clarified that test excavation of the specific area GL14b (Transect 8) was conducted on the day after Glen's fieldwork participation and that artefacts were recovered from this location. This evidence suggests that the area was subject to the same use as the wider site GL14a, b, c. The soils in this location were highly eroded and skeletal and it is unlikely that evidence of ceremonial grounds or hearths is likely to be found through further test excavation. After these matters were discussed and clarified on 8 January 2016, Glen Freeman provided a written response to withdraw the request for further excavation in this area. No further issues were raised with the ACHA. As such, no further excavation is recommended in this area but the surface artefacts within GL14b will be collected prior to project impacts.

3 Landscape context

3.1 Overview

Information about the landscape in the extension area provides valuable information about the expected spatial distribution and likelihood of archaeological material. Landscape features can identify suitable camping, transitory and ceremonial areas used by Aboriginal people in the past. Natural resources including the flora and fauna that may have provided food and material resources are linked to the hydrology, geology and soil types in a region. Furthermore, natural and cultural post-depositional site formation processes influence the presence and nature of Aboriginal objects in the landscape, including their archaeological integrity.

3.2 Topography

The extension area is on the eastern side of the Great Dividing Range approximately 7 km northwest of Marulan. It is within the physiographic province of the Shoalhaven Plateau which is an area of heavily dissected country at elevations largely above 600 m Australian Height Datum (AHD). Strike ridges and dense vegetation characterise this area and differentiate it from the extensively cleared undulating plains to the west (Hird 1991, p. 10). Most of the extension area is within undulating terrain ranging in elevation between 620 and 690 m AHD. Most of the extension area comprises broad hill spur crests sloping north towards the quarry which are dissected by three streams tending north.

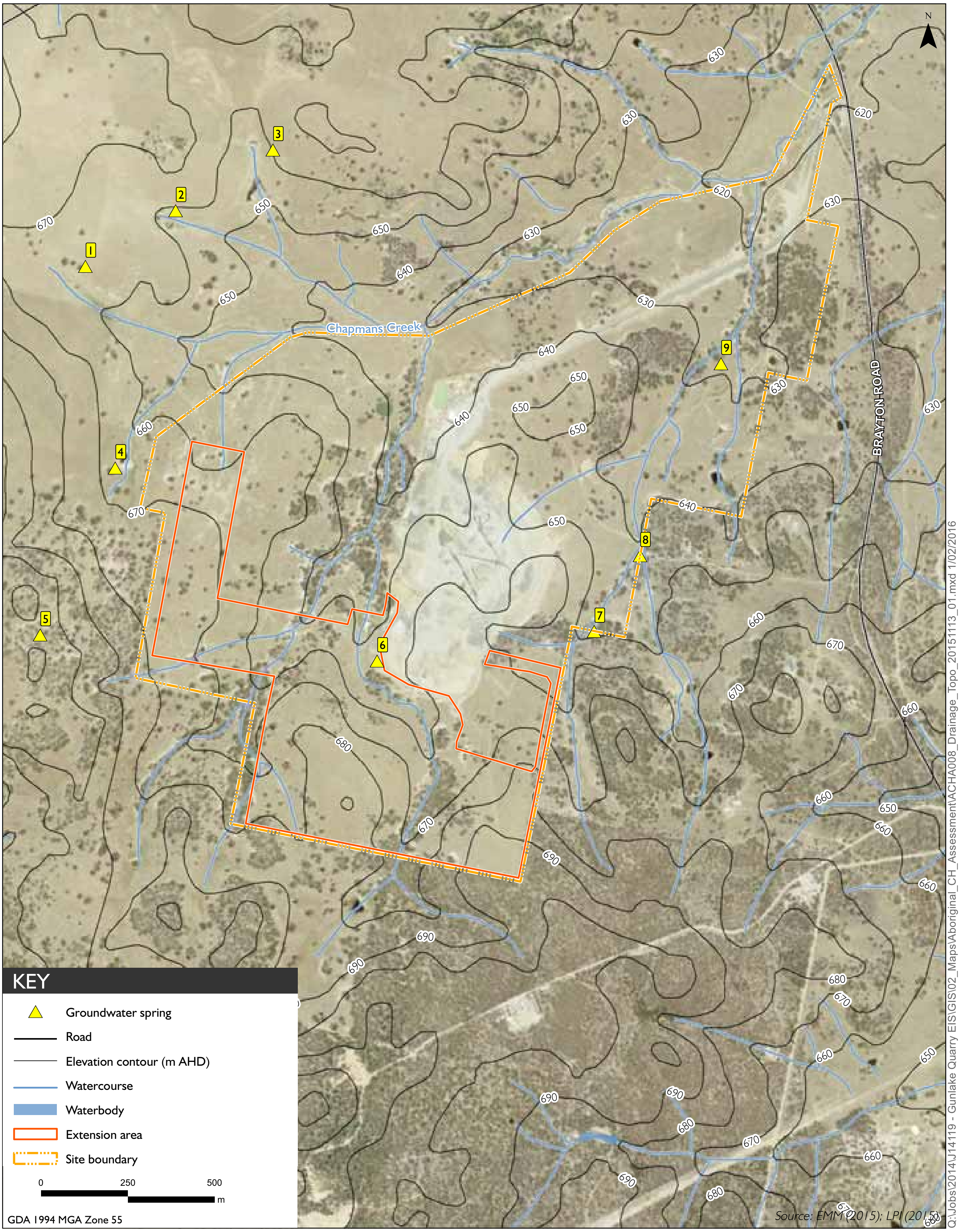
The extension area is characterised by a landform pattern of undulating hills with level to moderately inclined slopes. The landform elements in the extension area as defined in the *Australian Soil and Land Survey Field Book* (CSIRO 2009) are:

- level to gently inclined broad spur hill crests (with typical slope values of 0–10%);
- gently inclined to moderately inclined hill slopes (with typical slope values of 6–12%);
- level to gently inclined foot slopes (with typical slope values of 0–10%); and
- stream channels.

The topography and drainage of the extension area is shown in Figure 3.1.

3.3 Drainage

The extension area is part of the Wollondilly River Catchment which flows north-east approximately 5 km to the west. The extension area contains the upper tributaries of Chapmans Creek form approximately 500 m to the south of the extension area, occurring as gullies between steeper hills. The extension area contains only first and second order streams which converge into a third order stream approximately 250 m to the north. These tributaries are ephemeral streams but may have formed chains of ponds that held water for extended periods after rain. Chapmans Creek drains into Joarimin Creek approximately 5 km north-east which continues for approximately 3 km north-west and drains into the Wollondilly River approximately 4.5 km north-west of the extension area.



Drainage and topography

Gunlake Quarry

Aboriginal cultural heritage assessment

Figure 3.1

There are a series of nine water features (springs) which are essentially areas of shallow groundwater discharge exist within 1500 m of the extension area in the headwaters of Chapmans Creek (Figure 3.1). Cook (2008) labelled these as Springs 1–9 in their groundwater impact assessment for the original Gunlake Quarry Project. The report noted that the discharges from these types of springs likely vary in response to seasonal and climatic factors, but anecdotal evidence indicated that they are low-volume semi-permanent flows. Springs #4, 5 and 6 are likely to have influenced water availability in the extension area: Spring 6 is in the extension area, Spring 5 is south of the extension area but is northerly flowing and may have contributed to stream flows in the extension area, and Spring 4 is less than 200 m west of the extension area flowing north.

3.4 Geology

The geology and soils of the extension area and its surrounds are shown in Figure 3.2.

Reference to the *Goulburn Geology Map 1:100,000* (Thomas *et al* 2002) shows that the extension area is in the south-eastern extension of the Molong-South Coast Anticlinorial Zone. This is a major broadly north-south trending geological structural zone in the eastern central part of the Lachlan Fold Belt. The Lachlan Fold Belt is a Palaeozoic litho-tectonic assemblage underlying the south-east of Australia.

The quarry overlies a folded and deformed basement Bindook Porphyry Complex sequence of Devonian age volcanic rock, volcanoclastics and intrusive lithologies (Cook 2008). Dominant lithologies of granite occur to the west and south-west of the extension area and basalt occur to the west and north-west.

Locally, the brittle Bindook Porphyry can be divided into the Barralier Ignimbrite and Joaramin Ignimbrite. Ignimbrites are poorly sorted, pyroclastic rocks which are comprised mainly of pumice and ash. These units are the youngest of the Bindook Porphyry; Barralier Ignimbrite is the youngest unit in the sequence. Bindook Porphyr generally consists of quartz, feldspar, porphyry, dacide, felstik and tuff.

Granite and porphyry are typically unsuitable for stone tool manufacture, although finer grades of porphyry have manufacturable qualities and there are instances of this material being used in the Hunter Valley (Umwelt 2008).

Quartz is the most abundant local resource likely to have been used for stone tool manufacture. It is a resource widely utilised in the broader region and can occur in pockets and veins of geology such as granite and sandstone conglomerate. The quality of quartz can vary greatly from homogenous varieties capable of good flaking outcomes to material with numerous flaws and incipient fracture planes. Therefore, stone artefacts other than quartz are likely to have been imported from other areas.

3.5 Soils

Most of the extension area is part of the Bindook Road Soil Landscape, with a small portion (approximately 1.5 ha) of the Wyangala Soil Landscape (Hird 1991) occurring in the south-western corner where elevation increases. The Bindook Road Soil Landscape occurs on undulating rises of low relief (10–40 m) and gentle slopes overlying Bindook Porphyry geology. The A soil horizon is typically sandy loams on crests and sideslopes overlying red sandy clay loams and bleached sandy clay loams. The A horizon overlies either weathering porphyry directly (typically on crests) or an intermediately B horizon on side slopes. These soils have formed *in situ* and also from alluvial-colluvial material derived from the parent rock (Hird 1991, p. 34).

The Wyangala Soil Landscape occurs on low hills to rolling hills on Siluro-Devonian granites including the Wyangala and the Wologorong Granite. Soils include loamy sands overlying clayey sands and highly weathered granite, also with pockets of mottled clay and sandy clay (Hird 1991, p. 177). Large granitic boulders are also a feature of this landscape.

3.6 Climate

Climatic conditions would have influenced the occupation of the area by past Aboriginal people. Climate not only influenced living conditions, it dictated the sustenance and cultural resources available. The climate of the Goulburn region is affected by its distance from the coast and the topography of the surrounding landscape. The annual rainfall of the extension area generally exceeds 650 mm. The mean temperature of the coldest month at Goulburn is 6.2°C while that of the hottest month is 19.9°C. Easterly breezes have a cooling affect during the summer months. Overall, the extension area has mild to hot summer and mild to cold winters.

The probability of the soil water storage capacity being exceeded and prolonged catchment flow occurring is not high at any time of the year, reaching only 25–30% in winter. All months except January have adequate soil moisture for plant growth in more than 50% of all years (Hird 1991, p.187).

At the start of the Holocene approximately 11,500 years ago, climate conditions changed substantially. The melting of Pleistocene ice sheets caused a rise in sea levels and an associated rise in temperature and rainfall. The changes reached their peak approximately 6,000 years ago. At around 1,000 years ago temperatures stabilised to temperatures similar to today. Thus, the climate of the Extension area for the past 1,000 years would probably have been much the same as present day conditions, providing a habitable environment.

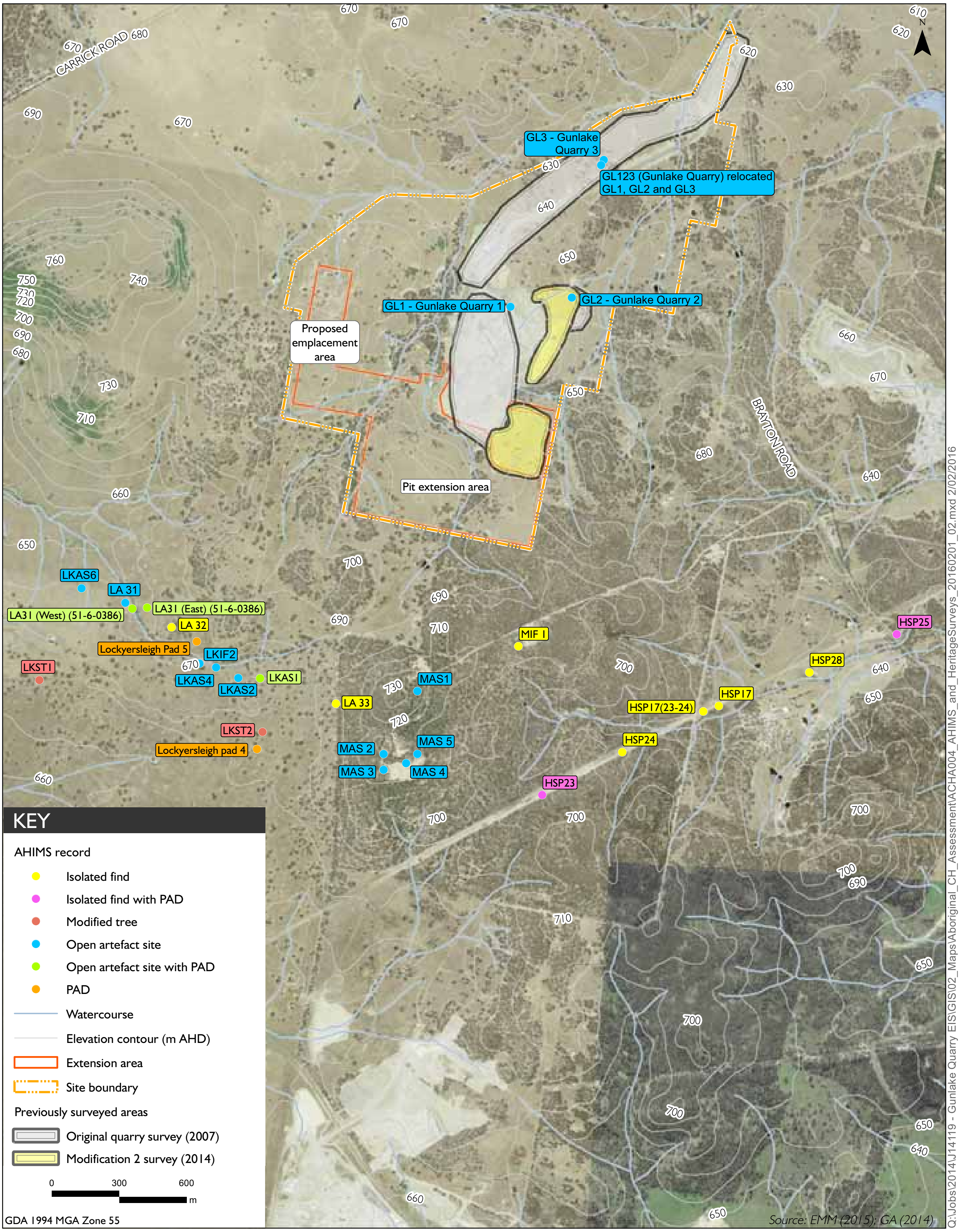
3.7 Vegetation

Native vegetation would have been a dry sclerophyll forest with red stringybark predominant. This vegetation community generally occurs in hilly country where rainfall exceeds 640 mm per annum. The extension area has largely been cleared of native vegetation but small scattered pockets of bush and scrub still remain mainly near streams and on hill crests. Most of the extension area is now grassland representative of having been cleared for farming.

3.8 Land use history

Land use of the extension area includes cleared agricultural land, predominantly grazing land for sheep. Vegetation clearance close to streams can change their morphology, increase bank erosion and cause sediment aggradation. This process can significantly reduce the flow of surface water, especially in creek headwaters. Vegetation clearance also results in sheet erosion on crests and hill slopes which transports soils down-slope. This results in increasingly skeletal soils on crests and upper slopes and aggrading soils on lower slopes and foot slopes. These processes are likely to have occurred in the extension area.

The streams have been dammed at a number of locations to retain water in drier months. There is also evidence of drainage diversion bunds being built into hill slopes.



AHIMS results and previous surveys near the extension area

Gunlake Quarry

Aboriginal cultural heritage assessment

Figure 4.2

3.9 Environmental implications for archaeology in the extension area

The main environmental features that indicate archaeological sensitivity are the extension area's level to gently inclined crests, gently inclined hill slopes and gently inclined foot slopes adjacent to streams. These landforms have been shown to predominantly contain open artefact sites as the remnants of past Aboriginal activity (refer Chapter 4). The main limitation to identifying these sites through survey is low ground surface exposure and visibility conditions as the result of the thickly grassed paddocks and tree foliage which characterise the area. There is potential for the sandy loam soils to retain subsurface archaeological evidence on gentle gradients where erosion is minimal or where aggrading soils have accumulated archaeological material from up-slope.

The moderately inclined slopes and crests featuring rocky porphyry outcrops are less likely to contain Aboriginal objects because they would have been undesirable activity areas due to their gradient and the deterrent of rocky ground for camping. The soils in these areas are likely to be skeletal from sheet erosion and heavily mixed with large rock inclusions which make the potential for the accumulation of subsurface archaeological deposits to be low.

Post-depositional factors that would have disturbed stone artefacts include vegetation clearance, creek damming and diversion bunds. Sheep grazing would have caused less damage than paddock preparation. These activities may have displaced any Aboriginal objects vertically and horizontally within the soil matrix without fully diminishing their archaeological and cultural value. The extent of displacement depends on the type of ground disturbance, gradient of slope and the type of erosion, such as sheet wash on hill slopes and gullying and scouring adjacent to streams.

Drainage of the extension area in its current condition indicates that water availability was ephemeral. However, its present condition is the result of erosion and sediment accumulation. Furthermore, the natural springs may have contributed to greater water reliability of the area.

Given that the woodland and forest areas have been cleared over the past century, mature trees which might carry carving or scarring (also known as modified trees) are predicted to be rare in the extension area, but some large native paddock trees still remain and could not be discounted until inspected.

4 Archaeological background

4.1 Ethno-history

4.1.1 Historic overview

European explorers first visited the Southern Tablelands as early as 1798 when John Wilson was sent to the area by Governor Hunter (Chisholm 2006). His reason for exploring the area was to dispel the myth that convicts would be able to walk to China (Higginbotham 2009, p.21). He ascended Mt Towrang and viewed the Goulburn Plains before returning home.

Stock and cattle stations were established in the 1820s throughout the Goulburn Plains and the wool industry dominated the area during the 1800s (Firth 1983). Pastoralists set up stations run by the convict labour force and some of the wealthiest pastoralists ran their stations from Sydney or the Cumberland Plain sending sons or overseers to run the day to day operations (Higginbotham 2009, p.27).

Marulan, the closest town to the extension area (5 km south-east), was established first in 1834 and then moved approximately 2 km to the north-west in 1868 when the Great South Railway Line was constructed. Other towns established in the area included Bungonia (1836), Tallong (1869) and Wingello (1871).

The area is predominantly used for cattle and sheep grazing, although there are several quarries in the area including Gunlake. Tourism to the Southern Highlands has increased as the improvements to the Hume highway connected the area to Sydney. The area was amalgamated into the Goulburn Mulwaree local government area (LGA) in 2005.

4.1.2 Local Aboriginal population

Information about the socio-cultural structure of Aboriginal society prior to European contact largely comes from ethno-historic accounts made by Europeans. These accounts and observations were made after massive social disruption due to disease and displacement. As a result, this information is often contentious, particularly in relation to language area boundaries.

The extension area is located near the boundary of two Aboriginal groups (based on Tindale 1974):

- the Ngunawal whose territory extended to the south and south-west from Queanbeyan to Yass and east to beyond Goulburn; and

- the Gandangara whose territory extended to the north and north-west at Goulburn and Berrima, down the Hawkesbury River to Camden and whose name incorporates terms meaning west and east.

There are also two groups whose boundaries occur nearby to the east and north-east:

- the Wodiwodi whose territory extends to the north-east north of the Shoalhaven Rover to Wollongong; and

- the Wandandian whose territory extends to the south-east from Ulladulla to the Shoalhaven River and Nowra.

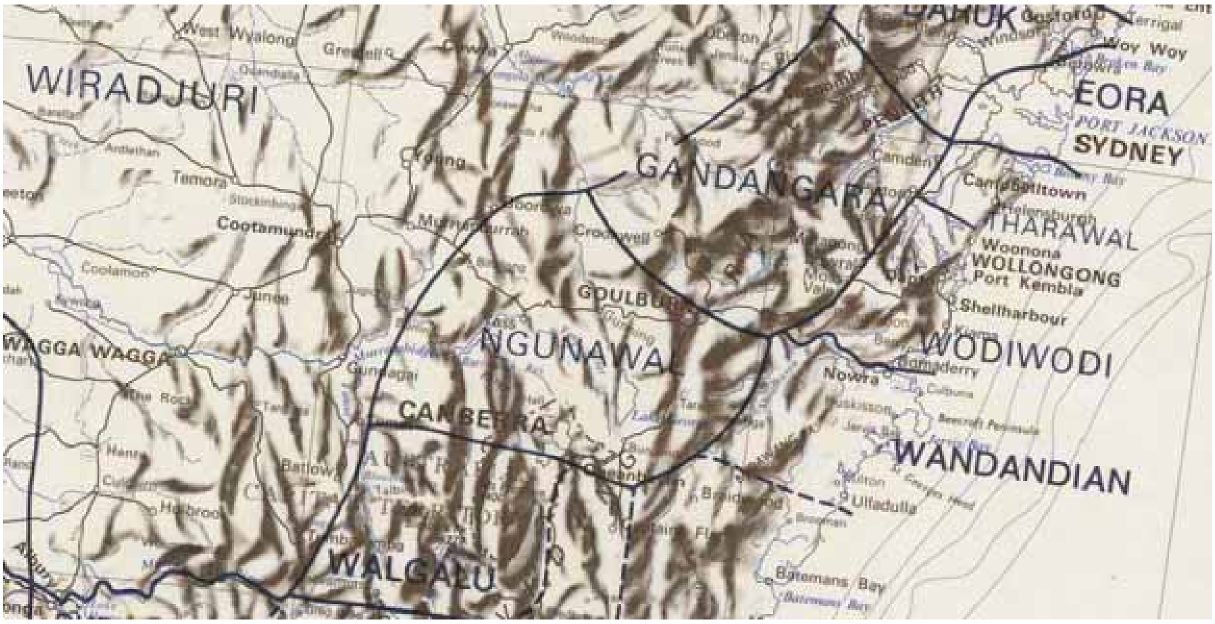


Figure 4.1 Aboriginal language group boundaries (Tindale 1974)

4.1.3 Living arrangements

Generally, Aboriginal people lived in family based clan groups of between 30 and 50 people living within a defined area. Each group would have been mobile for at least part of the year and comprised of males and females with approximately four to eight pairs of husband and wives. Most men were considered to have only one wife, though Govett (1836) notes that the chiefs of each tribe were able to have two wives.

There is evidence of the construction of covered sleeping areas known as, gunyahs, a shelter made of bark or bushes laid against supporting trees or poles (Govett 1836, p. 19). Timber and bark were also used to make tools and weapons adhered with natural glue. Local and imported stones including quartz and silcrete were used to make a variety of tools.

Louisa Atkinson, botanist, journalist and fiction author, writing in 1863 of her life in the Southern Highlands in the 1830s and 1840s describes the appearance and construction techniques of gunyas:

> Their dwellings were of a description most readily constructed, soon dilapidated, and forsaken without regret. Sometimes a sheet of bark supported on end in an inclined position by a small pole, at others, a few branches place round a triangle, formed by partially severing a sapling so as to bend both ends to the ground, and supported in the middle by a sloping forked stick, were the materials almost always employed; but occasionally these were rendered more comfortable, and impervious to wind and rain, by being built over with grass (Lawson 1988 p. 46).

This description though saturated with values very different to those of the original inhabitants, accords with early photographs and drawings of gunyas.

4.1.4 Burial customs and ceremony

Burial in the region appeared to occur in a number of ways. Individuals could be interred in the ground in a shallow grave covered by stone, rocks or cobbles. Positioning of the burial may have been associated with ownership of areas (ERM 2012). Other reports of burial included placing the corpse in a hollow tree or in a sitting position in the ground (Gillespie 1984, p.2).

Writing for the *Sydney Mail* in 1863, Louisa Atkinson describes a burial near Berrima:

> The mode of interment is to confine the hands around the knees, drawing them up to the chest; a shallow grave is then dug, the corpse placed in it, and built over with earth-the stems of the trees in the vicinity being carved with simple devices (Lawson 1989, p. 51).

Atkinson also notes that the dead were buried with all their possessions and the items that they used during their illness (Lawson 1989, p. 51).

It has been hypothesised (ERM 2012, p. 26 in draft) that the Marulan and Marulan South area may have been suitable for large or regular ceremonial and tribal meetings, because their locations were at the centre of a number of different geographic and Aboriginal group boundaries.

4.1.5 Tools and weapons

Kangaroo and possum skins were used for cloaks and covering as well as wrapping tools for travel. Wood was used to create many tools including canoes, spears, boomerangs, clubs and containers. The bark of stringy bark trees were used for making shelters and rope. Hearths were constructed using wood and stone to provide warmth and for cooking.

Of the materials used for tools, stone survives best in the archaeological record. Stone was widely used in axes and spears, and as grinding and cooking implements. The geology of the region provided stone for tool manufacture including quartz pebbles and silcrete cobbles eroding from some creeks. Material may have also been imported from the surrounding region through trade.

4.1.6 Food

Aboriginal people subsisted on plant foods, aquatic life from the surrounding waterways and ate a variety of fauna such as possum, kangaroo, snakes and lizards. Migrating Bogong moths were the basis of the food supply during the summer months and may have been the basis for large tribal gatherings during these months (Matthews 1994).

4.1.7 Summary

Much information on the practices of Aboriginal people has been lost due to settlement and interactions with European settlers but certain generalisations can be made from early colonial records and subsequent research. Aboriginal people moved in small family groups (Smith 1992), which belonged to clans, all of which were united by language and cultural affinities with ties to specific territories. Historical records have noted large gatherings of people took place in Goulburn in the early 1800s (Smith 1992).

Aboriginal people subsisting on plant foods, aquatic life from the surrounding waterways and ate a variety of fauna. Aboriginal groups had a wide range of tools and equipment made of wood and stone, including reed spears and axes. The bark of stringybark trees were used for making shelters and rope.

Burial in the region was characterised by the interment of individuals in graves to be covered by a layer of stone, rocks and cobbles. There is evidence of the construction of gunyahs, a shelter made of bark or bushes laid against supporting trees or poles (Govett 1836, p. 19).

4.2 Aboriginal Heritage Information Management System search

The most recent search of the Aboriginal Heritage Management System (AHIMS) register for the extension area was completed on 2 February 2016. The search identified previously recorded Aboriginal sites in the local area in order to assist in characterising the local archaeological record.

The search covered 4 km by 4 km centred on the extension area. It identified 20 Aboriginal sites. Figure 4.2 shows the AHIMS sites recorded near the project and their frequency is summarised in Table 4.1.

Open artefact sites are the most common registered site type and are commonly found in close proximity to streams. Isolated finds are more sporadically distributed but also are associated with streams. Potential archaeological deposits (PADs) have been identified with open artefact sites (10%) and isolated finds (7%) but also where no Aboriginal objects have been identified (7%) and are recorded on inference only.

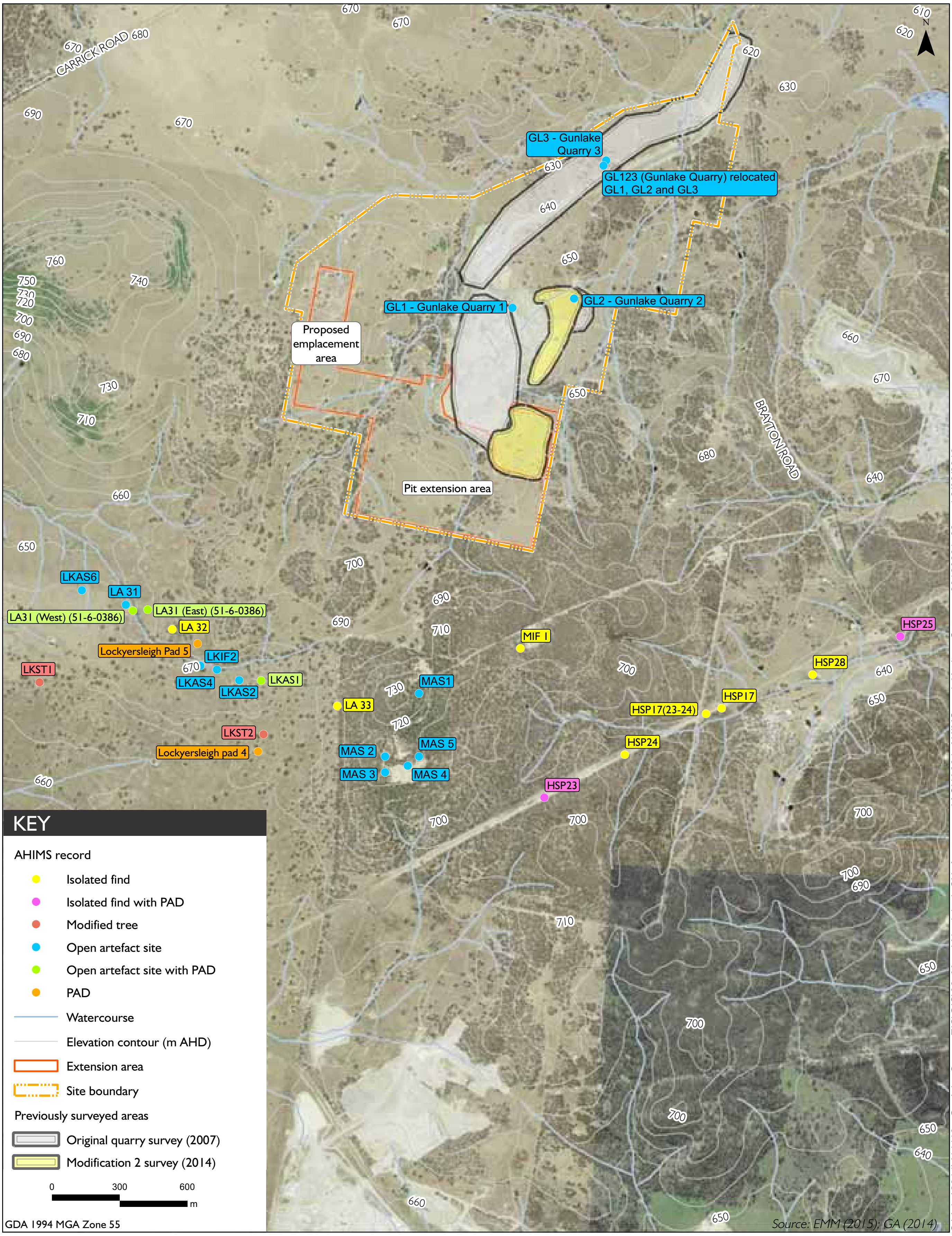
Two modified trees have also been recorded to the south of the extension area and are associated with the Lynwood Quarry Modification 4 Project (Umwelt 2015).

The only sites that occur within the project site boundary are three low density artefacts scatters recorded in 2007 and their relocated coordinates after salvage collection (AASC 2007, refer Section 4.3.3). No Aboriginal sites have been recorded in the project site boundary since the AASC report (2007).

Aboriginal sites recorded south of the extension area invariably comprise stone artefacts in low numbers. The closest site is over 700 m south of the project boundary (this site appears closer on the map has an incorrect AHIMS coordinates and does not actually occur near the project).

Table 4.1 AHIMS registered sites in the search area

Site type	Frequency	Percentage
Isolated find	7	23%
Isolated find with PAD	2	7%
Modified tree	2	7%
Open artefact site	14	47%
Open artefact site with PAD	3	10%
PAD	2	7%
Total	**30**	**100%**



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AHIMS results and previous surveys near the extension area

Gunlake Quarry

Aboriginal cultural heritage assessment

Figure 4.2

4.3 Regional archaeological context

4.3.1 Overview

Archaeological investigations have been undertaken around the project over the last 20 years. The archaeological investigations for the nearby Lynwood Quarry and Peppertree Quarry are discussed in more detail below and Table 4.2 presents a summary of other investigations in the region.

4.3.2 Regional context

Lynwood Quarry Project, Marulan (Umwelt 2005, 2006, 2007a, 2007, 2008a, 2008b, 2009, 2010, 2012, 2015)

The following summarises Umwelt's investigations for the approvals for the Lynwood Quarry facility, located approximately 3 km south of the extension area. To date the investigations have included survey, test and salvage excavation, detailed artefact analysis and a comprehensive excavation report is in production. Lynwood Quarry is currently in the exhibition stage for a modification to expand the quarry up to approximately 1 km south-west of the current extension area (Modification 4) and the results are summarised in this section.

The hydrology of the Lynwood Quarry project area is in the upper catchment of Joarimin, Marulan and Lockyersleigh creeks. The main source of water is Joarimin Creek which flows through the centre of the area as a first to fourth order stream. There are ephemeral to semi-permanent tributaries that flow only during or shortly after heavy rainfall but some would have retained water for several weeks after such events (Umwelt 2010, p.9). The landscape is characterised by spur crests and gentle slopes with some areas of moderate slopes and rocky ridge crests in the northern portion of the Lynwood Quarry project area. Soils are predominately part of the Bindook Road Soil Landscape where the A soil horizon comprises sandy loams on crests and side slopes overlying red sandy clay loams and bleached sandy clay loams. Overall, the Lynwood Quarry project area and current extension area share similar landscape elements. However, the notable difference is that the Lynwood Quarry project area features a broader network of streams and greater water reliability, mainly from Joarimin Creek.

Much of Umwelt's work is reliant on an Aboriginal site identification system based on archaeological terrain units (ATUs). The ATUs take into account both the environmental (stream order, geology and soils, landform element and gradient) and cultural context of the area and are used as part of the predictive model for surface and subsurface sites.

In 2005, Umwelt prepared an ACHA for the Lynwood Quarry project area (Umwelt 2005), approximately 3 km south of the current extension area. The survey covered approximately 350 hectares in five transects over a variety of landforms. The survey identified 52 Aboriginal sites comprising 30 artefact scatters, 13 isolated finds, seven culturally modified trees and two stone arrangements. Several artefact scatters with more than 150 stone artefacts were recorded. However, most sites comprised less than 10 artefacts. Artefactual material included silcrete, quartz and chert.

Over half of the sites were within 30 m of streams, typically on the banks of ephemeral and semi-permanent tributaries. Crests and saddles contained approximately 30% of sites, lower slopes 8%, mid-slopes 6% and upper slopes 4%.

Additional surveys were completed for Country Energy infrastructure and modifications (Umwelt 2007, 2008b). The identified sites generally followed the results of the 2005 survey, with most sites comprising less than ten artefacts, primarily made from silcrete and quartz.

In 2010, Umwelt prepared an ACHA for a modification to the Lynwood Quarry in response to site infrastructure and construction route changes (Modification 2) (Umwelt 2010). The survey did not identify Aboriginal sites, but five areas of PAD were identified on three ATUs comprising a riparian corridor, spur crests and a gentle slope nearby tributaries of Joarimin Creek.

Three stages of test and salvage excavation have been completed as part of the archaeological investigations at Lynwood Quarry.

Stage 1 included three separate stages of excavation (Umwelt 2008a). Stage 1a excavated 20 power pole locations. Over 300 artefacts were recovered. The dominant raw material type was quartz followed by quartzite, silcrete and chert. Stage 1b involved five additional test excavation sites comprising 110 test pits, which yielded a total of 52 artefacts. All of the tested areas were considered to have poor integrity.

Stage 2 comprised four stages of investigation (Umwelt 2008, 2009, 2011). Stage 2a included subsurface testing of known sites. The subsurface testing confirmed the 2005 findings about the degree of disturbance and the low potential for stratigraphic and spatially intact soil deposits integrity. The excavation recovered 648 artefacts, comprising 199 surface artefacts and 448 subsurface artefacts. More than half of the recovered artefacts were silcrete and about a third were quartz. The two sites with highest artefact densities were on spur crests with a south easterly aspect in areas with deep, well-drained sands with high bioturbation. Sites on slopes and saddles had high erosion and low numbers of artefacts. Four additional sites were recorded during fieldwork.

Stage 2b tested the remaining ATUs in the development impact area (Umwelt 2009). Twenty-two artefacts were identified at one locality and seven at another.

Stage 3 consisted of two stages of investigation. Stage 3a involved further subsurface salvage of ATUs and potential archaeological deposits (PAD) and Stage 3b consisted of a final report incorporating the results of all stages (in production).

The combined survey and excavation program at Lynwood Quarry identified 94 Aboriginal sites. Ten of these sites have since been combined into one site (Joarimin Creek South). Thirty-four ATUs were identified, 29 of which contain Aboriginal sites recorded through survey and test excavation. The preliminary analysis of the results of the survey and three stages of excavation have been summarised by Umwelt (2010, Appendix E). Several observations relevant to the current extension area are summarised below:

- The largest numbers of known sites are on the Bindook Porphyry geological unit, on spur crest and gentle slope landforms. However no subsurface artefacts have been recovered from moderate slopes on this geological unit.

- Stone artefact frequencies range significantly between sites. Surface artefact scatters range between 1 and 170, with the largest scatters identified on spur crests and deep sands on Bindook Porphyry. Subsurface excavations on spur crests have also recovered the highest artefact frequencies at Lynwood Quarry, with a maximum of 1,269 artefacts recovered from one site, (MRN54) (Umwelt 2010: Appendix E, p.7).

- Where suitable soil deposits remain, surface artefact scatters are indicative of larger subsurface deposits. Spur crests are likely to have isolated finds and 'low to moderate to high density' and 'low to moderate complexity' artefact scatters. Subsurface material on this landform are unlikely to retain archaeological integrity because of topsoil loss and disturbance, except the landform is fairly stable, ie on relatively level ground with rock outcrops or remnant vegetation has aided to stabilise the soil.

- Gentle slopes are likely to have low density, low complexity artefact scatters. Subsurface artefactual material is unlikely to retain archaeological integrity because of the downward movement of soils through gravity and sheet wash.

- Gentle foot slopes near streams are likely to have moderate density and low complexity artefact scatters. Subsurface material is unlikely to retain archaeological integrity because of the downward movement of soils through gravity and sheet wash except where colluvial deposits have acted to secure archaeological deposits.

- Areas associated with ridge crests, saddles on ridge crests, saddles on spur crests and slopes of moderate gradient reflect transient use. These areas are unlikely to have retained archaeological deposits because of soil loss from erosion.

- No subsurface artefacts were recovered from ridge crests and saddles in Bindook Porphyry.

- Four areas have artefact numbers and densities which may reflect long term occupation including spur crests, parts of Joarimi Creek South and gentle slopes in association with a reliable water source.

- Silcrete and quartz were the dominant materials and it was assessed that most of the stone used for tool manufacture was brought into the area.

- The majority of excavated areas resulted in generally low assessments of Aboriginal cultural and archaeological significance and low research potential. Therefore further salvage was not considered to be warranted for most sites.

Umwelt have recently completed an ACHA for the quarry extraction area modification (Modification 4) which is extends north-west of the current Lynwood Quarry to within approximately 2 km of the current project area (Umwelt 2015). The survey of the proposed Granite Pit Area identified 15 Aboriginal sites comprising five isolated finds, nine artefact scatters and two scarred trees, along with seven PADs. The majority of isolated finds and artefact scatters were found in association with the tributaries of Lockyersleigh Creek which were the most reliable streams in the area. Areas of PAD were identified on gentle slope, spur crest and rocky crest landform elements and were also associated with these streams. Three PADs were assessed to have moderate to high archaeological significance and the remaining four PADs were assessed to have moderate of low to moderate archaeological significance.

Peppertree Quarry Project, Marulan (ERM 2006 and 2012)

Environmental Resource Management (ERM) was engaged by Boral to complete an Aboriginal heritage assessment conducted for the Environmental Assessment of the Peppertree Quarry. The assessment identified 11 sites within the quarry footprint and a proposed water storage dam along Tangarang Creek. The majority of artefacts identified were silcrete and quartz flakes and cores. A recommendation was made for salvage excavation along Tangarang Creek.

Following project approval, ERM undertook a large scale test and salvage excavation prior to the commencement of quarry activities. The following results are currently in draft.

A test excavation program sampled six landforms using ten linear transects. The excavation comprised 103 test pits from which 2,089 artefacts were recovered. The highest artefact frequencies were identified on hill tops and a spur crest rather than lower slopes and the banks of Tangarang Creek.

The areas selected for salvage excavation were based on the results of the test transects. Ten open area trenches were expanded and salvage. The salvage comprised 122 m^2 of open excavation and recovered 20,956 artefacts (average of 171 artefacts/m^2). A number of high density artefact concentrations, hearths and ovens were excavated and a potential human burial was identified but avoided.

The results of the salvage excavation identified seven areas around high artefact concentrations, suggesting the varied and long-term use of the area for camping and meeting that ERM concluded were domiciliary areas. Flakes dominate the assemblage with backed artefacts, cores and retouched flakes also present. Seven types of raw material dominated by silcrete, chert, quartz and quartzite were recorded. Chalcedony, basalt and granite artefacts were present in low frequencies.

The occupation pattern from the excavations showed evidence that the preferred camping areas were on shallow hill slopes and hill tops associated with Tangarang Creek. Long term and frequent habitation by a large group is suggested by the relatively high technological diversity of artefacts, volume of artefacts and the presence of non transportable items such as grinding stones. There was also evidence of a lack of initial manufacture stages across the quarry site, and suggests that initial reduction of material may have occurred in another area.

Table 4.2 Summary of selected regional archaeological investigations

Author	Year	Project title	Type	Summary	Number of sites recorded	Site types/s (*n*)	Distance to extension area
EMM	2015	Marulan South Limestone Mine Continued Operations Project (currently in draft)	ACHA including survey and test excavation	An archaeological survey identified 41 sites and a subsequent 17 during the test excavation. Nineteen sites were previously identified in other investigations. All sites were open stone artefact scatters comprising between 1 and 100 artefacts, except one site which was a modified tree. The highest frequency of sites was found near reliable streams. Gently inclined to level landforms adjacent to Marulan Creek revealed considerable subsurface deposits, while to the south, more rugged ridges and ridge spurs bordering the Bungonia Gorge had skeletal soils with minimal subsurface deposit.	77	Artefact scatter (76), Modified tree(1)	13 km SE
RPS Harper Somers O'Sullivan (RPS HSO)	2009	Marulan South Limestone Mine	ACHA including survey	Survey identified 16 Aboriginal sites including 11 isolated finds and 5 artefact scatters The majority of sites were located on lower slope landform units adjacent to streams.	16	Isolated finds (11), Artefact scatter (5)	13 km SE
RPS HSO	2008	Blue Circle Southern Cement (BCSC) 1 (Marulan South)	Salvage collection	A total of 91 artefacts were collected from BCSC 1 which was 53 more than identified in the original site investigation (ERM 2006). It was noted as being in a highly disturbed area with visible impacts from both natural and human events. Alluvial disturbance was also indicated through the presence of flattened grass and debris. The majority of the collected artefacts were located within 50 m of drainage lines, with the exception of one artefact scatter which was located approximately 100 m from the drainage line. It was considered that no further contextual data could be attached to the collected assemblage. Site BCSC1 was considered to be of low archaeological significance and the majority of artefacts considered to be disturbed and displaced. No further investigation was undertaken.	N/A	N/A	13 km SE
Williams	2004	Proposed pyrotechnics facility Lots 11 and 12, DP 1056566, Marulan South	ACHA including survey	The sites were mostly found in areas of exposure near perennial streams, ridge crests and simple slopes.	8	Artefact scatters (6), Isolated finds (2)	10 km SE

Table 4.2 Summary of selected regional archaeological investigations

Author	Year	Project title	Type	Summary	Number of sites recorded	Site types/s (*n*)	Distance to extension area
Haglund	1986	Areas within Bungonia State Recreation Area likely to be affected by present and future recreational activities and associated developments	ACHA including survey	In total, 15 sites were identified and comprised artefacts consisting of flakes, cores and blades made of silcrete, quartz and indurated mudstone. Haglund (1986) hypothesised that artefact numbers and their distribution indicated that sites were repeatedly used by small groups. The sites were also described as containing large amounts of flaked debris and reject material.	15	Artefact scatter (15)	15 km SE

4.3.3 Archaeological investigations near the extension area

The Gunlake Quarry archaeological investigations near the extension area are shown in Figure 4.2.

In 2007, AASC completed an ACHA for the original Gunlake Quarry layout and associated infrastructure. The survey was limited to the impact areas of the original quarry footprint and did not cover the current extension area. Three small artefact scatters (with artefact numbers ranging from four to six) of low significance were identified within approximately 1.5 km, of the extension area to the north. A further two sites (one isolated find and one artefact scatter comprising two artefacts) were identified over 4 km south-east of the extension area. The three artefact scatters north of the extension area were collected as part of a salvage program and reburied outside the quarry impact area.

Cultural Heritage Management Australia (CHMA) recently completed an ACHA in September 2014 for a modification to the existing Gunlake Quarry pit and overburden embankment areas (Modification 2) (CHMA 2014). The survey covered the Modification 2 pit footprint to the south-east of the original quarry footprint and the overburden extension footprint to the east of its original layout. No Aboriginal objects were identified during the survey. The absence of surface artefacts was attributed to highly eroded soils, extensive rocky outcrops and the considerable distance to permanent water (over 1 km) which arguably made the area unsuitable for anything other than transitory occupation. CHMA determined that only unpredictable deposits of artefacts would occur across the landscape (CHMA 2014, p. 2). CHMA did not recommend test excavation because outcropping bedrock dominated the ground surface. The Modification 2 area was assessed to have low archaeological potential and no further investigation was recommended.

4.4 Summary of archaeological background

- No Aboriginal sites were previously recorded in the extension area.
- The most common Aboriginal site types in the regional context are open stone artefact sites.
- Open stone artefact sites are usually situated close to streams on elevated, level to gently inclined landforms, such as hill crests and hill spur crests. To a lesser extent they are found on foot slopes.
- Subsurface archaeological deposits mostly occur on level to gently inclined landforms, such as hill crests and hill spur crests. To a lesser extent they are found on foot slopes. However, the intactness of the deposit is reliant on the condition and depth of soils.
- The dominant raw materials for stone artefact production in the area are silcrete and quartz which are regionally outcropping.
- Areas of high rock outcropping on typically sensitive landforms may act as a deterrent for Aboriginal occupation.
- The Marulan South area has the greatest archaeological record in the region. Salvage excavation results has indicate an average of 171 artefacts/m^2 in one instance (ERM 2012).
- Other evidence of Aboriginal occupation and activity in the region include hearths and modified trees and potential burials and quarries, although these are far less common. Hearths have been found in association with high artefact concentrations. They are usually located on shallow hill crests, close to water. Archaeological evidence of ceremonial and burial sites is very rare in region.

5 Predictive model of site location

A predictive model of Aboriginal site location is based on:

- the type and distribution of Aboriginal archaeological sites described in previous reports and AHIMS;
- ethno-historical information about Aboriginal material culture; and
- the landscape features applicable to the extension area and its surrounds.

The following predictions regarding the location of Aboriginal sites have guided the archaeological investigation:

- Open stone artefact sites (scatters and isolated finds) are the most likely site types to occur in the extension area; these may occur on all landforms as background scatter, but are likely to occur as larger scatters on hill crest, hill spur crest and foot slope landforms.
- Areas with subsurface archaeological deposits may occur on hill crest, hill spur crest and foot slope landforms where suitably intact soils exist.
- Ridges and saddles are less likely to contain intact archaeological deposits due to topsoil loss and disturbance.
- Open stone artefact scatters are likely to be made up of very few artefacts (typically less than ten); however, extensive scatters of over 150 artefacts may occur.
- The dominant raw material types expected are silcrete and quartz.
- Scarred or carved trees may occur where mature trees of a sufficient age to bear the marks of traditional Aboriginal scarring or carving. These are confined to areas that have not been cleared by European vegetation clearance.
- Grinding grooves, Aboriginal rock shelters, quarry sites, and stone arrangements are not anticipated to occur in the extension area because suitable rock outcrops do not occur.
- Evidence of hearths may exist in deeper, undisturbed soils. They are most likely to be on shallow crests or spurs near streams.
- Ceremonial grounds, mythological sites, and burials can occur anywhere in the landscape but their identification is very rare. Generally they would be identified by mounds of earth or stone markers arranged in a conspicuous layout.

6 Archaeological survey

6.1 Overview

EMM archaeologist Ryan Desic, accompanied by five Aboriginal site officers, surveyed the extension area over two days on 27 and 28 July 2015.

The aims of the survey were to:

- identify Aboriginal sites and places; and
- characterise the landscape to aid predictions of subsurface archaeological sensitivity.

6.2 Method

6.2.1 Survey approach

The survey method aimed to sample the land across the entire extension area. This involved the survey team walking a series of survey transects divided by the landform elements in the extension area. The survey team inspected the ground surface of each transect while spaced out at 10 m intervals along a c.50 m wide corridor where possible. This method was considered to be suitable as a large amount of the extension area was grassed, and exposures were easily identified at this spacing. Exposures were then inspected in more detail.

The survey team targeted ground exposures such as scalds, eroding stream banks and animal tracks, which provided good ground surface visibility for the detection of Aboriginal objects, primarily stone artefacts. All mature trees were inspected for scars of Aboriginal origin.

6.2.2 Landform division for sampling

Survey transects were recorded using the *Australian Soil and Land Survey Field Book* (CSIRO 2009) as a guide. The landform descriptor 'hill spur crest' was used for this assessment but it is not described (2009) which only defines the broader descriptor of 'hill crest'. The distinction of 'spur' was used to further define the lateral crests of land that descend from the summit of hills or ridges. Spurs are typically closer to streams in distance and elevation than the main crest of a ridge or hill.

The extension area was divided into 15 survey transects made up of the following landform elements:

- hill spur crest;
- hill slope;
- foot slope; and
- stream channel (comprising stream bank and stream bed).

6.2.3 Identification and recording of Aboriginal sites

i Definition of a 'site'

Aboriginal sites identified during survey were defined by the presence of one or more Aboriginal objects on the ground surface. The boundaries of a site were limited to the extent of the observed Aboriginal objects. A 'site' does not include the assumed extent of subsurface archaeological deposits.

PADs are technically separate to sites as they are defined as the predicted extent of subsurface Aboriginal objects in a particular area. PADs are not technically Aboriginal sites until Aboriginal objects are identified, typically through archaeological excavation. PADs can also be associated with artefact scatters that are likely to have eroded out of a more extensive subsurface deposit.

Although it was predicted that certain landforms were associated with PAD, this assessment avoided the demarcation of areas of PAD in the extension area. This approach was used primarily because an archaeological test excavation strategy was developed to test all landforms across the extension area and therefore it was unnecessary to define the predicted extent of archaeological deposits as they would be characterised from the test excavation results.

The Aboriginal site types identified in this assessment were open stone artefact sites (more than one stone artefact in a specific location) and isolated artefacts referred to as 'isolated finds'. A general boundary definition employed by archaeologists is that artefacts more than 50 m apart are regarded as separate sites, although this technique may not reflect subsurface artefacts occurring between the 50 m distance. The 50 m separation rule was used for this assessment. EMM acknowledge that the 50 m rule is an arbitrary distinction and is mainly used as a tool for the consistency of results and for comparison with Aboriginal sites beyond the extension area. Notwithstanding, to address Aboriginal sites that were likely to be fragmented parts of localised artefact distributions, site names were given suffixes eg GL14a, GL14b, GL14c which were all on the same 400 m by 200 m area but separated by grass cover.

ii Site recording

Site locations were recorded using a hand-held GPS unit with recorded data confirmed on GIS software. Transects were accurately mapped by downloading tracks recorded on GPS. Aboriginal sites were recorded by marking each artefact location or each cluster of artefacts within a 5 m radius as a separate waypoint in the GPS. Site boundaries were allocated by drawing a line around the cluster waypoints for each site using ArcGIS computer software. Stone artefacts more than 50 m apart were recorded as separate sites (see 6.2.3 i).

Photographs identifying landscape context and representative samples of site artefact contents were taken for each site. Appendix B contains AHIMS site cards for all the sites recorded during the survey.

6.3 Results

6.3.1 Survey coverage data

i Rationale

The aim of recording and analysing survey coverage data is to determine the effectiveness of the survey for an evaluation of the distribution of Aboriginal objects across the landscape, taking into account archaeological potential. The percentage of the ground surface exposed in each landform and the visible ground surface within exposures (as ground exposures are often obscured by vegetation, gravels etc) influence the survey results. For example, an archaeologically sensitive landform surface that is highly exposed by erosion is likely to reveal Aboriginal artefacts whereas a thickly grassed landform of the same sensitivity is unlikely reveal any artefacts. Where there is limited visibility, subsurface testing is a more suitable method to characterise the archaeological resource if predicted to be in the area.

Overall, calculation of effective survey coverage is used to estimate not only how much area was physically surveyed but also how favourable the conditions were to identify Aboriginal sites. Therefore an assessment of effective survey coverage is important in determining further investigations measures such as the requirement for test excavation.

ii Results

A total of 15 discrete transects, each within a separate landform, were walked, adding up to approximately 14 km. Landform coverage is summarised in Table 6.1 and coverage details for each transect is provided in Table 6.2.

Figure 6.1 illustrates the survey transects logged by GPS. However, the survey track data represents only where the archaeologist walked and does not represent the broader transect with covered by the survey team.

Effective coverage was generally high, 18% on average, considering that many pastoral landscapes in NSW often result in less than 5% effective coverage on average where thick grass is present. Overall, effective coverage ranged from 1% to 64% across the 15 transects. Examples of the surveyed landforms are shown in Photograph 6.1 to Photograph 6.4.

The main factors influencing high ground surface visibility were the expansive eroded scalds and animal tracks on crests concentrated in the proposed embankment area. Furthermore, stream banks and foot slopes also had large exposures relating to water erosion such as sheet wash and gullying.

The proposed pit extension area had lower ground surface visibility. Vegetation including thick native grass, riparian corridors of native regrowth vegetation and tree foliage were the main causes of lower ground surface visibility. Additionally, ground surface visibility was obscured by considerable areas of exposed porphyry bedrock primarily outcropping on hill spur crests (up to 30%) and hill slopes (up to 50%) in this area. There was a distinct decrease in porphyry outcropping in the proposed embankment area where only 02% porphyry outcropping was observed on hill spur crests and hill slopes.

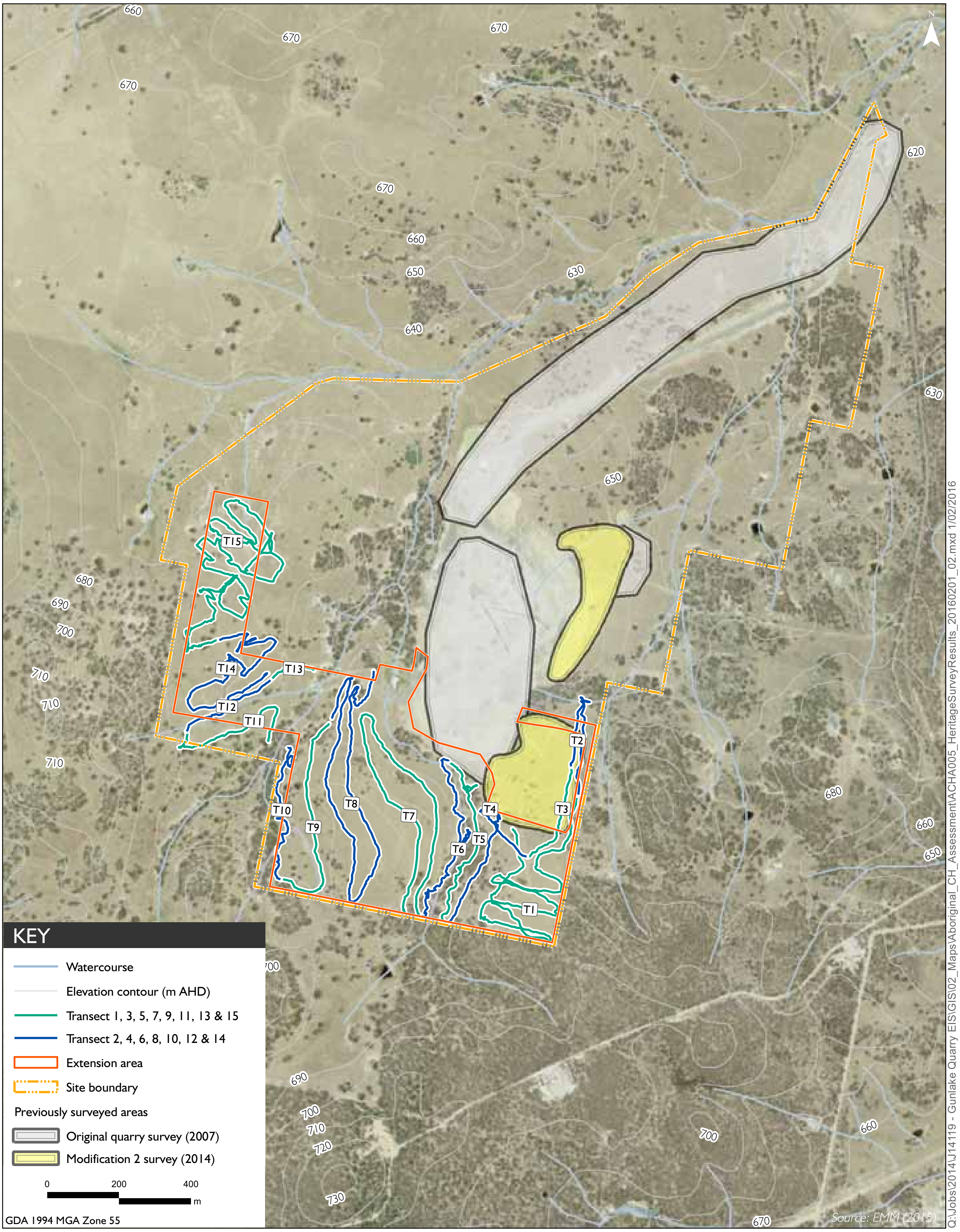
Existing ground disturbance was primarily attributed to extensive historic vegetation clearing across the whole extension area. The effects of clearing have clearly contributed to accelerated soil erosion, particularly on hill spur crests, hill slopes and stream channels. Livestock grazing appears to have been the primary historic land use and evidence of ploughing was not observed. Highly disturbed areas were confined to constructed soil drainage bunds on hill slopes and dammed sections of streams.

Effective coverage for obtrusive site types such as scarred or carved trees, grinding groove sites and rock shelters was comprehensive for the extension area. Most trees encountered were the product of regrowth. None of the exposed porphyry bedrock was suitable for procuring grinding grooves and no rock shelters were identified.

The effective coverage results indicate that the survey was particularly effective for identifying open stone artefact sites on all landforms in the proposed embankment area and on stream channels and on some foot slopes in the proposed pit extension area. The hill spur crests and hill slopes in the proposed pit extension area generally did not provide adequate ground exposures, either because of thick vegetation or rock outcropping. Therefore, it was conservatively extrapolated that the gently inclined hill spur crests, hill slopes and foot slopes in the proposed pit extension area would have similar archaeological characteristics to those revealed in the proposed embankment area where adequate ground exposures were present. The only method to verify this prediction was to conduct a test excavation in this area.

Table 6.1 Landform coverage summary

Landform	Landform area (m^2)	Area effectively surveyed (m^2)	% of landform effectively surveyed
Hill spur crest	354,484	103,600	29
Hill slope	230,436	20,816	9
Foot slope	64,849	8,624	13
Stream channel	57,986	26,216	45



Survey coverage results

Gunlake Quarry
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Figure 6.1

EMM

Table 6.2 Survey coverage summary for each transect

Transect	Landform element	Length (m)	Width (m)	Area (m^2)	Exposure	Visibility	Effective coverage (area available for detection) (m^2)	Effective coverage %	Extent of rock outcrop %	Disturbance
T1	Hill spur crest	1,818	50	90,881	5%	50%	2,272	3	20	Extensive clearing; erosion
T2	Hill slope	582	50	29,115	5%	50%	728	3	5	Extensive clearing; erosion
T3	Hill spur crest	317	50	15,866	5%	50%	397	3	5	Extensive clearing; erosion
T4	Hill slope	734	50	36,707	30%	60%	6,607	18	50	Extensive clearing; erosion
T5	Foot slope	731	50	36,525	10%	50%	1,826	5	2	Extensive clearing; erosion
T6	Stream channel	847	50	42,346	80%	70%	2,3714	56	2	Extensive clearing; erosion
T7	Hill slope	1,324	50	66,193	5%	10%	331	1	30	Extensive clearing; erosion
T8	Hill spur crest	1,678	50	83,922	5%	70%	2,937	4	20	Extensive clearing; erosion
T9	Hill slope	630	50	31,492	5%	70%	1,102	4	20	Extensive clearing; erosion
T10	Foot slope	566	50	28,324	30%	80%	6,798	24	N/A	Extensive clearing; erosion
T11	Hill spur crest	489	50	24,457	40%	90%	8,804	36	N/A	Extensive clearing; erosion; drainage bunds
T12	Stream channel	313	50	15,640	20%	80%	2,502	16	N/A	Extensive clearing; erosion; portions of highly disturbed dams and drainage bunds
T13	Hill slope	136	50	6,825	30%	60%	1,228	18	N/A	Extensive clearing; erosion; drainage bunds
T14	Hill slope	1,202	50	60,104	30%	60%	10,819	18	N/A	Extensive clearing; erosion; drainage bunds
T15	Hill spur crest	2,787	50	139,359	80%	80%	89,190	64	2	Extensive clearing; erosion

Photograph 6.1 **Rock outcropping on hill slope in eastern portion of the extension area (Transect 5, facing S)**

Photograph 6.2 **Thickly grassed hill spur crest in the central portion of the extension area (Transect 8, facing NE)**

Photograph 6.3 Eroded stream bank of a tributary to Chapman's Creek (Transect 6, facing S)

Photograph 6.4 Extensive scald exposure on a broad hill spur crest (Transect 15, facing NE)

6.3.2 Aboriginal sites

i Overview

The survey team identified 15 individual Aboriginal sites. All of the Aboriginal sites were comprised of stone artefacts, made up of 12 open stone artefact sites and 3 isolated finds. The Aboriginal site locations are shown on Figure 6.2 and detailed descriptions of each site are tabulated in Appendix D and as AHIMS cards in Appendix B.

ii Landscape distribution

Aboriginal sites were found on each landform defined for this assessment (Table 6.3). One third (33%) were identified on level to gently inclined (0–9% slope tangent) hill spur crests, primarily in the proposed embankment area. No Aboriginal sites were identified on hill spur crests in the proposed pit extension area. Similarly, almost a third of sites (27%) were identified on foot slope landforms within close proximity to streams. Although only one site (GL14a) was found on a hill slope landform, it contained the second highest artefact frequency (32 artefacts). However, this site is on the upper portion of a hill slope bordering on the hill spur crest and is considered to be an extension of the broader G14 site. The remaining sites identified on drainage depression, dam wall, and stream bank landforms are in highly eroded and disturbed landscapes and are likely to have been transported downslope into these depressions through erosion.

Table 6.3 Site type frequency within each landform type

Landform type	Open stone artefact	Isolated find	Total	Percentage of sites
Hill spur crest	5	0	**5**	33%
Foot slope	3	1	**4**	27%
Stream bank	2	0	**2**	13%
Modified: dam wall at stream channel	1	1	**2**	13%
Drainage depression	0	1	**1**	7%
Hill slope	1	0	1	7%
Total	**12**	**3**	**15**	**100%**

Most sites (73%) were identified within 50 m of a stream, with approximately one quarter of these being on foot slope landforms. Aboriginal sites on the hill spur crest landforms varied the greatest in distance to water, ranging from less than 50 m to 250 m. The results indicate that the Aboriginal sites on hill spur crests were the least influenced by proximity to water and that outlook and suitably level ground was a more influential aspect of site preference.

iii Site artefact frequency and density

Site artefact frequencies ranged from 1 to 235 across sites (Table 6.4). Eleven of the 15 Aboriginal sites (73%) contained less than 5 artefacts. Three sites contained between 11 and 32 artefacts and one significant outlier contained 235 counted artefacts (GL14c). Site GL14c was identified over approximately 40,000 m² on a broad, level to very gently inclined hill spur crests overlooking tributaries to Chapmans Creek to the east and west.

Only a preliminary count of artefacts was made for GL14c because of the extensive area and frequency of artefacts within its boundaries. It is estimated that between 300–400 artefacts may exist within the site boundary of GL14c. Sites GL14a, b, c, d, if considered as whole, contain 281 counted artefacts. Overall, Aboriginal sites on hill spur crest landforms contained the highest artefact frequencies.

Artefact densities within sites of greater than 10 m² as calculated on basic length x width divided by artefact frequency (excluding all isolated finds) resulted in artefact densities of 0.001 up to 0.008/m^2. The value of calculating artefact densities for surface Aboriginal sites is very limited for this assessment as artefacts/m² decreases significantly in the larger site areas, such as G14c, despite these being the sites with the highest artefact frequency. Table 6.4 presents artefact frequency and densities for all the Aboriginal sites identified during the survey.

Table 6.4 Site artefact frequency densities

Site Name	Artefact frequency	Landform element	Site area (m²)	Artefact density/m²
GL4	3	Modified: dam wall at stream channel	40	0.08
GL5	2	Foot slope	25	0.08
GL6	2	Foot slope	20	0.10
GL7	2	Stream bank	2	N/A
GL8	4	Foot slope	100	0.04
GL9	2	Stream bank	10	N/A
GL10	4	Hill spur crest	200	0.02
GL11	1	Foot slope	1	N/A
GL12	16	Hill spur crest	400	0.04
GL13	1	Modified: dam wall at stream channel	1	N/A
GL14a	32	Hill slope	5,200	0.01
GL14b	3	Hill spur crest	2,800	0.001
GL14c	235	Hill spur crest	40,000	0.01
GL14d	11	Hill spur crest	400	0.03
GL15	1	Drainage depression	1	N/A

iv Artefact types and raw materials

The dominant artefact raw material observed in the field was silcrete which was present in 66% of sites. The silcrete was present in various colours, including shades of grey, white, brown and dark red. Quartz was also commonly found in varying qualities from highly isotropic, almost clear examples to white opaque examples with numerous flaws and fracture plains. Other less common raw materials included quartzite, chert and indurated mudstone/tuff (IMT).

Artefact types were typical of Aboriginal open camp site assemblages and comprised flakes, broken fragments of flakes (proximal, medial and distal portions and indeterminate flaked pieces), cores, and tools (retouched flakes). Retouched flakes were identified in four sites. Sites GL8, GL12 and GL14d each had one retouched silcrete flake and GL14c contained three retouched silcrete flakes. It is likely that GL14c contains a higher frequency of retouched flakes than recorded, as only a preliminary count of artefacts was made and not all flakes were examined for signs of retouch. Photograph 6.5 shows examples of artefact types and their raw materials.

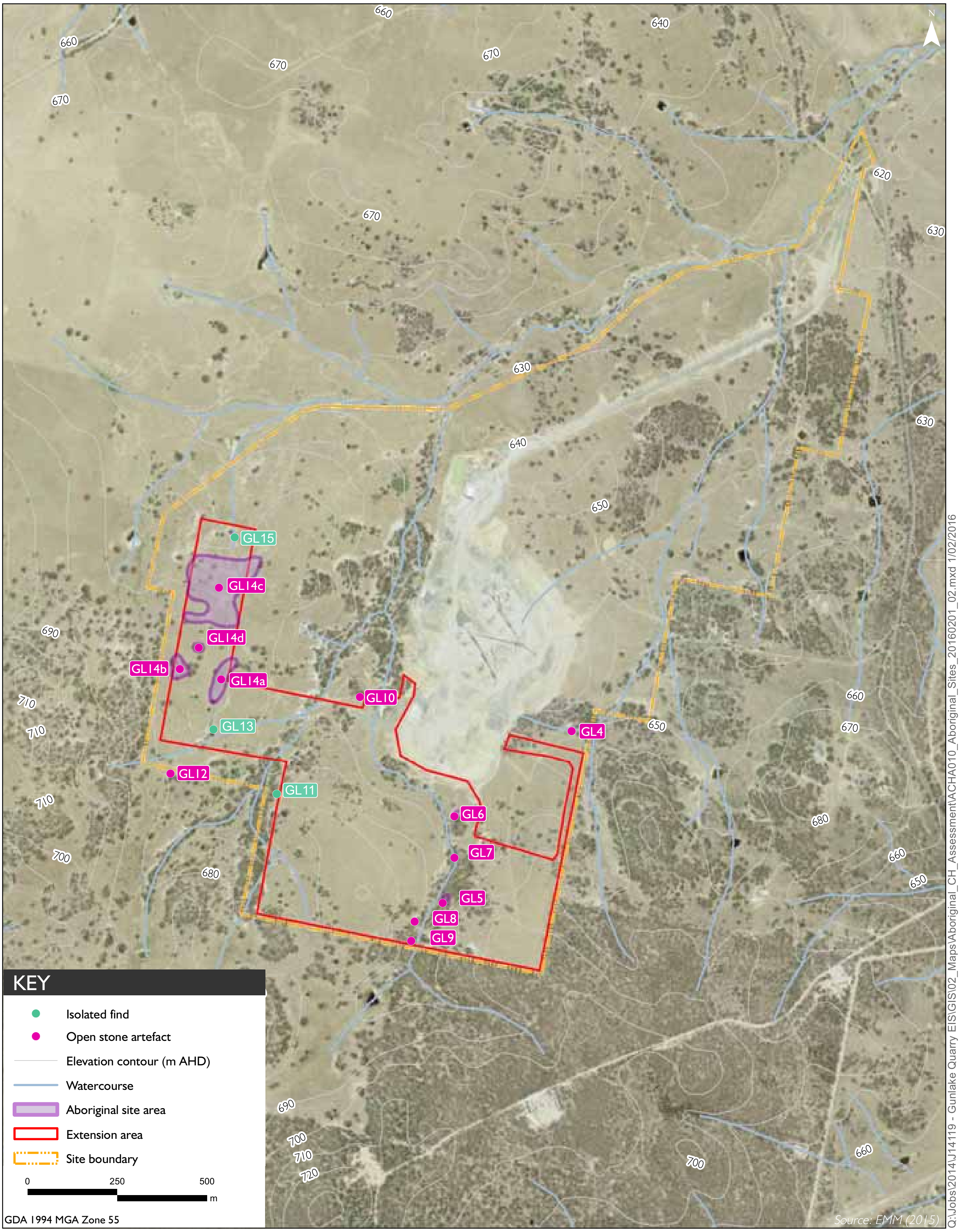
Site GL14d showing the variation of flakes in their raw material, including silcrete of various colours, chert and quartz

Site GL14a showing quartz occurring in grades of milky white to the more crystalline smokey grey. An example of IMT is also present (second from right)

Site GL13 comprising a single IMT core approximately 8 cm long

Site GL8 (from left to right): brown silcrete flake retouched along left lateral margin, brown IMT blade flake, white quartz distal flake and grey silcrete distal flake

Photograph 6.5 Artefact types and raw materials



EMM

Aboriginal site results

Gunlake Quarry
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Figure 6.2

7 Archaeological test excavation

7.1 Overview

EMM archaeologists, accompanied by Aboriginal site officers, conducted an archaeological test excavation in the extension area over five days from 6 to 10 October 2015. The excavation team comprised 10 people made up of five archaeologists and up to five Aboriginal site officers on each day. All RAPs were invited to provide a representative according to a roster.

The purpose of the archaeological test excavation was to characterise the integrity, extent, distribution, nature and overall significance of the archaeological record. A greater understanding of the archaeological resource in the extension area has contributed to appropriate management recommendations.

The results of background research for the region and the archaeological survey of the extension area justified the requirement for an archaeological test excavation, primarily because:

- The survey results identified an extensive open stone artefact concentration made up of sites GL14a, b, c and d (Figure 6.2). These sites have a combined artefact frequency of potentially 300–400 artefacts including flakes, cores and tools which indicates an extensive tool manufacture site. This is almost twice the frequency of the largest open stone artefact site identified at the nearby Lynwood Quarry (170 artefacts) (Umwelt 2010, Appendix p.7). Test excavation aimed to resolve whether the surface material is indicative of a more extensive subsurface deposit, which would have implications for the significance and management requirements of the sites.

- There are landforms in the extension area, notably those in the proposed pit extension area, that are heavily grassed and did not reveal Aboriginal objects. Test excavation could identify whether Aboriginal sites occur in these contexts in addition to those identified on similar landforms where adequate ground exposures exist.

- The results of previous assessments for Gunlake have indicated that the surrounding areas surveyed were of low archaeological potential. Test excavation could identify if certain areas of the local landscape were favoured by Aboriginal people in the past, which may be attributed to mirco-topographic variations such as rock outcrop and water availability.

7.2 Strategy

The aims of the test excavation were to:

- characterise the subsurface archaeological deposit in areas of known surface sites;

- verify the presence of subsurface Aboriginal objects in landforms where surface sites have not been identified (possibly because of low ground surface exposure and visibility conditions); and

- identify areas of low archaeological potential, indicated by the low frequency or absence of artefacts and/or drop-off in artefact frequency along transects.

Table 7.1 presents the landforms targeted for excavation and a hypothesis for each landform type.

Table 7.1 Landforms targeted for test excavation

Sensitive landform targeted	Hypothesis	Predicted subsurface potential
Level to gently inclined hill spur crest	This landform type has been shown to contain low to moderate to high density and low to moderate complexity artefact scatters (indicative from the survey results and previous investigations at Umwelt 2010). Spur crests are the most likely to have retained archaeological integrity, specifically where rock outcrops or remnant vegetation has aided to stabilise soils.	High
Level to gently inclined foot slope near adjacent to streams	This landform type has been shown to contain low to moderate density and low complexity artefact scatters. Subsurface material may not retain archaeological integrity because of the downward movement of soils through gravity and sheet wash except where colluvial deposits have acted to secure archaeological deposits.	Moderate
Gently inclined hill slope	This landform type has been shown to contain low density, low complexity artefact scatters. Subsurface artefactual material may have accumulated here but is unlikely to retain archaeological integrity because of the downward movement of soils through gravity and sheet wash.	Moderate

7.3 Research questions

The test excavation aimed to address a set of research questions to aid the assessment of overall significance of the archaeological deposit. These are presented in Table 7.2. However, the paucity of artefact numbers from the test excavation resulted in many of the research questions remaining unaddressed; this topic discussed further in Chapter 8.

Table 7.2 Research questions

Question	Analysis method
Is the distribution and density of surface artefact sites in the extension area a true reflection of Aboriginal occupation patterns?	• Comparison of artefact number and distribution in surface and subsurface contexts.
Are the results of the excavation comparable to other investigations in the local area, primarily Lynwood Quarry? What similarities and differences do the results suggest about Aboriginal occupation patterns between areas, given the variation in environmental contexts?	• Review of Lynwood Quarry results against Gunlake Quarry results.
What is the makeup of Aboriginal sites in key landform contexts?	• Size and technological tabulation; and • Descriptive statistics of artefacts by attribute and landform.
Can connections with other areas be identified?	• Review of regional raw material sources and artefact characteristics for each raw material.
How does the assemblage vary across the extension area?	• Analysis of frequency and variability of artefact attributes (eg core size, implement forms).
Is there any indication of different site activities being undertaken at different locations?	• Functional analysis of artefact and implement forms to determine eg knapping floors, hunting areas, ceremonial areas, camping areas.

7.4 Test pit layout

The test excavation program involved placing eight linear test pit transects across the extension area in the landforms targeted for test excavation (reference to transect numbers in this chapter relate to the test pit transects and should not be mistaken with the survey transects that are discussed in the previous chapter). Forty-two individual 1 m x 1 m test pits were excavated. Their layout is shown on Figure 7.1. The final layout and orientation of the test pit transects differed slightly from those presented to RAPs and OEH during consultation (Table 2.2 and Appendix A). Most of these were slight variations of the transect angles to better cover landforms. It also involved excavating additional test pits to better characterise certain landforms. Specifically, Transect 4 was moved from the proposed pit extension area because of very rocky ground and relocated to further test site GL14c further. Additionally, Transect 6 was extended to further test a hill slope landform and Transect 8 was added to test site GL14b.

7.5 Excavation method

The test excavation method comprised:

- manual excavation of 1 m x 1 m test pits spaced 20 m intervals across landforms;
- excavation of the soil deposits in levels termed 'spits' to identify the nature of the soils and to identify any stratigraphic sequence. The first test pit in each tested area was excavated in 10 cm spits and subsequent pits excavated in 20 cm spits. This method was modified to excavate according to soil horizon during the second day of excavation, after it was established that the artefact bearing deposit was confined to the A1 topsoil and did not continue into the rocky A2 soil horizon identified in most tested areas;
- each pit was excavated until basal clay was reached, or at least one 20 cm spit below the archaeologically sterile (where no artefact deposit exists). However, this was not always achievable as the rocky soils in many areas made further excavation unfeasible;
- all excavated soil was dry-sieved on site during the excavation program using 5 mm aperture mesh; and
- all pits were backfilled after recording.

Excavation recording methods included:

- photographic recording of all phases of work on site;
- soil profile drawings for each test pit;
- pH testing; and
- the location, dimensions and characteristics of all test pits deposits recorded on standardised context sheets.

Photographs of the excavation are shown in Photograph 7.1.

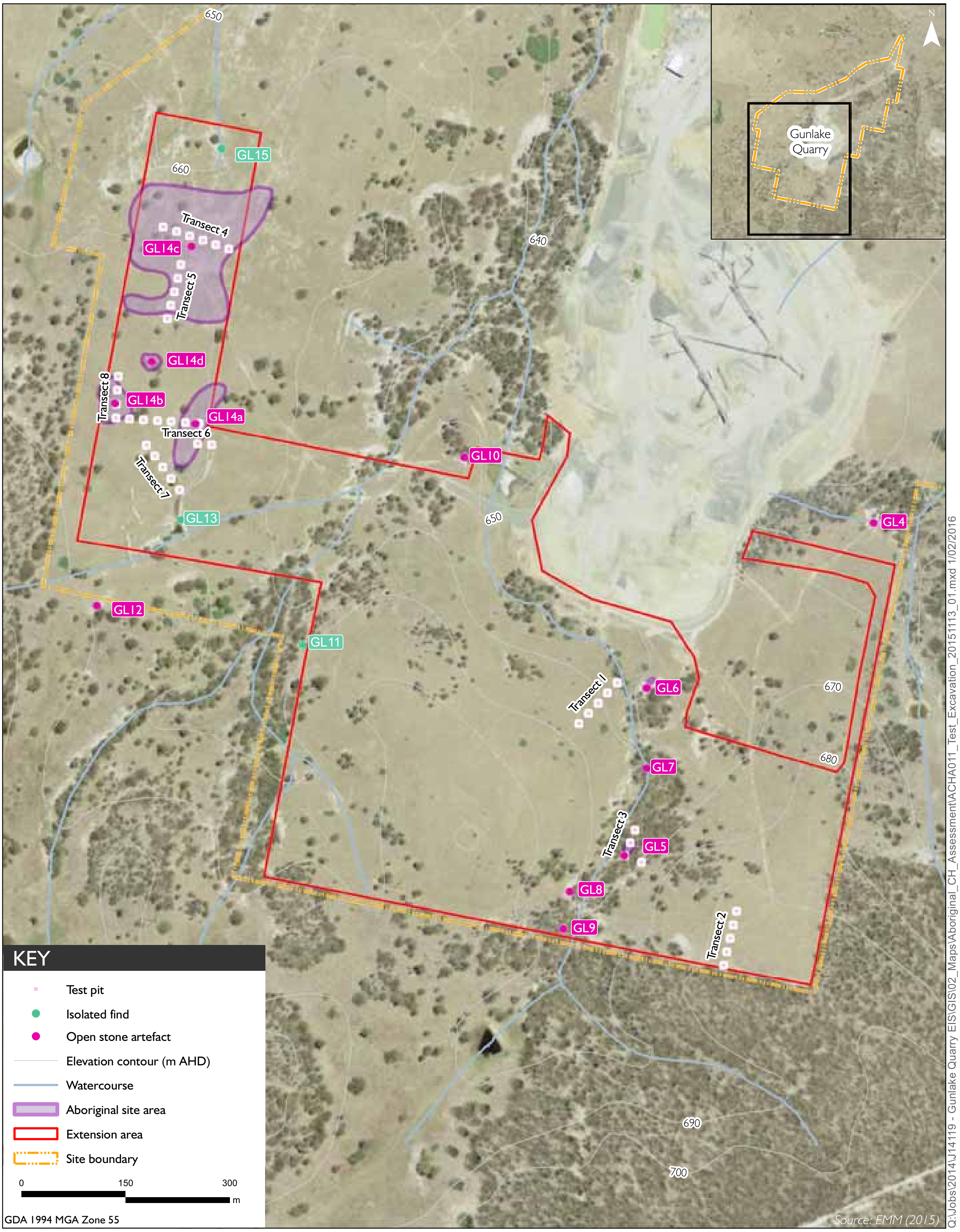
Excavating test pits along a hill spur crest

Sieving excavated material

Recording test pits

Recording test pit excavated to basal clay

Photograph 7.1 Test excavation photos



Test excavation layout

Gunlake Quarry

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Figure 7.1

7.6 Test excavation results

7.6.1 Soils

Soil deposits are important to archaeology as they have the potential to retain archaeological material. Therefore, variables such soil type, soil depth, level of disturbance, erosion, aggradation and inclusions all influence the likelihood of artefacts and features being retained within the soil. The extent of these variables also influences the archaeological integrity of archaeological deposits, and by extension, their significance.

Soils varied across the tested landform types and there was also considerable intervariability within the same landform type across the extension area. This section describes the soils observed in the extension area. Examples of soil profiles are shown in Figure 7.2 to Figure 7.9.

Soils in the proposed embankment area generally comprised a light brown sandy loam A horizon overlying either weathering porphyry directly or an intermediate B horizon. The hill spur crests and hillslopes had a highly truncated A1 horizon which was typically less than 10 cm in depth followed by a highly compacted A2 horizon with frequent gravels, often increasing in gravels until porphyry bedrock was reached. There was evidence of a slight accumulation of A1 soils at the lower portions of the hill slopes but still less than 15 cm of topsoil remained. It was clear that soils on crests were highly deflated by erosion caused by vegetation clearance and the vast scalds and sheet washes that ensued. Subsequently, the artefact bearing A1 horizon was largely limited to less than 10 cm of soil and a considerable amount of artefactual material had already eroded from this deposit to be present on the ground surface.

Soils in the proposed pit extension area were generally similar in composition to the proposed embankment area but featured much higher rock outcropping content in boulder form. Considerable boulders up to 40 cm in diameter were common in Transect 2 in the eastern portion of the extension area. The A1 soil horizon has experienced less erosion than the hill spur crests in the proposed embankment area. This is likely to be because of thicker grass coverage and the presence of larger boulders which have acted to stabilise the soil. Similarly, frequent larger boulders were present in Transect 1 on a foot slope landform. However, the waning foot slopes within 10 m of a stream channel (Transect 3 and Transect 1) revealed evidence of a shallow accumulation of silty alluvium up to 35 cm in depth with no boulders visible.

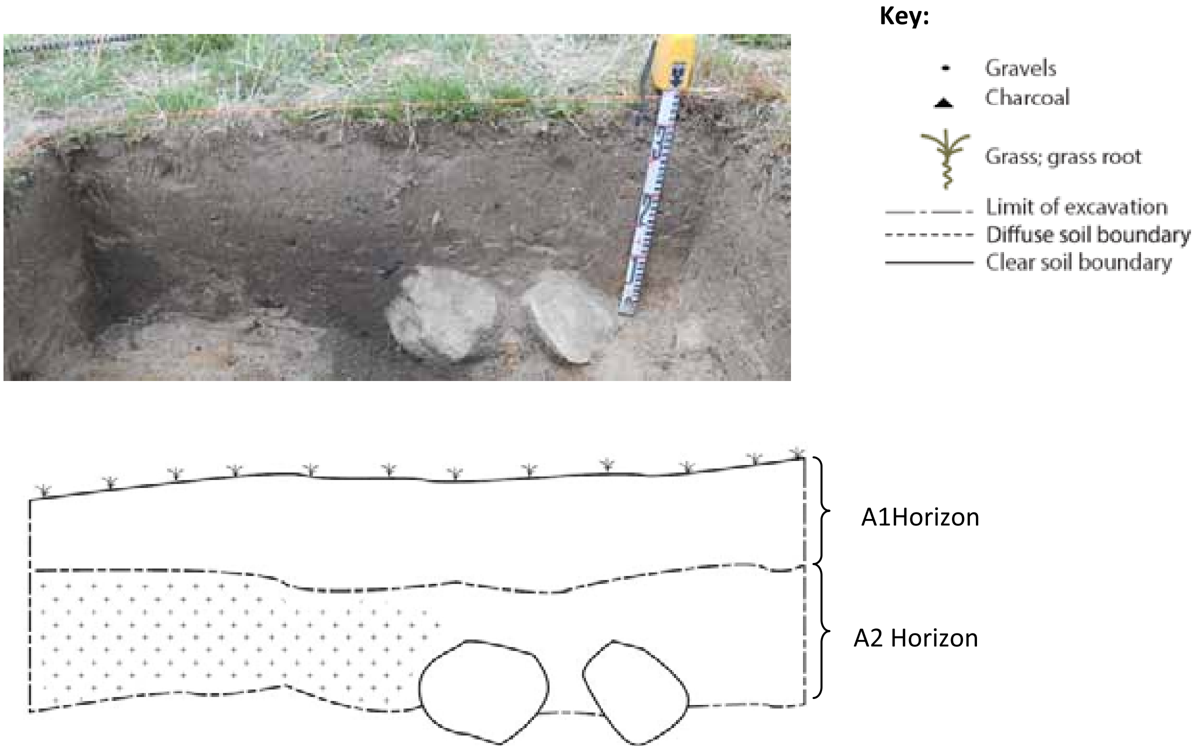


Figure 7.2 **Soil profile of Transect 1, TP 783E 860N showing small boulders and a pocket of mixed charcoal from a burnt tree root.**

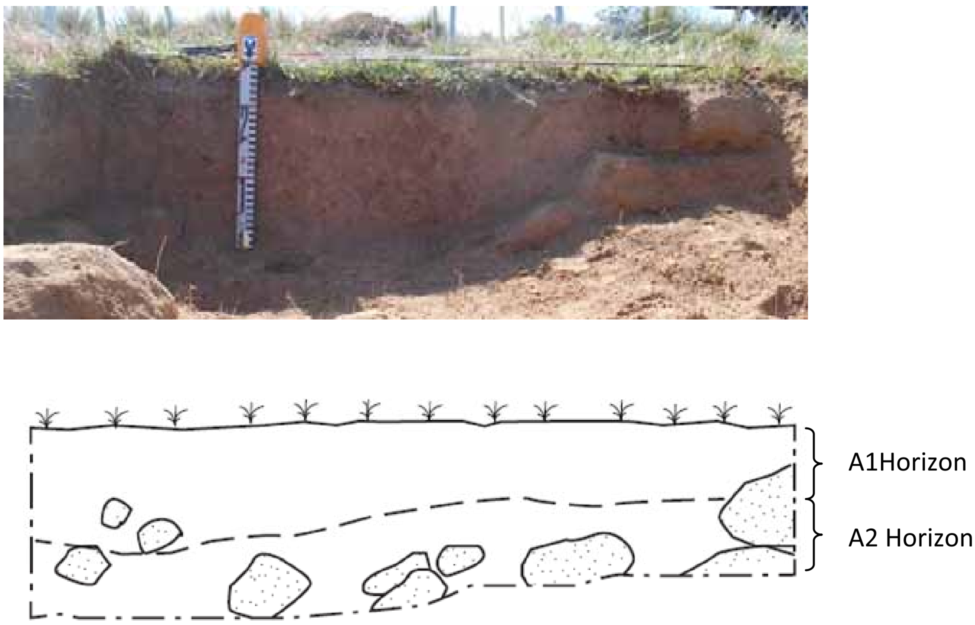


Figure 7.3 **Soil profile of Transect 2, TP 936E 514N showing frequent small boulders.**

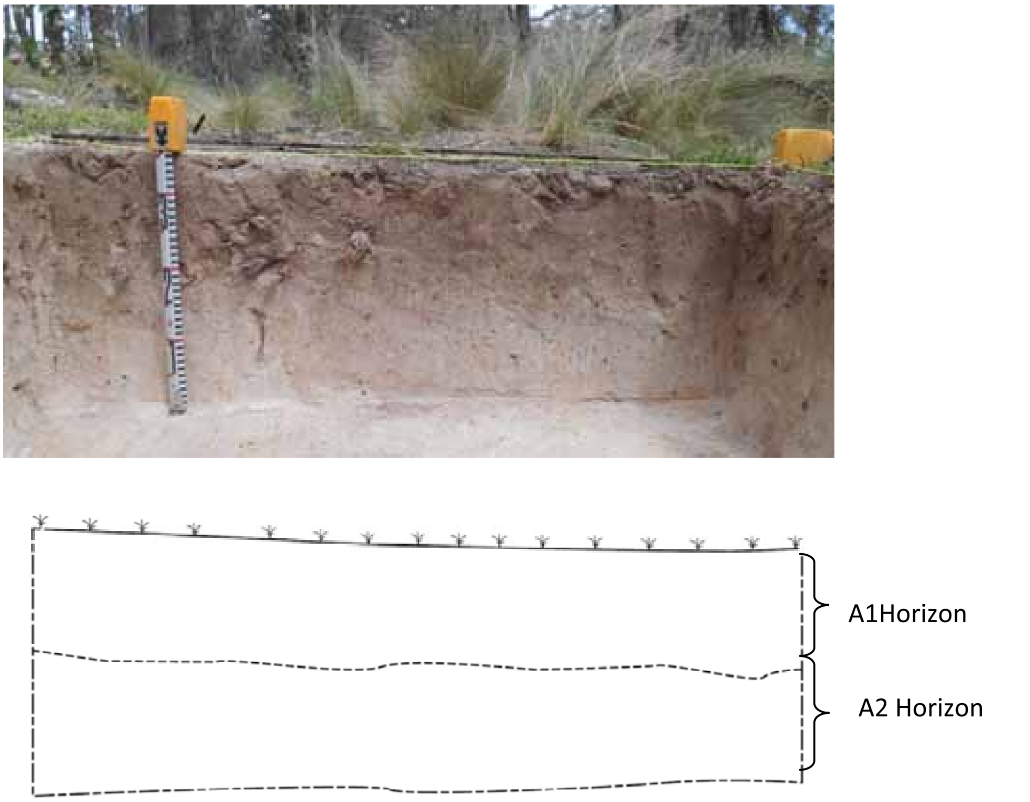


Figure 7.4 **Soil profile of Transect 3, TP 814E 612N. An example of silty alluvium accumulated adjacent to a tributary of Chapman's Creek.**

Figure 7.5 **Soil profile of Transect 4, TP 185E 484N. An example of a highly truncated soil profile with frequent rocky inclusions.**

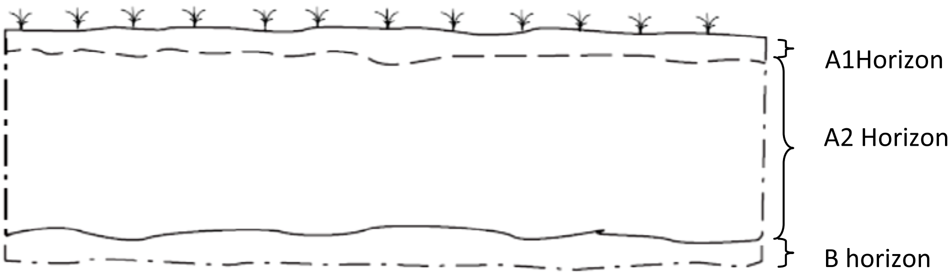


Figure 7.6 Soil profile of Transect 5, TP 136E 404N showing a very truncated A1 horizon and a bleached A2 horizon relating to the lack of topsoil vegetation.

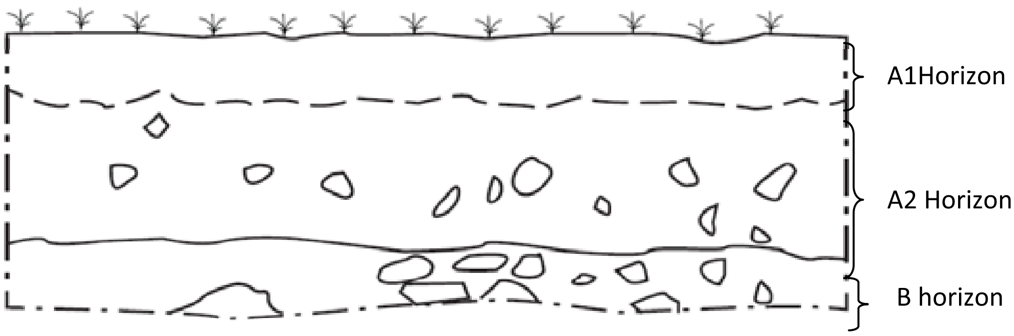


Figure 7.7 Soil profile of Transect 6, TP 102E 241N

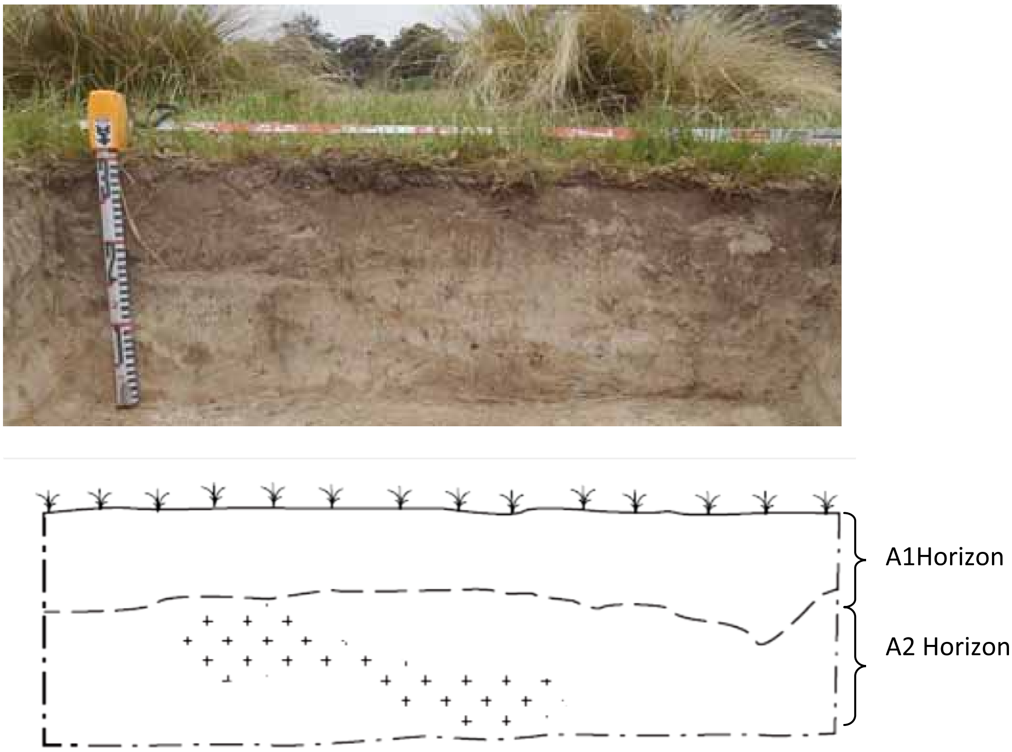


Figure 7.8 **Soil profile of Transect 7, TP 186E 202N showing slightly deeper A1 accumulation at the base of the hill slope with fewer rocky inclusions**

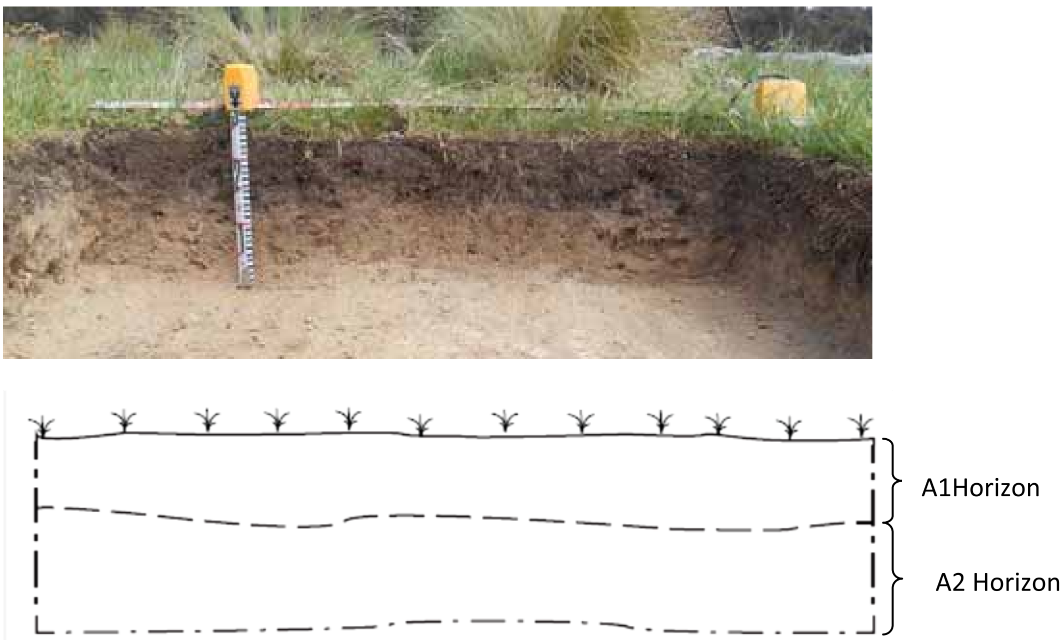


Figure 7.9 **Soil profile of Transect 8, TP 062E 281N showing highly truncated A1 horizon and a A2 horizon with high gravel content.**

7.7 Artefact frequency and distribution

Artefact frequencies for each test pit are presented in Table 7.3 and are shown in Figure 7.10. During the test excavation, 89 artefacts were recovered from the 42 test pits. This equates to an average density of 2.12 artefacts/m^2. One third (15) of the test pits contained artefacts. Artefact frequencies within the 42 individual 1 metre squares ranged from zero to 20 artefacts/m^2. All but four of the artefacts (95%) were recovered from the upper 20 cm of soil, and after the excavation method was revised to excavate according to soil horizon, it was established that artefacts were invariably confined to the A1 soil horizon (approximately the upper 10 cm).

The majority of stone artefacts were identified in Transects 5 (39%) and 8 (24%).

Transects 1 and 2 did not yield artefacts.

Table 7.3 Artefact frequencies for each test pit

Transect	Test pit	Number of artefacts	Total artefacts per transect	Landform type
1	703E 860N	0	0	Foot slope
	723E 860N	0		
	743E 860N	0		
	763E 860N	0		
	783E 860N	0		
2	936E 454N	0	0	Hill spur crest
	936E 474N	0		
	936E 494N	0		
	936E 514N	0		
	936E 534N	0		
3	794E 612N	3	5	Foot slope
	794E 632N	0		
	794E 652N	0		
	814E 612N	2		
4	125E 484N	0	14	Hill spur crest
	145E 484N	0		
	165E 484N	0		
	185E 484N	1		
	205E 484N	0		
	225E 484N	13		
5	136E 404N	6	35	Hill spur crest
	136E 424N	20		
	136E 444N	1		
	136E 464N	8		
	136E 384N	0		
6	062E 241N	0	2	Hill spur crest
	082E 241N	2		
	102E 241N	0	10	Hill slope
	122E 241N	6		
	142E 241N	4		

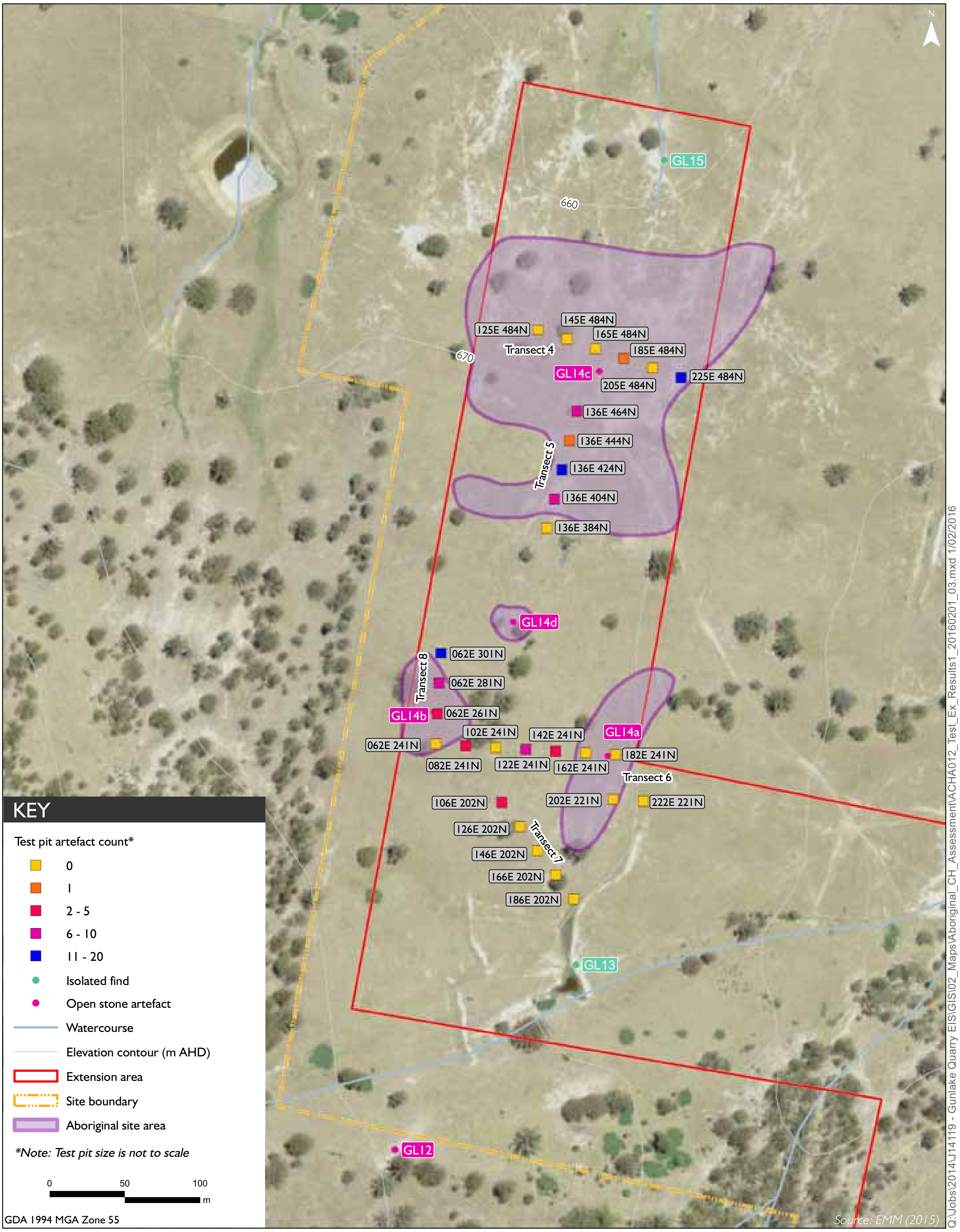
Table 7.3 Artefact frequencies for each test pit

Transect	Test pit	Number of artefacts	Total artefacts per transect	Landform type
	162E 241N	0		
	182E 241N	0		
	202E 221N	0		
	222E 221N	0		
7	106E 202N	2	2	Hill slope
	126E 202N	0		
	146E 202N	0		
	166E 202N	0		
	186E 202N	0		
8	062E 261N	2	21	Hill spur crest
	062E 281N	6		
	062E 301N	13		
Total			**89**	

Approximately 80% of artefacts (n=72) were recovered from the hill spur crest in the proposed embankment area. Artefact distribution across the landform was not consistent and 6 out of the 16 pits (37%) did not contain artefacts and only three pits contained over 10 artefacts. Conversely, no artefacts were recovered from the hill spur crest in the proposed pit extension area (Transect 2) and only 5 artefacts (6%) were recoveredin the proposed pit extension area as a whole. Considerably fewer artefact frequencies were recovered from hill slope (13%) and foot slope landforms (7%). Overall, low average frequencies were recovered per landform type, ranging from 1 to 3.4 artefacts per m² (Table 7.4). An example of artefacts from a test pit with the highest frequency is shown in Photograph 7.2.

Table 7.4 Artefact frequency and average frequency per landform

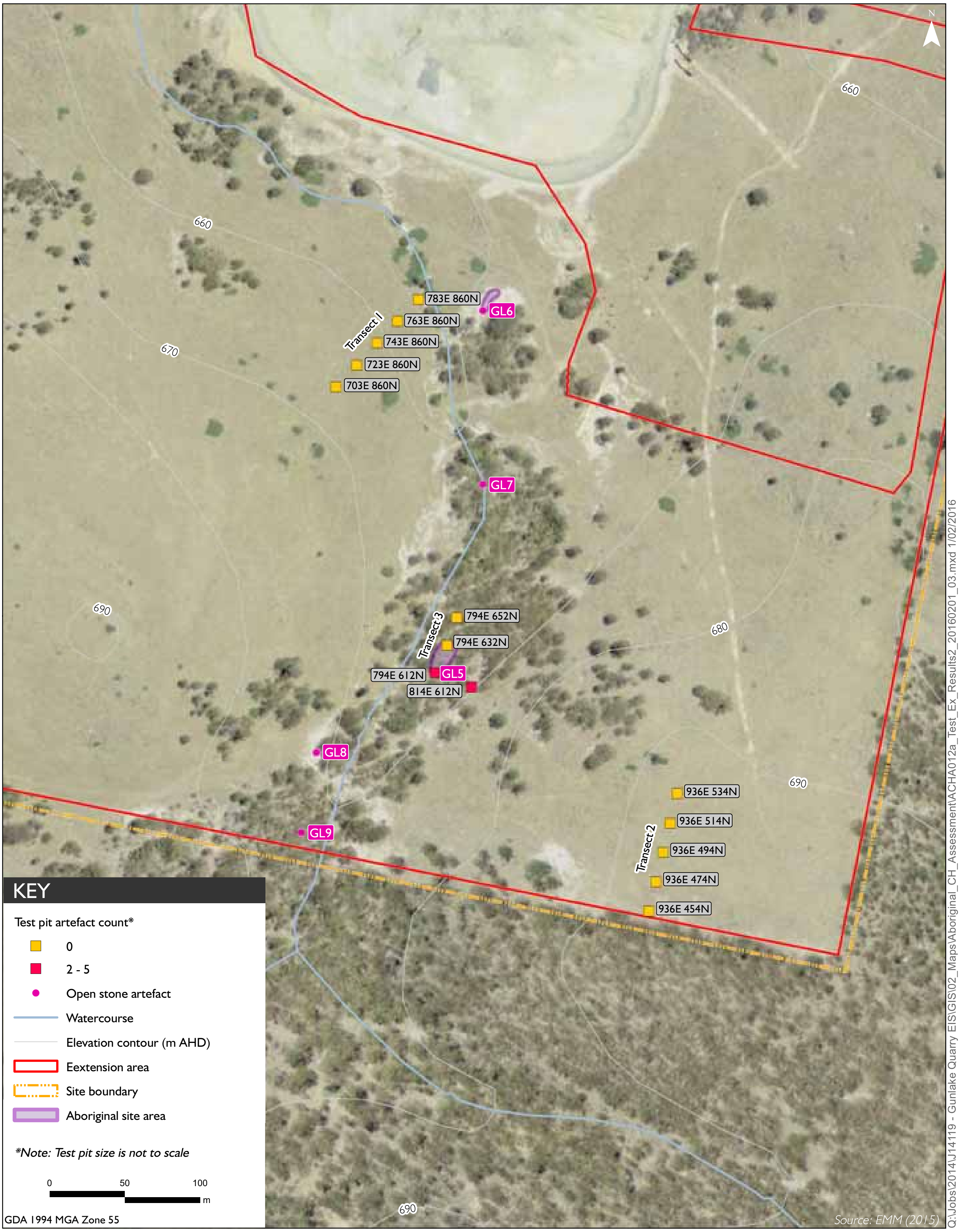
Landform type	Number of pits	Artefact total	Average frequency per m²
Foot slope	9	5	1.8
Hill spur crest	21	72	3.4
Hill slope	12	12	1.0
Total	**42**	**89**	**2.12**



Test excavation results

Gunlake Quarry
Aboriginal Cultural Heritage Assessment

Figure 7.10



Test excavation results

Gunlake Quarry

Aboriginal Cultural Heritage Assessment

Figure 7.11

Photograph 7.2 Assemblage from the top 20cm of TP 136E 424N in Transect 5 — two retouched flakes (top left) and a quartz core, (bottom right)

7.7.1 Artefact raw materials

Silcrete, a silica rich, sedimentary rock, was the predominant raw material recovered from the excavation and made up 67% of the assemblage and tended to be light grey or, less frequently, dark grey or reddish brown. Silcrete was most prevalent in Transect 5, making up 83% of that assemblage. To a lesser extent, it was also the most dominant material in Transects 4 and 6 (64–75%).

Quartz made up 27% of the total assemblage. Quartz artefacts found in the test area were mostly milky white or smoky grey. Other, crystal-like quartz contained yellow or pink seams. The quality of the quartz ranged from homogenous varieties with good conchoidal fracture characteristics, to material containing numerous flaws and incipient fracture planes which makes the material less suitable for stone tool manufacture. Consequently, only two quartz flakes in the assemblage displayed evidence of being retouched. Quartz was the only material type found in Transect 3, on the foot slope and was well represented in the assemblage from Transect 8 (43%).

Artefact raw materials and their frequencies across test pit transects are shown in Figure 7.12. Examples of raw materials are shown in Photograph 7.3.

Photograph 7.3 TP 142E 241N Transect 6, top 20cm. Left to right: quartz core with 25% cortex, fine grained red silcrete flake, a backed silcrete artefact (Bondi Point with missing distal tip) and silcrete retouched flake

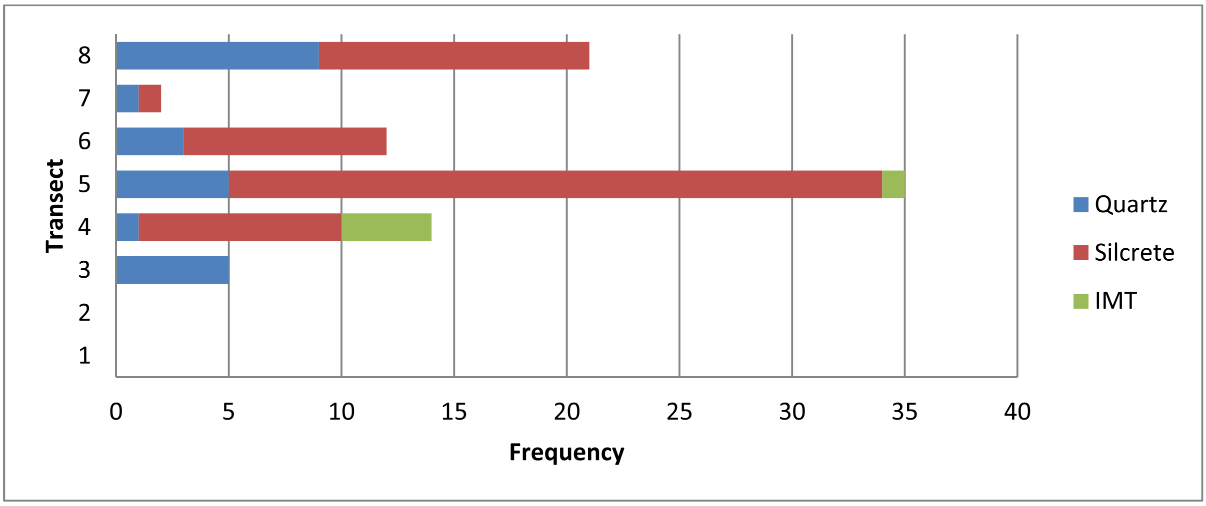


Figure 7.12 Artefact raw materials

7.7.2 Artefact types

Artefact technological types and their frequency are shown in Figure 7.13. Complete flaked artefacts made up 52% of the assemblage. On the whole these were small flakes, ranging in size from 8 mm to 33 mm and in weight from 0.2 g to 3.65 g. The two longest flakes had been retouched. Flake fragments, made up of proximal, medial and distal portions, flaked pieces and longitudinally split flakes made up 35% of the assemblage.

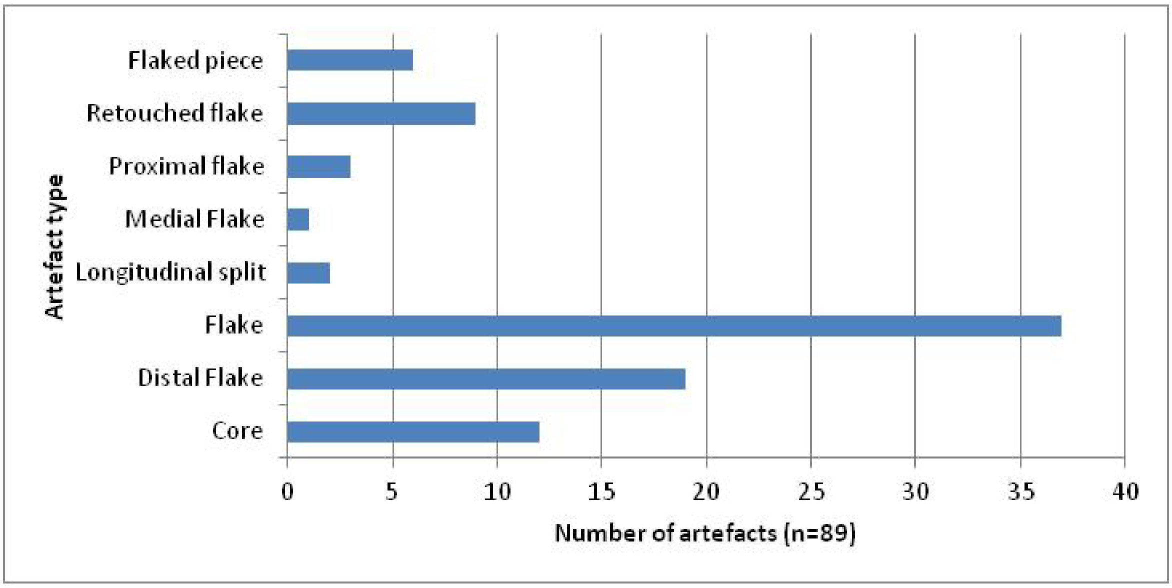


Figure 7.13 Artefact types and their frequency

Fifteen cores were recovered from the excavation (16%). Most of these were relatively small, from 14 mm to 35 mm long and from 0.13 g to 19.36 g in weight. This indicates extensive reduction of raw material, particularly silcrete which made up two thirds of the cores. Cortex, the outer weathered portion of stone, was present on approximately 10% of the artefacts which suggests extensive reduction was occurring in the extension area and the majority of artefacts are the result of later stages of reduction (Hiscock 2001). The raw material frequency for each artefact type is presented in Table 7.5.

All but one core was recovered from the hill spur crest in the proposed embankment area and one third of these (five) came from a single pit (Transect 5: TP 136E 424N). An example of a core is shown in Photograph 7.4.

Photograph 7.4 Silcrete core from Transect 4 with numerous step termination scars. Cores were used to produce flakes for various purposes but the core itself could be used as a tool for activities such as scraping

Table 7.5 Raw materials frequency for each artefact type

	Core	Distal flake	Flake	Longitudinal split	Medial flake	Proximal flake	Retouched flake	Flaked piece	Total
Quartz	4	2	12	-	1	-	2	3	**24**
Silcrete	8	15	25	2	-	4	4	3	**61**
IMT	-	2	2	-	-	-	-	-	**4**
									89

Retouched flakes (n=9) were represented across Transects 5, 6 and 8 from the hill spur crest and upper hill slope in the proposed embankment area. Examples of retouched flakes are shown in Photograph 7.5.

Retouch was more prevalent on silcrete flakes than quartz although the nature of the quartz itself sometimes makes this difficult to identify. Flakes tended to be worked along the lateral margins, often using a pressure flaking technique to create a serrated edge. Flakes were retouched onto the dorsal or ventral surface but not usually both. There was one backed silcrete artefact (ID#1434). It had been reworked by the removal of small flakes along one distal margin to create a distinct, steep blunt edge. The distal tip was missing but it was probably pointed. This type of artefact known as a 'Bondi point' was possibly used as a spear point, cutting or piercing implement for objects such as animal skins.

Holdaway and Douglass (2011) cite ethnographic examples to demonstrate how "production to enable multiple uses, transport of artifacts [sic] to multiple locations, maintenance, and recycling" are all factors in producing the material remains that exist at a particular site (Holdaway and Douglass 2011, p.27). They point out that the privileging of retouched artefacts and cores over flakes and broken flakes by archaeologists is not necessarily the way that the people who created and used them would have viewed them. While a distal flake could be part of the overall debitage, it could also have been deliberately selected for its sharp edge. Therefore how stone artefacts were valued depended on the situation or purpose for which they were required and were often selected on an expedient basis.

Photograph 7.5 Retouched flakes (ID#1413, 1424, 1433, 1434, 1439, 1447, 1422)

7.8 Summary of test excavation results

The Aboriginal stone artefact assemblage can be summarised thus:

- 89 artefacts were identified in 15 of the 42 individual 1 m x 1 m test pits;
- one third of test pits contained one or more artefacts;
- the majority of artefacts (92%) were recovered from the top 20 cm of soil;
- artefact frequencies per 1 m x 1 m square ranged from zero to 35 which equates to a frequency of 2.12 artefacts per m^2;
- the highest densities of artefacts were recovered from the hill spur crest in the proposed embankment area in association with sites GL14a, b, c and d;
- silcrete dominated the assemblage and made up 67.5% of artefacts. Quartz made up 27% of the assemblage and IMT 5.5%;
- the number of reworked flakes was relatively small (10%) and included a single backed artefact; and
- most retouched flakes (seven of the nine) were silcrete.

8 Discussion

8.1 Aboriginal sites and their distribution

The survey results and the test excavation results must be considered jointly when characterising the archaeological record of the extension area. The survey and the test excavation results both showed that sites GL14a, b, c and d (associated with a low hill spur crest and its upper hill slope) were the most intensely occupied portion of the extension area, as reflected by the greatest number of stone artefacts. However, the test excavation results contradict the hypothesis that the surface distribution of GL14a, b, c, d, is simply a window into a much larger subsurface distribution. Although a subsurface distribution beneath the surface was verified, it was generally very limited.

The greatest factor contributing to small number of subsurface artefacts is the integrity of the soil deposit. The artefact bearing deposit, established as the A1 topsoil horizon, has been severely truncated by erosion in this area. This is common on crests and upper slopes that have historically been cleared of vegetation and subsequently used for animal grazing. As a result, a considerable portion of the archaeological deposit has been exposed on the surface as sites GL14a, b, c and d. The subsurface deposit, GL14a, b, c and d is sporadically distributed and not consistent with the surface scatter boundary. The site boundary of GL14a, b, c and d as shown by surface artefacts therefore can be considered as a far better representation of the site than what the subsurface archaeology offers. For example, four of the six test pits excavated on Transect 4 contained no artefacts despite being positioned directly adjacent to concentrations of surface artefacts.

While the subsurface record was limited, the test excavation results still confirmed that hill spur crests were the most likely landforms to contain subsurface deposits. Seventy-two of the 89 artefacts (81%) were recovered from a hill spur crest, an average of 3.4 artefacts per m^2. This was nearly twice the density found on foot slopes and over three times the density on hill slopes. However, Transect 2, from which no artefacts were recovered, was on a hill spur crest. The extensive outcropping of bedrock here, as also mentioned in CHMA's investigation of the adjacent Modification 2 area (CHMA 2007), may have been a deterrent for occupation. Furthermore, while equally close to a stream as sites GL14a,b,c and d, the gradient to access the stream was considerably steeper and with more rocky terrain to navigate. This prediction extends to the hill spur crest in the centre of the proposed pit extension area which is also very rocky. Therefore, it is reasonable to conclude that the hill spur crest in the proposed embankment area, less than 1 km west, was a far more desirable landform to occupy with resources that were easier to access.

Test excavation on mid to lower portions of hill slopes and foot slopes in the proposed embankment area found very low artefacts throughout the whole extension area (refer Figure 7.10 and Figure 7.11: Transect 1, 3, 7 and the mostly easterly pits of Transect 6). For example, only three artefacts were recovered from testing the surface site GL5. Overall, it appears that the five surface sites identified on the foot slopes and bank of the nearby stream channel (GL5, 6, 7, 8, 9) better represent site distribution and characteristics on these landforms. The foot slopes and lower hill slopes in the extension area therefore have low archaeological potential. There was no evidence that colluvial deposits had acted to secure archaeological deposits, as observed in some instances in the Lynwood Quarry project area (Umwelt 2010 Appendix E).

The research questions posed in Section 8.3 can only be addressed to a limited extent, mainly because of the paucity of artefacts recovered during the test excavation. The limited artefact assemblage recovered would not justify detailed comparisons with other artefact assemblages such as those at Lynwood Quarry and Peppertree Quarry, particularly because the main archaeological resource in the extension area, sites GL14a, b, c and d, lack archaeological integrity. Notwithstanding, it is reasonable to draw comparisons on a broader level, particularly in relation to Aboriginal site location across landform types and their general makeup.

The results of the survey and test excavation support the findings at Lynwood Quarry and Peppertree Quarry in that elevated, level to gently inclined landforms overlooking streams such as hill spur crests and low hill crests are the most archaeologically sensitive landforms in the region. However, the subsurface archaeological potential on these landforms varies considerably and is highly dependent on the condition of soils to retain the archaeological deposit. The extent of outcropping rock may also have been a factor as it may have acted as a deterrent for occupation. The highest subsurface artefact frequencies recovered during Stage 2a at Lynwood Quarry were from deep, well-drained sands on hill spur crests. Therefore, hill spur crests, although likely to have been widely occupied by past Aboriginal people (except where considerable rock outcropping occurs), only retain significant archaeological deposits where soils have been less affected by erosion.

Although the extension area shares similar landforms with regional examples such as Lynwood Quarry it is important to consider that the absence of nearby perennial water is also one of the main reasons why the archaeological record in the extension area is less extensive and with isolated concentrations when compared to the more intensively used areas in the region. The Lynwood Quarry project area features a much broader network of streams, which is mainly influenced from Joarimin Creek that flows through the centre of Lynwood Quarry as a fourth order stream. Considering the increased hunting and gathering resources that come with reliable water, it is understandable that the extension area was used more selectively because of its limited resources. This may be why the most extensive evidence of Aboriginal occupation is concentrated at sites GL14a, b, c and d: it may have been the best area to utilise the available resources. The nearby water springs may have also contributed to increased water reliability near sites GL14a, b, c and d, but without records of the flow volume of these springs, it is difficult to speculate to what extent they would have influenced Aboriginal occupation in the extension area.

8.2 Artefact assemblage characteristics

The artefact assemblage generally represents the by-products of stone tool manufacture. The paucity of artefact numbers recovered from excavation limits meaningful analysis of technological types. However, the typically small stone cores suggest extensive reduction of the available raw material and also that smaller tools were the desired outcome of manufacture. Such examples, and the evidence of a 'backed' tool, are typical of mid- to late-Holocene assemblages where small 'backed' tools were made for larger composite tools and weapons. In excavations at Peppertree Quarry, backed and retouched artefacts were identified as a small portion of the assemblage but included Bondi points and geometric microliths (ERM 2012, p.160).

The artefact assemblage in the extension area is typical to the local area and the region. Silcrete and quartz are the dominant raw material type across the Lynwood Quarry, Peppertree Quarry and Marulan South Limestone Mine project landscapes. Despite silcrete being the most common artefact raw material in the extension area, was not outcropping due to; the underlying geology does not permit it. However, outcropping silcrete has been identified in the region, from the banks of Marulan Creek 12 km to the east (EMM 2015) and by McIntyre who found a "quarry site" 10 km to the west where silcrete and quartz were thought to have been quarried at the site (McIntyre 1993).

Quartz is a locally and regionally available raw material, often occurring as river cobbles or as veins in granite rock types. Although quartz outcropping was not specifically observed in the extension area, it would have been available within a radius of a few kilometres. Therefore, it is likely that people imported the raw materials used for stone tool manufacture into the extension area, but generally from a convenient distance when using silcrete and quartz and possibly further when using chert, quartzite and IMT. Like the extension area, relatively smaller numbers of chert, IMT and quartzite were identified at Lynwood Quarry (Umwelt 2006).

The low archaeological integrity of the extension area creates difficulties around defining any particular 'activity areas' where localised activities took place within the general 'open camp site'. As most of the archaeological record has eroded out of the soil deposit and it is possible that some has been reburied, the artefacts found at each site lack spatial integrity and may have moved a considerable number of metres from their original position. It is safer to make conservative interpretations when faced with sites of this nature.

8.3 Conclusion

The results of the survey and test excavation indicate that the extension area represents a landscape that has evidence of concentrated occupation on the hill crest spur and its upper slopes in the embankment area (sites GL14a, b, c and d). This is characterised by the distribution of hundreds of artefacts across the landform. Smaller, less intensive occupation is likely to have occurred on foot slopes and adjacent to creek banks across the extension area. The rocky hill spur crests and hill slopes in the proposed pit extension area did not demonstrate evidence of Aboriginal occupation.

No new Aboriginal sites have been recorded as the result of the test excavation. Most of the archaeological material recovered (artefacts recovered from test pit transects 4, 5, 6, 7 and 8) can be considered as part of the larger GL14 site (comprised of GL14a, b, c and d). Similarly, the subsurface material recovered from test pit Transect 3 is considered to be a part of GL5.

The extent of erosion and paucity of subsurface archaeological deposit indicates that the extension area has low archaeological potential and that the surface evidence of Aboriginal occupation is characteristic of the local archaeological record. Therefore, it is predicted that further excavation of GL14a, b, c and d would result in a continuous sporadic assemblage with a low return on the labour effort involved if an average of 3.4 artefacts/m^2 is an indicator for the rest of the area. It is likely that if the test pits with higher densities (such as the maximum frequency of 20 artefact/m^2) were expanded then a similar count could be recovered for a number of metres. However, even these frequencies are considerably low when compared to regional examples such as Peppertree Quarry which has an average of 171 artefacts/m^2.

9 Significance assessment

9.1 Defining heritage significance

Heritage sites, objects and places hold value for communities in many different ways. The nature of those heritage values is an important consideration when deciding how to manage a heritage site, object or place and balance competing land-use options.

The many heritage values are summed up in an assessment of 'Cultural Significance'.

The primary guide to management of heritage places is the Australia ICOMOS Burra Charter 2013. The Burra Charter defines cultural significance as follows:

> Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups (ICOMOS 2013).

The purpose of this assessment is to identify various aspects of Aboriginal heritage for the purpose of assessing possible development impacts. The aspect of Aboriginal heritage identified in this assessment pertains to physical Aboriginal objects and sites.

9.2 Socio-cultural and historic value: significance for the Aboriginal community

'Non-archaeological Aboriginal heritage values' refers to places which have meaning in accordance with memory or tradition but not associated with cultural objects. These sorts of places are described as "intangible sites" and include any historic values related to historically important persons, events, phases or activities in the Aboriginal community. Aboriginal cultural knowledge is defined as:

> ...accumulated knowledge which encompasses spiritual relationships, relationships with the natural environment, and the sustainable use of resources, and relationships between people, which are reflected in language, narratives, social organisations, values, beliefs, and cultural laws and customs... (DECC 2010).

Research and consultation with the Aboriginal community was conducted to determine whether any socio-cultural heritage value relates specifically to the extension area regardless of archaeological evidence.

Aboriginal heritage sites with archaeological evidence are all of value to the Aboriginal community through the tangible connection that they represent with pre-European Aboriginal land use. EMM acknowledges that the registered Aboriginal parties consider Aboriginal objects as culturally significant items.

To date, no information has been received that identifies specific heritage value unrelated to the Aboriginal sites. No historical connection has been identified specifically pertaining to the project area.

9.3 Scientific value

9.3.1 Overview

Scientific value is assessed according to the research potential of a site. Rarity and representativeness are also related concepts that are taken into account. The following scientific values are identified as 'low', 'moderate' or 'high' for each identified Aboriginal site with an overall rating identified based on the results of each individual assessment. In the overall assessment of significance, research potential and rarity is generally be weighted higher.

9.3.2 Research potential

Research potential or demonstrated research importance is considered according to the contribution that a heritage site can make to present understanding of society and the human past. Those heritage sites, objects or places of high scientific significance are those which provide an uncommon opportunity to inform us about the people in an area, or provide a rare glimpse of artistic endeavour or provide a rare chronological record of changing life through archaeological investigation. That is, these sites have the ability to provide information about the past that is not obtainable from any other source or it supplements written and oral sources.

9.3.3 Rarity

The comparative rarity of a site is a consideration in assessing scientific significance. A certain site or artefact type may be 'one of a kind' in one region, but very common in another. Rarity also applies to sites and objects that were once common, but have become uncommon through development and change.

9.3.4 Integrity

The integrity of a site is also a consideration in determining scientific significance. While disturbance of a topsoil deposit with artefacts does not entirely diminish research value, it may limit the types of questions that could be addressed. A heavily cultivated paddock may be unsuited to addressing research questions of small-scale site structure, but it may still be suitable for answering broader questions of regional stone tool distribution and raw material logistics.

9.3.5 Research themes

The capacity of a site to address research questions is predicated on a definition of what the key research issues are for a region. In the local region, the key research issues revolve around the chronology of Aboriginal occupation and variability in stone artefact manufacturing technology.

9.3.6 Educational value

Educational value relates to the capacity of a site to portray more easily recognisable archaeological features. While the educational potential of Aboriginal sites can only be effectively realised through interpretation, those sites with more obtrusive elements and suitable settings offer greater potential to illustrate the main features of past Aboriginal activity.

An educator selecting sites to demonstrate to students the physical evidence of Aboriginal occupation in an area is more likely to choose an extensive grinding groove site or a rock shelter with art. In contrast, an educator would avoid a small scatter of artefacts which, to the lay person, may not be readily differentiated from natural gravel. Therefore, aesthetic values play a major part in the educational value of an Aboriginal site.

9.4 Statements of scientific significance

Table 9.1 presents the statements of scientific significance for each Aboriginal site according the scientific value criteria set out in Section 9.3. No socio-cultural or historic heritage values have been identified for the identified sites and therefore assessment of significance stands on scientific terms alone.

Note that sites GL14a, b, c and d have been assessed as a single site because it is inferred that they are fragmented concentrations of a broader distribution across the site landform. Considering GL14a, b, c and d as a whole, there are a total of 11 sites of low scientific significance and one site of moderate scientific significance.

Table 9.1 Statement of scientific significance for surface and subsurface Aboriginal sites

Site name	Research potential	Rarity and representativeness	Integrity	Research themes	Educational value	Overall archaeological significance rating
GL4 (open stone artefact scatter)	**Low:** The site is a common type of low density in a highly disturbed context.	**Low:** The site is comprises common material and artefact types.	**Low:** The site is in a highly disturbed context on a dam wall.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site is sparse and its contents are not easily identifiable examples of stone artefacts.	**Low:** GL4 is a common low density open stone artefact scatter in a disturbed context.
GL5 (open stone artefact scatter with deposit)	**Low:** The site is a common type with a sparse assemblage of common debitage.	**Low:** The site comprises common materials and artefact types.	**Low:** The site contains very sparse subsurface material in minor eroded deposit.	**Low:** The site does not contribute to questions of chronology or tool manufacture.	**Low:** The site's contents are sparse and are not easily identifiable examples of stone artefacts.	**Low:** GL5 is a common low density open stone artefact scatter with very limited subsurface deposit.
GL6 (open stone artefact scatter)	**Low:** The site is a common type with a sparse assemblage of common debitage.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is on a erosion scald on skeletal soils.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site's contents are sparse and are not easily identifiable examples of stone artefacts.	**Low:** GL6 is a common low density open stone artefact scatter.
GL7 (open stone artefact scatter)	**Low:** The site is a common type with a sparse assemblage of common debitage.	**Low:** The site comprises common materials and artefact types.	**Low:** Identified on eroding creek bank. Provenance unknown.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site's contents are sparse and are not easily identifiable examples of stone artefacts.	**Low:** GL7 is a common low density open stone artefact scatter.
GL8 (open stone artefact scatter)	**Low:** The site is a common type with a sparse assemblage, including one retouched. flake.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is on a erosion scald on skeletal soils.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Moderate:** Contains easily identifiable artefact types including a retouched flake.	**Low:** GL8 is a common low density open stone artefact scatter.
GL9 (open stone artefact scatter)	**Low:** The site is a common type with a sparse assemblage of common debitage.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is on an eroding creek bank. Provenance unknown.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site's contents are sparse and are not easily identifiable examples of stone artefacts.	**Low:** GL9 is a common low density open stone artefact scatter.

Table 9.1 Statement of scientific significance for surface and subsurface Aboriginal sites

Site name	Research potential	Rarity and representativeness	Integrity	Research themes	Educational value	Overall archaeological significance rating
GL10 (open stone artefact scatter)	**Low:** The site is a common type of low density in a highly disturbed context.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is in a highly disturbed context on a vehicle turning circle.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site's contents are sparse and are not easily identifiable examples of stone artefacts.	**Low:** GL10 is a common low density open stone artefact scatter.
GL11 (isolated find)	**Low:** The site is an isolated artefact in disturbed context.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is in a disturbed context near a drainage bund.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site comprises only one small artefact.	**Low:** GL11 is a common low density open stone artefact scatter.
GL12 (open stone artefact scatter)	**Low:** The site is a common type of moderate density artefacts.	**Low:** The site comprises common materials and artefact types.	**Low:** The site is on an erosion scald on skeletal soils.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Moderate:** The site contains easily identifiable artefact types including a retouched flake.	**Low:** GL12 is a common open stone artefact scatter on a typical landform, albeit with an above average artefact frequency
GL13 (open stone artefact scatter)	**Low:** The site is an isolated artefact in disturbed context.	**Low:** The site comprises common materials and artefact types.	**Low** The site is in a highly disturbed context on a dam wall.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site comprises only one small artefact.	**Low:** GL13 is a common low density open stone artefact scatter.
GL14a,b,c and d (open stone artefact scatter with deposit)	**Moderate:** The site is of a common type with a high frequency of artefacts but lacking intact contextual value.	**Moderate:** High artefact frequency is rare for the local area but common for similar landforms in the region.	**Low:** Highly eroded landform on skeletal soils. Minimal subsurface potential.	**Moderate:** Detailed recording may address issues of tool manufacture owing to extensive assemblage.	**High:** The site is the best local example of diverse artefact scatter. Assemblage has diverse artefact types and raw materials. Easy to locate and observe material.	**Moderate:** GL14, a, b, c and d combined is an extensive artefact scatter on a common site landform with good examples of artefact types and raw materials. However, it lacks archaeological integrity because of the highly eroded skeletal soils.
GL15 (isolated find)	**Low:** The site is an isolated artefact in disturbed context.	**Low:** The site comprises common materials and artefact types.	**Low** The site is in a highly disturbed context on a dam wall.	**Low:** The site does not contribute to issues of chronology or tool manufacture.	**Low:** The site comprises only one small artefact.	**Low:** GL15 is a common low density open stone artefact scatter.

10 Impact assessment

10.1 Sources of development impact

The project will result in impacts to Aboriginal objects. The following ground disturbance activities have the potential to impact known and unknown Aboriginal objects in extension area:

- the extension of the quarry pit footprint into areas not previously subject to large-scale ground disturbance;
- the covering of areas by overburden embankment; and
- the construction of a haul road to access the overburden embankment area by extending existing haul roads in the quarry area.

10.2 Definition of impact type

Project elements will impact Aboriginal sites to varying degrees: disturbance, where artefacts are moved locally from their original setting, is distinguished from loss where artefacts will be removed or destroyed.

Disturbance means Aboriginal sites and objects will be disrupted and moved a short distance through displacement of ground. An example of this is the construction of a haul road, where topsoil (the artefact bearing layer) will be moved during the construction, but not removed from the locality. Artefacts are retained generally in the same locality but with some loss of context and spatial patterning.

Total disturbance is when the entirety of the Aboriginal site will be disturbed by the project.

Partial disturbance describes the disturbance of part of a recorded site.

Loss entails complete removal of an Aboriginal site's elements, such as large-scale earthworks. The total modification of a landscape can also constitute loss, even if artefacts are collected and later returned to the modified surface in their original positions, because the context (an integral part of archaeological site value) is irretrievable. These types of impact will occur by extending the quarry footprint as well as the overburden embankment and associated works will be subject to varying degrees of loss.

The quarry pit extension would completely remove topsoil from the area. Furthermore, this report has defined the impacts from embankment areas as loss. The creation of an embankment area involves truck movements, the deposition of large amounts of rock, landscaping and landform rehabilitation. Artefacts on the original ground surface and beneath the surface will be either stripped to retain topsoil for rehabilitation of the extension area or mixed into the embankment soils over time and will be unable to be retrieved once the embankment is created.

Recent investigations on the short term impacts of emplacement areas (in cases where the topsoil is not stripped prior to emplacement) (KNC 2012 and 2013) indicate that while some compaction of the ground is evident, the artefact themselves remain intact beneath layers of soil if separated by a synthetic barrier. However, without using a barrier it was anticipated that the deposit would degenerate and devalue over time as bioturbation causes the stockpile soils to mix with the archaeological deposit. This loss of a secure context would reduce the scientific value of the site.

Total loss is when the entirety of a site will be lost as a result of the project.

Partial loss describes the loss of part of a site.

Degrees of impact from lesser to greater are:

- partial disturbance;
- total disturbance;
- partial loss; and
- total loss.

10.3 Impacts to sites

Out of the 15 Aboriginal sites identified during the archaeological investigations, 11 will be impacted to some degree. Although sites GL11 and GL10 are outside the mapped disturbance footprint, they will be impacted. GL11 is within 10 m of the proposed pit extension area and will be impacted from the construction of drainage diversion bunds. GL10 is adjacent to an existing access track and will be impacted when the track is upgraded to a haul road.

Seven Aboriginal sites will be subject to total loss. Sites GL14a, b, c, and d as a whole, including subsurface artefacts, will be subject to partial loss as site artefact distributions also occur outside the proposed embankment area. Four Aboriginal sites will be avoided by the project as they occur outside the project disturbance boundaries. Impacts to Aboriginal sites are presented in Table 10.1 and shown in Figure 10.1

Table 10.1 Impact assessment summary

Site name	Site type	AHIMS number	Significance	Impact type	Level of impact	Consequence of impact
GL4	Open stone artefact scatter	TBC	Low	None	No impact	Nil
GL5	Open stone artefact scatter with deposit	TBC	Low	Pit extension	Total loss	Total loss of value
GL6	Open stone artefact scatter	TBC	Low	Pit extension	Total loss	Total loss of value
GL7	Open stone artefact scatter	TBC	Low	Pit extension	Total loss	Total loss of value
GL8	Open stone artefact scatter	TBC	Low	Pit extension	Total loss	Total loss of value
GL9	Open stone artefact scatter	TBC	Low	Pit extension	Total loss	Total loss of value
GL10	Open stone artefact scatter	TBC	Low	Haul road	Total loss	Total loss of value

Table 10.1 Impact assessment summary

Site name	Site type	AHIMS number	Significance	Impact type	Level of impact	Consequence of impact
GL11	Isolated find	TBC	Low	Pit extension	Total Loss	Total loss of value
GL12	Open stone artefact scatter	TBC	Low	None	No impact	Nil
GL13	Open stone artefact scatter	TBC	Low	None	No impact	Nil
GL14a,b,c and d	open stone artefact scatter with deposit	TBC	Moderate	Embankment	Partial loss	Partial loss of value
GL15	Isolated find	TBC	Low	None	No impact	Nil

10.4 Measures to minimise harm and alternatives

10.4.1 Extension pit configuration

Quarrying cannot readily avoid environmental impacts without sterilising the resource, as the hard rock resource is in a fixed location. The proposed pit extension area contains sites of low and moderate archaeological significance and it is not feasible to avoid the identified Aboriginal sites in this area without significantly altering the pit extension configuration.

10.4.2 Overburden emplacement

The proposed extension will result in an increase in overburden material that needs to be stored. Unlike the location of the resource which is fixed, the location of overburden emplacements has greater flexibility. The approved overburden emplacement bund will not be able to accommodate all of the overburden from the extended pit area because it is already at its maximum height and there is vegetation to the north and the south. Further, it will be uneconomic to haul overburden from the south of the quarry to the emplacement north of the pits.

There was discussion of the feasibility to have the embankment area moved south of its current proposed position to avoid sites GL14a, b, c and d. This option was more likely to have been chosen if the test excavation program recovered extensive subsurface archaeological deposits that would have warranted conservation. However, the significance of these sites was evaluated against the impacts to the ecology and hydrology of the area: that is, if the area to the south was chosen, it would impact the riparian corridor around the tributary to Chapman's Creek and it would also change the course of the stream channel. Therefore, the impacts to native flora and fauna resulting from this option was considered to be a greater environmental impact, considering that the impacts to archaeological resource could be mitigated through surface salvage collection (refer Chapter 11).

10.5 Ecologically sustainable development (ESD) considerations

Aboriginal heritage management is based on the principle of *intergenerational equity* which has the intention to ensure present generations consider future generations when making management decisions. This principle is possibly the most relevant part of the notion of *ecologically sustainable development* (ESD) when considering Aboriginal heritage management.

While it is acknowledged that the project is for quarrying activities that are common in the region (eg Peppertree Quarry, Lynwood Quarry and Marulan South Limestone Mine) and will result in additional impacts to Aboriginal heritage, the proposed management measures are anticipated to provide detailed information about the Aboriginal heritage of the extension area to ensure all information about the Aboriginal history of the area is not lost. This will help to achieve intergenerational equity by allowing retention of cultural materials for the enjoyment and education of future generations.

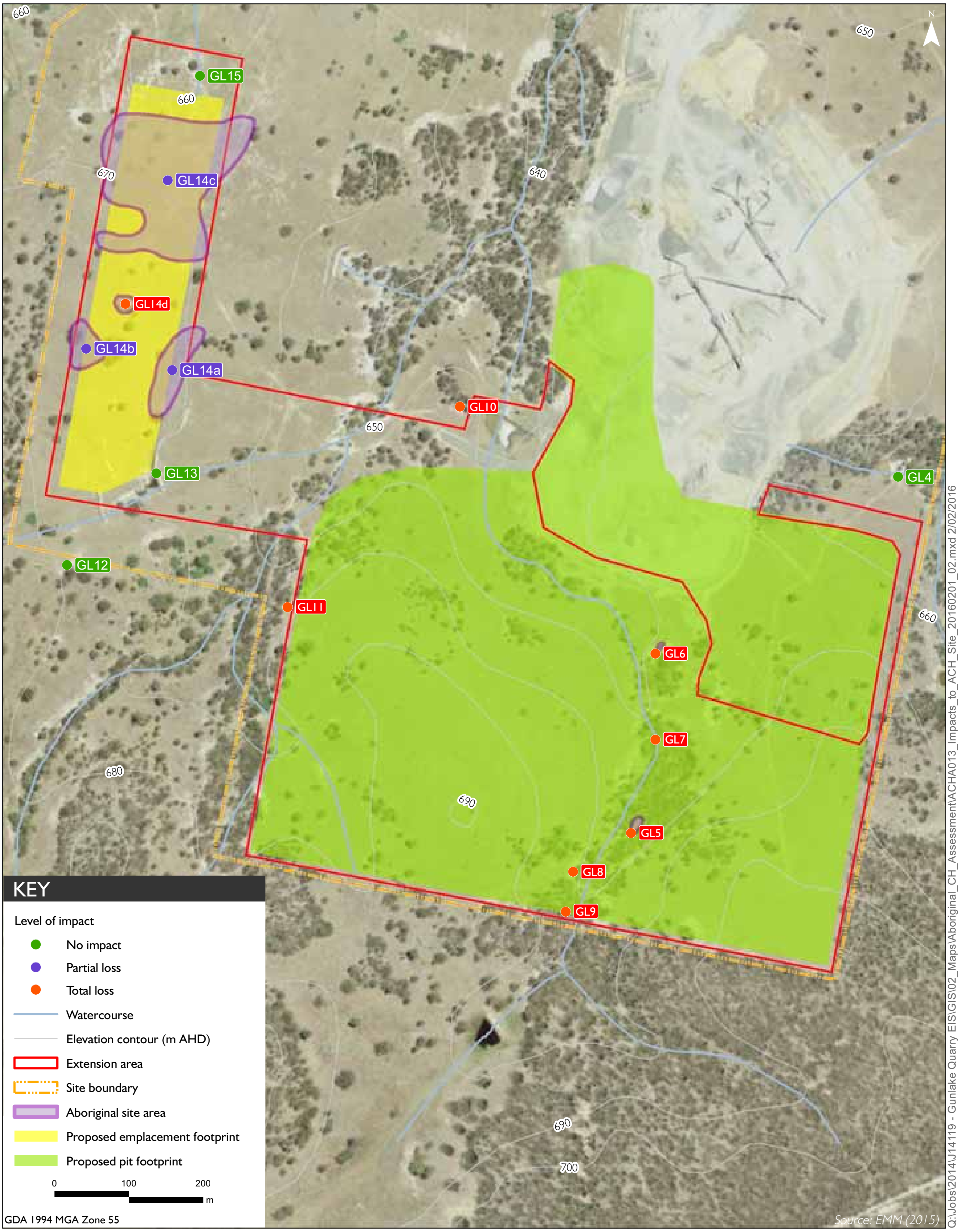
Regionally, there are examples of conserving areas of high cultural significance. Highly sensitive archaeological landscapes, including a possible Aboriginal burial, adjacent to Peppertree Quarry have been set aside for passive management and protection. Furthermore, the Bungonia National Park and the Taro National Park retain land to the north and south of the extension area for the protection of Aboriginal sites and landscapes.

10.6 Cumulative impact within the region

Unavoidable harm to Aboriginal objects is acknowledged as an impact of the project. The project represents an extension to one of the smaller quarries in the region. The closest comparable resource is Lynwood Quarry which has identified over 100 sites. The archaeological investigation for the project combined with Lynwood Quarry and has demonstrated that the archaeological resource of the region is relatively consistent and predictable, even in areas with limited water resources. It is reasonable to assume that many undiscovered Aboriginal sites comparable to those recorded in the extension area occur in the surrounding region, particularly in association with elevated landforms adjacent to streams. Although ground disturbance footprints related to mining areas can exceed 1 km^2 for some of the larger projects (eg Lynwood Quarry and Marulan South Limestone Mine), they remain isolated and many archaeologically sensitive landscapes remain in the Southern Tablelands region.

Furthermore, there are existing conservation areas within the Lynwood Quarry project area which will retain representative examples of the local and regional archaeological record (Umwelt 2015). Fifty-four sites have been conserved in-situ and will continue to be managed for conservation during the 30 year life of the Lynwood Quarry. Twelve sites have been conserved long-term within the Lynwood Quarry Cultural Heritage Management Zone (CHMZ) including a stone arrangement (ceremonial which is the site with the highest significance in the Lynwood Quarry project area. Additionally, 19 isolated finds, 30 open stone artefact sites, one in-situ grinding bowl and four scarred trees are being managed for their conservation for the 30 year life of Lynwood Quarry. Therefore, sites of greater variety and complexity are already being conserved at Lynwood Quarry.

Additionally, while mining has resulted in impacts to sites, the management and mitigation of impacted sites through archaeological excavation, collection and consultation with the Aboriginal community has contributed to our understanding of the Aboriginal past in this region.



Impacts to Aboriginal sites

Gunlake Quarry
Aboriginal Cultural Heritage Assessment

Figure 10.1

11 Management

11.1 Aboriginal heritage management

This section describes the management measures for identified Aboriginal heritage values in the extension area. The management measures proposed here respond to:

- the impacts identified in the preceding chapter;
- the assessed significance of the Aboriginal sites;
- the views of the Aboriginal community as represented by RAPs;
- the need to address intergenerational equity in the values of Aboriginal heritage;
- the need to protect sites not impacted by the project but under the care of the proponent; and
- the need to mitigate the loss and disturbance of impacted Aboriginal sites and Aboriginal objects.

While Aboriginal sites cannot be replaced once lost, the salvage of Aboriginal objects that would be impacted by the project will provide a tangible link to these sites. Furthermore, with care in duration, those salvaged materials can be studied to help understand other Aboriginal sites present in the landscape and to add to the growing body of information about past Australian Aboriginal life.

11.2 Management measures

11.2.1 Aboriginal heritage management plan

The Gunlake Quarry Aboriginal Heritage Management Plan (AHMP) will be updated and provide details of:

- all Aboriginal sites identified for the project and those previously recorded in the broader project site boundary;
- management measures and their progress towards completion;
- continuing consultation and involvement of registered Aboriginal parties;
- protocols for newly identified sites;
- protocols for suspected human skeletal material; and
- provisions for review and updates of the AHMP.

11.2.2 Avoidance

Avoidance of Aboriginal sites is a preferred management option as it ensures Aboriginal sites and their landscape information will be preserved for future generations.

Four Aboriginal sites, GL4, GL12, GL13 and GL15, will be avoided by the project as they occur outside the project disturbance boundaries.

11.2.3 Collection

All Aboriginal sites in the project disturbance footprint subject to impact will be collected by a qualified archaeologist and RAPs. This will include the complete extent of the Aboriginal sites subject to total loss and partial loss. Collecting the entirety of the sites that will be only partially impacted is recommended primarily because of the highly eroded condition of the local soils. The sites will gradually degenerate further and moved by sheet wash, rill and gully erosion. As shown in Figure 10.1, sites GL14 a, b, and c are primarily within the proposed embankment area and marginally extend beyond the boundary. Complete surface collection of these sites would provide a more complete record of the sites and would also avoid issues with minor variations in project construction (within a few metres) that could impact artefacts outside the disturbance boundary if not collected.

Each site will be collected into labelled bags recording the site name, location and collection date. The location of all collected artefacts will be recorded by GPS for distribution maps. Collected artefacts will be entered into a database with basic attributes recorded for each artefact. Basic assemblage analysis will be undertaken and integrated into a salvage report which will contribute to the overall interpretation of the area.

Eleven sites will be collected, comprising: GL5, GL6, GL7, GL8, GL9, GL10, GL11, GL14a, GL14b, GL14c, and GL14d.

11.2.4 Aboriginal ancestral remains

In the event that known or suspected human skeletal remains are encountered during the activity, the following procedure will be followed:

- all work in the immediate vicinity will cease and the find will be immediately reported to the work supervisor who will immediately advise the Environmental Advisor or other nominated senior staff member;
- the Environmental Advisor or other nominated senior staff member will promptly notify the police and the state coroner (as required for all human remains discoveries);
- the Environmental Advisor or other nominated senior staff member will contact the OEH for advice on identification of the skeletal material as Aboriginal and management of the material; and
- if it is determined that the skeletal material is Aboriginal ancestral remains, the RAPs will be contacted and consultative arrangements will be made to discuss ongoing care of the remains.

11.2.5 Aboriginal artefact management

It is recommended that collected artefacts are relocated to the previously collected artefacts at site “GL123 (Gunlake Quarry) relocated GL1, GL2 and GL3” (AHIMS #51-6-0750).

11.2.6 Discovery of new Aboriginal sites

In the event of discovery of new Aboriginal sites outside of known site areas (which will be updated on completion of salvage collection), all work should halt and an archaeologists and members of the RAPs be contacted to determine the significance of the objects. Objects are to be managed based on their significance in a manner consistent with the management measures outlined above, including appropriate forms of salvage for the items.

11.2.7 Management summary

Table 11.1 provides a summary of Aboriginal sites, impact types and management recommendations.

Table 11.1 Management summary

Site name	Site type	AHIMS ID	Significance	Impact type	Management
GL4	Open stone artefact scatter	47-6-0777	Low	None	Avoidance
GL5	Open stone artefact scatter with deposit	47-6-0778	Low	Pit extension	Collection
GL6	Open stone artefact scatter	47-6-0779	Low	Pit extension	Collection
GL7	Open stone artefact scatter	47-6-0780	Low	Pit extension	Collection
GL8	Open stone artefact scatter	47-6-0781	Low	Pit extension	Collection
GL9	Open stone artefact scatter	47-6-0782	Low	Pit extension	Collection
GL10	Open stone artefact scatter	47-6-0785	Low	Haul road	Collection
GL11	Isolated find	47-6-0783	Low	Pit extension	Collection
GL12	Open stone artefact scatter	47-6-0784	Low	None	Avoidance
GL13	Open stone artefact scatter	47-6-0786	Low	None	Avoidance
GL14a,b,c,d	open stone artefact scatter with deposit	47-6-0787 47-6-0788 47-6-0789 47-6-0790	Moderate	Embankment	Collection
GL15	Isolated find	47-6-0791	Low	None	Avoidance

Abbreviations

Abbreviation	Term
$	dollars
AASC	Australian Archaeological Survey Consultants
AHD	Australian Height Datum
ACHA	Aboriginal cultural heritage assessment
AHIMS	Aboriginal Heritage Information Management System
AMBS	Australian Museum Business Services
ATU	Archaeological terrain unit
BOM	Bureau of Meteorology
c.	circa
CHMA	Cultural Heritage Management Australia
cm	centimetres
DPE	Department of Planning and Environment
EMM	EMM Consulting
EP&A Act	*Environmental Planning and Assessment Act 1979*
ERM	Environmental Resources Management
g	grams
GIS	geographical information system
GPS	global positioning system
IMT	Idurated mudstone/tuff
km	kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
m^2	square metres
mm	millimetres
Mtpa	million tonnes per annum
NSW	New South Wales
OEH	Office of Environment and Heritage
PAD	Potential archaeological deposit
PLALC	Pejar Local Aboriginal Land Council
RAP	Registered Aboriginal Party
RPS HSO	RPS Harpers O'Sullivan
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
t	Tonne
TP	Test pit

Glossary

Many of these definitions have been taken from the *Code of Practice for archaeological investigation of Aboriginal objects in NSW* (DECCW 2010).

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 rock shelters which by definition include physical evidence of occupation, midden shell, hearths, stone arrangements and other landscape features which derive from past Aboriginal activity.

Archaeological survey: A method of data collection for Aboriginal heritage assessment. It involved a survey team walking over the land in a systematic way, recording information. Activities are not invasive or destructive.

Aboriginal culturally modified 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. Culturally modified tree recognition guidelines exist to distinguish these features. Naturally scarred trees are often misidentified as Aboriginal culturally modified 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. In the context of this report 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 in 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.

Bioturbation: is the reworking of soils and sediments by animals or plants. Its effects include changing texture of sediments (diagenetic), bioirrigation and displacement of microorganisms and non-living particles.

Bipolar flaking: Where the stone to be worked is rested on an anvil or other stone before being hit by the hammerstone. This results in the presence of negative flake scars on both ends of the core.

Bondi point: See backed artefact definition.

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.

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.

Exposure: estimates the area with a likelihood of revealing buried artefacts or deposits, not just an observation of the amount of bare ground.

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.

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.

Microlith: Very small fragments of flakes retouched into geometric shapes and usually present on tools like barbed spears, arrows and sickles.

Midden: A collection of shells and associated economic remains resulting from Aboriginal food gathering and processing activity. Middens comprise shellfish remains of consistent size in a rich dark earth matrix commonly associated with stone artefacts, fish bone and animal bone although shells are commonly the most obtrusive element.

Keeping place: A room or facility with the express and exclusive purpose of storing Aboriginal cultural heritage materials with accompanying documentation in a secure and accessible manner which protects their cultural heritage values.

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.

Point cluster: A group of GPS points used to identify the locations of individual artefacts in the field.

Potential Archaeological Deposit (PAD): An area where there is an inferred presence of Aboriginal objects in 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.

Retouch: The modification of the edges of a flake or tool by the removal of a series of small flakes.

Thumbnail scraper: A thumbnail sized thin flake with steep unidirectional retouch or use-wear around a convex working edge.

Visibility: The amount of bare ground on exposures which might reveal artefacts or other archaeological materials.

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