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Drayton South Coal Project Archaeological and Cultural Heritage Impact Assessment
Hansen Bailey Environmental Consultants
25-Mar-2015

Drayton South Coal Project

Aboriginal Archaeological and Cultural Heritage Impact Assessment

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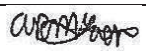
1	20-Jan-2015	Technical Review	Andrew McLaren	

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Executive Summary

AECOM Australia Pty Ltd (AECOM) was commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Anglo American Coal (Anglo American) to undertake an updated Aboriginal Archaeological and Cultural Heritage Impact Assessment (AACHIA) for the Drayton South Coal Project (the Project). The assessment is to form part of an Environmental Impact Statement (EIS) being prepared by Hansen Bailey to support an application for Development Consent under Part 4 Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project, to allow for the continuation of the existing Drayton Mine for up to 15 years.

This AACHIA report has been modified from the original AACHIA prepared for the Drayton South Coal Project that was refused by NSW PAC on 17 October 2014. The assessment was prepared in accordance with DP&E's draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005) and with reference to OEH's *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a) and *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011) provide 'best practice' documents for Aboriginal Cultural Heritage Impact Assessments in NSW.

The study area for this assessment comprises the original area assessed as part of the previous Drayton South mine application refused by NSWPAC. However, in accordance with the 'Drayton South Coal Project PAC Review Report' issued in December 2013, significant modifications were made to the Project's proposed mine plans resulting in overall reduction in the mine disturbance footprint from 1,928 ha to 1,441 suggesting 487 ha (25%) of land would no longer be impacted. Consequently, this assessment considers impacts to Aboriginal sites within the revised and reduced Project Disturbance Boundary.

Registered Aboriginal Party (RAP) consultation for the Project was undertaken by Hansen Bailey in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010) both as part of the original AACHIA and as part of this revised AACHIA.

Archaeological survey was undertaken within the study area as part of the original AACHIA over a total of 26 days initially between 2 May and 4 June 2011 followed by a supplementary archaeological survey between 10 and 11 October 2011 by a combined field team of AECOM personnel and RAPs.

During the original assessment, a total of 205 discrete Aboriginal sites were identified, of which 194 were directly within the study area, including both existing Aboriginal Heritage Information Management System (AHIMS) sites and newly recorded sites which were subsequently registered on the AHIMS register. Of the sites within the study area, high significance was attributed to three sites, based on their rarity and research potential. Moderate significance was attributed to 16 sites and low significance to 175 sites. Consultation with RAPs to date indicates that all Aboriginal archaeological sites within the study area are culturally significant and need to be cared for appropriately.

An updated AHIMS search was undertaken on 4 March 2015 identifying 194 individual AHIMS site records within or directly adjacent to the revised Project Disturbance Boundary. As is typical for the Hunter Valley, open artefact sites (i.e., artefact scatters and isolated finds) are the most common site type represented within the Project Disturbance Boundary, accounting for 192 (98.8%) of known sites. The remaining two sites were Aboriginal stone quarry sites, one of which was not located during the field survey (37-2-1955).

The updated impact assessment undertaken for this assessment indicates that all 194 AHIMS site records, representing 156 individual Aboriginal sites (154 isolated finds and artefact scatters, and two quarry sites), when employing a 100 m distance convention for site definition, will be wholly or partially impacted by the Project.

The previous Project application resulted in direct impacts to 175 Aboriginal sites comprising 173 artefact scatters and isolated artefact sites, and two stone quarries (one of which could not be located). As a result of the reduced Project Disturbance footprint, the Project application will now wholly or partially impact 156 Aboriginal archaeological sites representing an 11% reduction in the number of sites that would be impacted.

A management strategy to address impacts to the known and potential Aboriginal heritage resource within the Project Boundary is provided in Section 11.2. This management strategy was detailed in the draft ACHMP that was developed in consultation with RAPs (see Section 3.1.4) and prepared for the previous Drayton South mine application. The ACHMP will be reviewed and finalised based on the outcome of the new approval process and further consultation with RAPs. The final document will guide the management of Aboriginal cultural heritage within the Project Boundary and will contain the following key components:

- Details for the surface collection of all surface artefacts within the Disturbance Boundary;
- Details for archaeological test and salvage excavation within the Disturbance Boundary;
- Procedure for the management of non-impacted sites within the Project Boundary; and
- Procedures for the management of previously un-recorded sites within the Project Boundary.

1.0 Introduction

AECOM has been commissioned by Hansen Bailey on behalf of Anglo American to undertake an Aboriginal AACHIA for the Drayton South Coal Project. This assessment is to form part of an EIS being prepared by Hansen Bailey to support an application for Development Consent under Part 4 Division 4.1 of the EP&A Act for the Project, to allow for the continuation of the existing Drayton Mine for up to 15 years.

This AACHIA report has been modified from the original AACHIA prepared for the previous application which was refused by NSWPAC on 17 October 2014. This document has been prepared in accordance with DP&E's draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005) and with reference to OEH's *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a) and *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011) provide 'best practice' documents for Aboriginal Cultural Heritage Impact Assessments in NSW.

1.1 Project Description

Drayton Mine is located approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of NSW (see Figure 1). Drayton Mine has been operating in the Muswellbrook community for over 30 years and runs out of coal in 2015. The Project will allow for the continuation of the existing Drayton Mine for up to 15 years, by developing an open cut mining area within EL 5460. The Project will extract up to 6.4 Million tonnes per annum (Mtpa) of export quality thermal coal by utilising existing Drayton Mine assets and infrastructure.

The current Drayton South Coal Project application addresses the reasons provided by the NSW Planning Assessment Commission (PAC) for the refusal of the previous application. The mine plan and Project boundary are defined by ridgelines nominated in the 'Drayton South Coal Project PAC Review Report' issued in December 2013. The Project will remain behind the ridgelines nominated by the PAC. This at least doubles the buffer setback distance from the Coolmore and Woodlands thoroughbred horse studs and is at least 2 kilometres (km) from the horse stud operational areas.

The Project generally includes:

- Continuation of operations at Drayton Mine as currently approved with minor additional mining within the existing East, North and South Mining Areas for a period of 15 years;
- Development of a new open cut mining area with EL 5460 mining up to 6.4 Mtpa Run-Of-Mine (ROM) coal;
- Ongoing employment of a workforce of up to 500 full time equivalent employees;
- Utilisation of the existing Drayton Mine equipment fleet;
- Storage of water, and emplacement of tailings and rejects generated by the Project in existing Drayton Mine voids;
- Utilisation of the existing Drayton Mine infrastructure including the CHPP, rail loop and associated infrastructure, workshops, bath houses and administration offices;
- Construction of a transport corridor to the new mining area;
- Continued utilisation of the Antiene Rail Spur off the Main Northern Railway Line to transport product coal to the Port of Newcastle for export;
- Realigning and upgrading a section of Edderton Road;
- Continuation of mutually beneficial arrangements with neighbours Macquarie Generation and Mt Arthur Coal Mine;
- Installation of further water management and power reticulation infrastructure to support the new mining areas; and
- Progressive rehabilitation of disturbed areas as mining operations are completed.

Figure 2 shows the conceptual layout of the Project.

1.2 Study Area

The study area for this assessment comprises the original area assessed as part of the previous Drayton South mine application refused by NSWPAC. This area totally encompasses the revised Project Disturbance Boundary. In accordance with the 'Drayton South Coal Project PAC Review Report' issued in December 2013, significant modifications have been made to the Project's proposed mine plans resulting in overall reduction in the mine disturbance footprint from 1,928 ha to 1,441 suggesting 487 ha (25%) of land would no longer be impacted. While the study area for this assessment remains the same, the impact assessment considers impacts to Aboriginal sites from the revised mine Disturbance Boundary.

1.3 Secretary's Environmental Assessment Requirements (SEARs)

The Secretary of the NSW Department of Planning and Environment (DP&E) issued the Secretary's Environmental Assessment Requirements (SEARs) for the Project on 19 December 2014. For Aboriginal heritage, the SEARs included the following:

- an assessment of the likely impacts of the development on Aboriginal heritage (cultural and archaeological), including consideration of the significance of these objects or declared places to Aboriginal people and having regard to the OEH's requirements (see Attachment 2); and
- evidence of consultation, noting that consultation carried out for the original Drayton South Coal Project may be relied upon, but should be augmented with further consultation for this project.

Attachment 2 (Guidance Material) of the SEARs lists OEH's Aboriginal Cultural Heritage requirements for the Project. These include:

1) The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface and test excavation. The identification of cultural heritage values should be guided by the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and consultation with OEH regional officers.
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* (DECCW, 2010). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.
3) Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and OEH notified.

1.4 Assessment Objectives

The overarching objectives of this AACHIA were as follows:

- to identify the Aboriginal cultural heritage values of the study area through a combination of background research, archaeological survey and consultation with Registered Aboriginal Parties (RAPs);
- to assess the potential impact(s) of the Project on these values;
- to provide an appropriate management strategy for avoiding and/or mitigating potential harm to identified values; and
- to compile an AACHIA report that will assist the Director General of the DP&E in his/her assessment of the Project application.

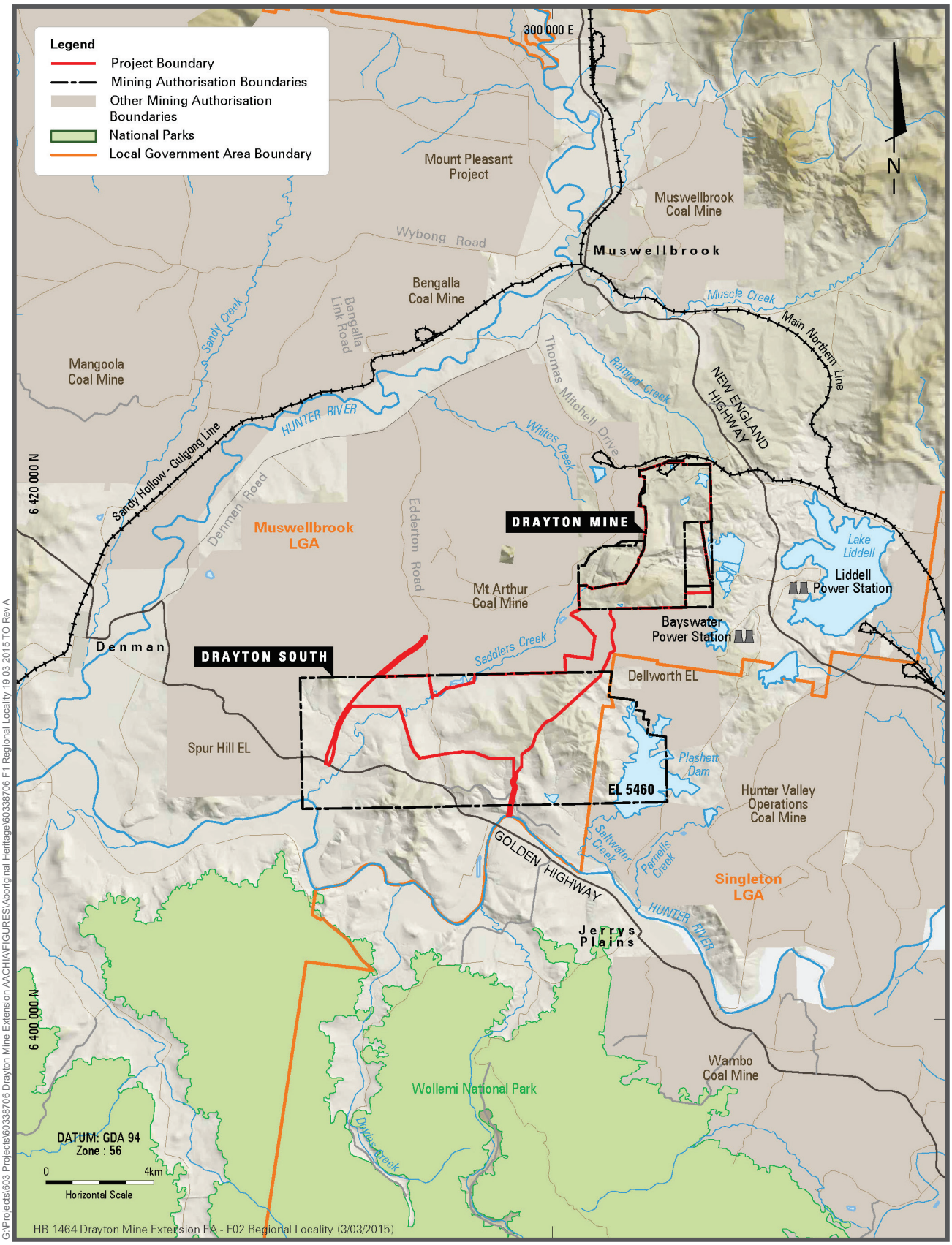
1.5 Project Team

The assessment was managed and report prepared by AECOM archaeologist Geordie Oakes. Daniel Sullivan (Hansen Bailey) undertook Aboriginal consultation, arranged Aboriginal fieldwork participation and prepared Section 3.0. Geordie Oakes, Abbee Warskitt and Matteui Catteau (AECOM) undertook fieldwork. Andrew McLaren (Archaeologist AECOM) provided QA review of all assessment outputs. Unless otherwise specified, Tim Osborne (Designer, AECOM) created all figures within this report.

1.6 Report Structure

This report contains eleven sections. This section - **Section 1.0** - has provided background information on the Project and assessment undertaken. The remainder of the report is structured as follows:

- **Section 2.0** outlines the statutory framework within which this assessment has been undertaken;
- **Section 3.0** details the Aboriginal community consultation program undertaken for this assessment;
- **Section 4.0** describes the existing environment of the study area and its associated archaeological implications;
- **Section 5.0** describes the archaeological context of the study area on a regional and local scale. Predictions regarding the nature of the study area's Aboriginal archaeological record are also provided;
- **Section 6.0** summarises relevant ethnohistoric information for the study area;
- **Section 7.0** describes the archaeological survey component of the assessment;
- **Section 8.0** outlines the significance of identified Aboriginal archaeological sites within the study area;
- **Section 9.0** provides an assessment of the potential impacts of the Project on identified Aboriginal heritage values;
- **Section 10.0** details an appropriate management strategy for the identified Aboriginal heritage values of the study area; and
- **Section 11.0** lists the references cited in-text.



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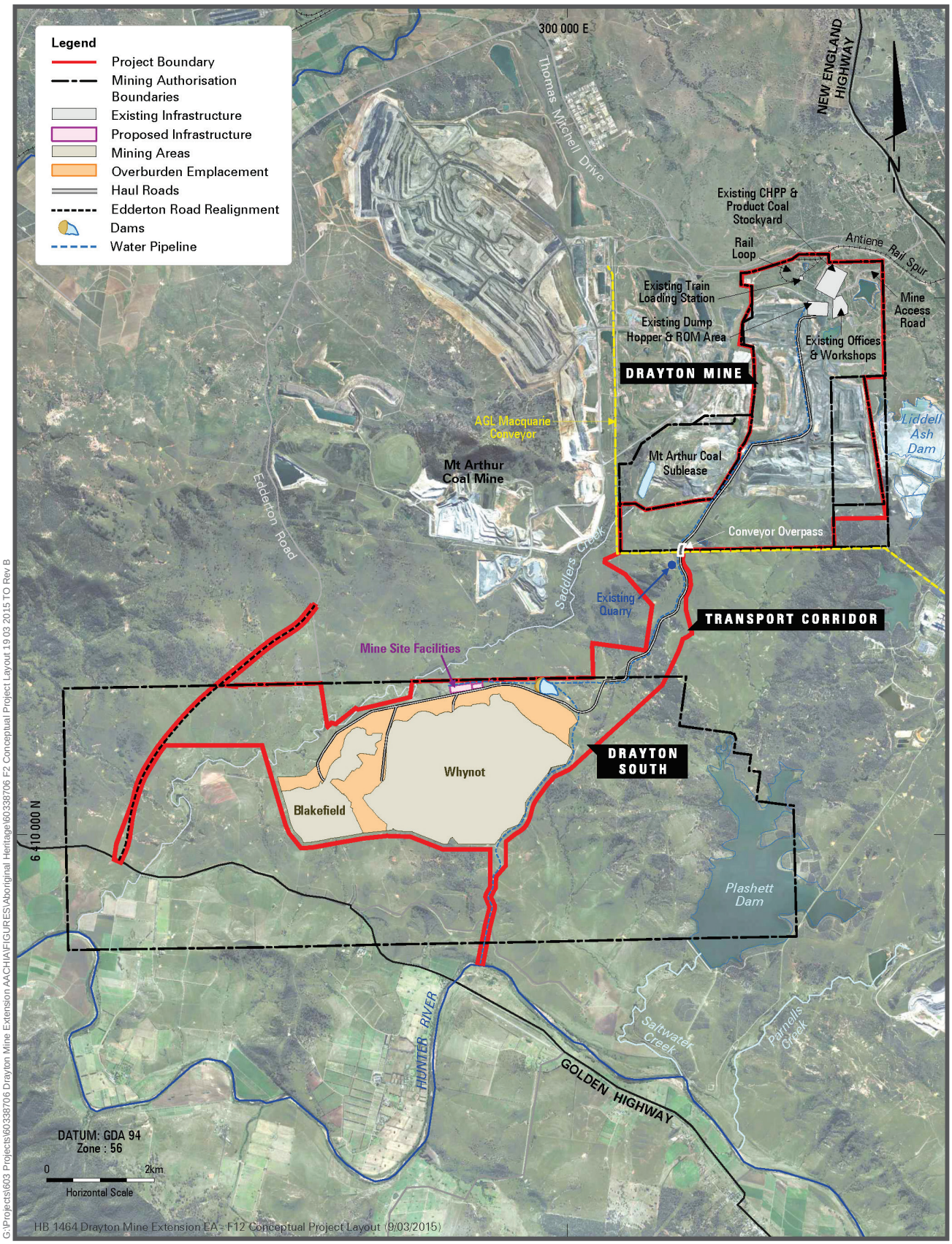
REGIONAL LOCALITY

Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales

Source: Hansen Bailey (2015)

FIGURE 1



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CONCEPTUAL PROJECT LAYOUT

Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales

Source: Hansen Bailey (2015)

FIGURE 2

2.0 Applicable Policy and Legislation

2.1 State Legislation & Policies

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act), administered by the NSW Department of Planning and Environment, requires that consideration be given to environmental impacts as part of the land use planning process in NSW. In NSW, environmental impacts are interpreted as including impacts to Aboriginal and non-Aboriginal (i.e., European) cultural heritage.

Upon repeal of Part 3A of the EP&A Act on 1 October 2011, the *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* inserted a new Division 4.1 into Part 4 of the EP&A Act. Division 4.1 provides a determination regime for State Significant Development (SSD). Section 89C of the EP&A Act stipulates that a development will be considered SSD if it declared to be such by the new *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD).

Under Clause 8(1) of SEPP SRD, a development is declared to be State Significant Development if:

a) the development on the land concerned is, by the operation of an environmental planning instrument, permissible with development consent under Part 4 of the EP&A Act; and

b) the development is specified in Schedule 1 or 2 of SEPP SRD.

The Project is SSD as it meets both of these criteria, namely:

- it is permissible with development consent on the land on which it is located; and
- it is development that is specified in Schedule 1 of SEPP SRD.

DEC's (now OEH) draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005) detail the relevant statutory requirements for Aboriginal cultural heritage assessments conducted under Division 4.1 of Part 4 of the EP&A Act. These guidelines require Aboriginal heritage assessments to be conducted in accordance DECCW's (2004) *Interim Community Consultation Requirements for Applicants* and the NSW National Parks and Wildlife Service's (1997) *Aboriginal Cultural Heritage Standards and Guidelines Kit*. However, it is noted that the NSW Office of Environment and Heritage's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) and *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) have effectively replaced these earlier policies and currently represent best practice guidelines for the assessment of Aboriginal cultural heritage in NSW.

2.1.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act), administered by OEH, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Director General of OEH responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as follows:

- An *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).
- An *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010* (NPW Regulation), and the demonstration of due diligence.

An Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened.

Consultation with Aboriginal communities is required under OEH policy when an application for an AHIP is considered and is an integral part of the process. AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons.

Pursuant to Section 89J of the EP&A Act, AHIPs are not required for projects approved under Division 4.1 of Part 4 of the EP&A Act. Impacts to Aboriginal heritage values associated with approved SSD projects are typically managed under Aboriginal Cultural Heritage Management Plans (ACHMPs). ACHMPs are statutorily binding once approved by the Planning Assessment Commission (PAC) or DP&E under delegation from the Secretary.

Section 89A of the NPW Act requires notification of the location of Aboriginal sites within a reasonable time, with penalties for non-notification. Section 89A is binding in all instances, including Division 4.1 projects

2.2 Local Government

2.2.1 Muswellbrook Local Environmental Plan 2009

The Muswellbrook Local Environmental Plan (LEP) is the comprehensive statutory planning document that applies to the Muswellbrook LGA. Clause 5.10 of the LEP provides specific provisions for the protection of heritage items and relics within Muswellbrook LGA. The objectives of the clause are:

- to conserve the environmental heritage of Muswellbrook;
- to conserve the heritage significance of items and heritage conservation areas including associated fabric, settings and views;
- to conserve archaeological sites; and
- to conserve places of Aboriginal heritage significance.

Clause 5.10 (2) requires development consent for the following:

- demolishing or moving a heritage item or a building, work, relic or tree within a heritage conservation area;
- altering a heritage item or a building, work, relic, tree or place within a heritage conservation area, including (in the case of a building) making changes to the detail, fabric, finish or appearance of its exterior;
- altering a heritage item that is a building by making structural changes to its interior;
- disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,
- disturbing or excavating a heritage conservation area that is a place of Aboriginal heritage significance;
- erecting a building on land on which a heritage item is located or that is within a heritage conservation area; and
- sub-dividing land on which a heritage item is located or that is within a heritage conservation area.

Before granting consent, Council must consider the impact of the development on the heritage significance of the item. However, development consent is not required if Council considers the proposed development to not adversely affect the heritage significance of the item concerned.

Schedule 5 of the LEP provides a list of heritage items and relics within Muswellbrook LGA. There are no Aboriginal heritage items listed in the heritage schedule that fall within the boundaries of the Study Area.

2.2.2 Singleton Local Environmental Plan 1996

The Singleton Local Environmental Plan (LEP) is the comprehensive statutory planning document that applies to the Singleton LGA. Part 9 of the LEP provides specific provisions for the protection of heritage items and relics within Singleton LGA. The following controls apply with respect to the development of heritage items:

A person shall not, in respect of a building, work, relic, tree or place that is a heritage item, except with the consent of council:

- demolish or alter the building or work;
- damage or move the relic, or excavate for the purpose of exposing the relic;

- damage or despoil land on which the building, work or relic is situated or land which comprises the place;
- erect a building on or subdivide land on which the building, work or relic is situated or on the land which comprises the place; or
- damage any tree on the land on which the building, work or relic is situated or on the land which comprises the place.

The Council shall not grant consent to a development application required by this clause unless it has made an assessment of:

- the significance of the item as a heritage item;
- the extent to which the carrying out of the development in accordance with the consent would affect the heritage significance of the item and its site;
- whether the setting of the item and, in particular, whether any stylistic, horticultural, or archaeological features of the setting should be retained;
- whether the item constitutes a danger to the users or occupiers of that item or to the public; and
- measures to be taken to conserve heritage items, including any conservation plan prepared by the applicant.

Schedule 3 of the LEP provides a list of heritage items and relics within Singleton LGA. There are no Aboriginal heritage items listed in the heritage schedule that fall within the boundaries of the study area.

3.0 Registered Aboriginal Party (RAP) Consultation

Registered Aboriginal Party consultation for the Project was completed by Hansen Bailey in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010). As suggested by the Project SEARs, consultation carried out for the previous Drayton South Coal Project application has been carried on and relied upon for this modified assessment with additional consultation being undertaken for the updated report to keep the RAPs up to date and informed on the Project as it progresses through the new application process.

3.1 RAP Consultation for the Previous Drayton South Coal Project Application (2012)

3.1.1 Notification and Registration

In accordance with Section 4.1.2 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010), the following agencies were notified of the Project and requests made to provide assistance for identifying and notifying Aboriginal people who may hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects or places within the study area.

- OEH Newcastle;
- Wanaruah Local Aboriginal Land Council (WLALC);
- NSW Department of Aboriginal Affairs – Office of the Registrar;
- National Native Title Tribunal (NNTT);
- Native Title Services Corporation Limited (NTSCorp);
- Singleton Shire Council (SSC);
- Muswellbrook Shire Council (MSC); and
- Hunter-Central Rivers Catchment Management Authority (CMA).

Notifications were issued in writing to agencies on 4 March 2011.

A public notice of the Project was published in local newspapers to identify Aboriginal stakeholders who wished to be consulted in relation to the Aboriginal cultural heritage impact assessment. One identical public notice was printed in the Singleton Argus and the Muswellbrook Chronicle on 4 March 2011.

In response to the above, on 7 March 2011 the WLALC provided a list of contact details for 31 known Aboriginal groups with an association to the area. This was followed by similar listings from OEH received on 8 March 2011 and MSC on recieved11 March 2011, identifying 32 and 34 Aboriginal groups respectively. An expression of interest letter was mailed to each Aboriginal group, as identified by Wanaruah LALC, OEH and MSC informing them of the Project and inviting them to register their interest in consultation.

From the public notice and expression of interest letters, 25 Aboriginal parties registered an interest in being consulted for the Project (Table 1).

Table 1 Register Aboriginal Parties

Ref	Registered Aboriginal Party	Contact Person
1	Aboriginal Native Title Consultants (ANTC)	Margaret Matthews
2	Buddang	Larry Foley
3	Bullen Bullen Consultants (BBC)	Lloyd Matthews
4	Cacatua Culture Consultants (CCC)	Donna Sampson
5	Claimants for the Plains Clan of the Wonnarua (CPCW)	Scott Franks
6	Culturally Aware (CA)	Tracey Skene
7	Gidawaa Walang Cultural Heritage Consultancy (GWCHC)	Annie Hickey
8	Hunter Traditional Owners (HTO)	Paulette Ryan
9	Hunter Valley Aboriginal Corporation (HVAC)	Rhonda Griffiths
10	Hunter Valley Cultural Surveying (HVCS)	Luke Hickey
11	Hunter Valley Natural and Cultural Resources Management	David French
12	Kayaway Eco Cultural and Heritage Services (KECHS)	Mark Hickey
13	Lower Hunter Wonnarua Council Inc. (LHWCI)	Tom Miller
14	Murong Gialinga Aboriginal and Torres Strait Islander Corporation	Debbie Foley
15	Ungooroo Aboriginal Corporation (UAC)	Allen Paget
16	Ungooroo Cultural and Community Services (UCCS)	Rhonda Ward
17	Upper Hunter Heritage Culture Consultants (UHHCC)	Darrel Matthews
18	Upper Hunter Wonnarua Council Inc. (UHWCI)	Rhoda Perry
19	Wanaruah Custodians (WC)	Barbara Foot
20	Wanaruah Local Aboriginal Land Council (WLALC)	Suzie Worth
21	Wattaka Wonnarua Traditional Owners (WWTO)	Des Hickey
22	Wonn 1 Contracting (W1C)	Arthur Fletcher
23	Wonnarua Nation Aboriginal Corporation (WNAC)	Laurie Perry
24	Yarrawalk/Tocomwall	Scott Franks & Barry McTaggart
25	Yinarr Cultural Services (YCS)	Kathleen Steward-Kinchella

In accordance with Section 4.1.6 of the Aboriginal Consultation Guidelines 2010, a copy of the following documentation was provided to OEH and the WLALC on 6 April 2011:

- A copy of the public notice advertised in the Muswellbrook Chronicle and Singleton Argus on 4 March 2011;
- A copy of the letter issued to all identified Aboriginal groups providing notification of the assessment for the Project; and
- A record of Aboriginal groups that have expressed interest in the Project.

As a result of additional Aboriginal groups registering their interest in the Project following the 6 April 2011, a revised record of RAPs was issued to OEH and the WLALC on 21 July 2011.

As specified in Section 4.1.5 of the Aboriginal Consultation Guidelines 2010, each of the RAPs were given the opportunity to withhold their information from being provided to OEH and the WLALC, if requested. No groups made this request.

3.1.2 Archaeological Survey Strategy and Cultural Heritage Values

3.1.2.1 Archaeological Survey Methodology

All RAPs were issued a hard copy of the proposed archaeological survey methodology developed by AECOM on 18 March 2011. The letter provided a description of the Project, the proposed archaeological survey methodology and other requirements. RAPs were encouraged to provide comments and raise any concerns in relation to the Project, the draft archaeological survey methodology or cultural heritage issues more generally.

3.1.2.2 Summary of Responses

Five written responses to the proposed methodology were received from RAPs.

All RAPs that responded agreed with the proposed archaeological survey methodology. Buddang emphasised that the Drayton South area is a place rich in Aboriginal cultural heritage and a potential pathway between local areas. MGATSIC expressed concern regarding the protection of Aboriginal artefacts found at the entrance to the study area off Edderton Road and the timeframe associated with the archaeological survey. MGATSIC also requested further clarification regarding strategies to direct traffic away from Aboriginal artefacts and the due diligence assessment associated with onsite drilling. KECHS requested a culturally-based and scientific approach be adopted for the assessment in addition to 100% survey coverage of the study area. KECHS recommended subsurface investigations be performed following the archaeological survey prior to construction. Each of the responses was addressed as part of the archaeological survey and this assessment.

Issues regarding the archaeological survey timeframe were clarified at the planning meeting and in the field. The survey was initially scheduled as a four week program; however, it was contingent upon the survey coverage. Hansen Bailey was later advised by archaeologist Geordie Oakes, following further consultation with the Aboriginal groups in the field, that an additional week of fieldwork was required to complete the archaeological survey within the study area.

As requested by KECHS and as a component of the archaeological survey methodology, the study area was surveyed in its entirety, with the exception of areas of dangerously steep terrain.

3.1.2.3 Planning Meeting

In accordance with Section 4.2.1 of the Aboriginal Consultation Guidelines 2010, correspondence was issued on 18 March 2011 to all RAPs inviting attendance of a planning meeting to discuss the various aspects of the Project including the consultation program, draft methodology and participation in the archaeological survey.

The planning meeting was held at The John Hunter Motel on 8 April 2011. In total, 16 RAPs representing 15 of the 25 registered groups attended the planning meeting. Glen Morris from OEH was also present.

Items discussed during the planning meeting included:

- Study area background;
- An overview of the Project including critical timelines and milestones;
- The Aboriginal stakeholder consultation process;
- An overview of the draft methodology and discussion of any concerns;
- Archaeological survey requirements;
- Contact details;
- The sharing of cultural heritage information; and
- An open discussion on any other aspects of interest.

3.1.2.4 RAP Participation in the Field Assessment

RAPs registered by 8 April 2011 were offered an opportunity to participate in the archaeological survey. From the 25 RAPs, 23 groups were able to participate. WC declined the invitation to be involved in the survey. Each RAP was contacted by phone and / or email from the 21 April 2011 to confirm dates representatives were required in the field, request insurances and to provide other logistics. From this, a field roster was developed for the archaeological survey.

The archaeological survey was originally scheduled to be completed over 20 business days from 2 to 27 May 2011. All RAPs involved in the archaeological survey provided valid insurances and attended an Anglo American safety induction prior to commencing work. Survey was divided equally, with each RAP eligible to participate for five days on a rotating roster pending weather conditions. A maximum of six representatives from RAPs were required per day.

Hansen Bailey was later advised by archaeologist Geordie Oakes, following further consultation with the RAPs in the field, that an additional week of fieldwork was required to complete the archaeological survey. To maintain the efficiency of the field assessment, six RAPs were randomly selected to participate in the final week of the survey from 30 May to 4 June 2011. On 24 May 2011, correspondence was provided to RAPs notifying them if they were or were not required to participate in the remaining portion of fieldwork.

At the completion of each fieldwork week, Geordie Oakes from AECOM prepared a brief field summary that was distributed to all RAPs to keep them informed as to how the fieldwork was progressing. Correspondence was issued on 31 May 2011 to all RAPs inviting them to attend a close out meeting to discuss the findings from the field assessment. The close out meeting was held at The John Hunter Motel on 10 June 2011. A copy of the presentation was provided to all registered Aboriginal groups on 15 June 2011.

Survey of the entire study area was scheduled to be completed during the initial program; however, access to a portion of land owned by Mt Arthur Coal, where Edderton Road is to be realigned, was not able to be arranged within the assessment timeframe. Therefore, an additional two days of survey was conducted from 10 to 11 October 2011 in accordance with the original methodology developed by AECOM. Six RAPs were randomly selected to participate in the archaeological survey. On 4 October 2011, correspondence was provided to RAPs notifying them if they were or were not required to participate in the remaining portion of fieldwork.

3.1.2.5 Cultural Heritage Exchange Sessions

As a component of the consultation program, Hansen Bailey actively sought out the views and cultural knowledge of RAPs. Correspondence was issued on 31 May and 15 June 2011, and offered at the close out meeting on 10 June 2011 to all RAPs inviting them to participate in cultural heritage exchange sessions. From the 25 groups registered, two groups participated in these sessions (WNAC and UPWCI).

Both groups advised Hansen Bailey that the study area and its immediate surrounds was a corridor between locales, which retained significant archaeological evidence of past Aboriginal utilisation. From further discussions, it was concluded that no specific features or places of Aboriginal cultural heritage were known to occur within the study area.

3.1.3 RAP Review of Draft AACHIA (Drayton South Coal Project 2012)

The draft AACHIA report for the Drayton South Coal Project was issued to all RAPs on 1 February 2012. Responses to the report were provided by 23 RAPs. A summary of the responses is provided below and are provided in full in Appendix A.

3.1.3.1 RAP Responses

A summary of RAP responses are outlined below:

- From the responses received, 16 RAPs accepted the content in the report and did not wish to make further comment. HVAC did not wish to make an individual comment on the report. The group preferred to support the views provided by WLALC in regards to the Project.
- Both Buddang and MGASTIC provided similar views and recommendations regarding the report, in that archaeology identified as being impacted by the Project should be collected and conserved in a designated area on site or in an offsite keeping place.
- UHWCI recommended that should the Project receive approval, employment, education and/or health initiatives should be established to benefit and support the local Aboriginal community.
- WNAC suggested an additional Aboriginal Cultural Heritage Assessment be prepared by the group in line with OEH's recently released *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)*.
- CPCW/Yarrawalk did not agree with the content in the report. In their response, it was noted that no cultural heritage information was provided by Aboriginal groups for consideration in the report.

- Wanaruah LALC stated that it could not support any further destruction of Aboriginal sites or landforms within the area due to their cultural significance.

3.1.4 RAP Review of Draft ACHMP (Drayton South Coal Project 2012)

The draft ACHMP for the Drayton South Coal Project was issued to all RAPs on 18 November 2013. Responses to the report were provided by ten RAPs. A summary of the responses is provided below and are provided in full in Appendix B. The majority of RAPs confirmed that they were accepting of the content of the ACHMP at the time of drafting, however additional comments were also received from two groups. These are summarised below and include:

- CPCW disagreeing with the content of the ACHMP, in that the document did not include sufficient detail on traditional heritage issues; and
- WNAC noting a range of additional cultural heritage management and conservation matters that could be considered for all heritage sites on Anglo American land, if the Project were approved.

3.2 RAP Consultation for the Drayton South Coal Project (2015)

3.2.1 RAP Review and Responses to the Modified Draft AACHIA

The modified draft AACHIA, along with information relating to the reduced mining footprint, was sent to all RAPs for review and comment in February 2015. Two responses were received from RAPs. Wonnarua Nation Aboriginal Corporation agreed with the contents of the report and Tocomwall stated “Tocomwall have reviewed the Recommendations and Management Strategy (pp 95-102) and support your recommendations”. In addition, Tocomwall requested that:

- sites not impacted by the Project be conserved and appropriately managed;
- a geoarchaeological component be included in the salvage methodology;
- landscape changes, particularly where creeklines may have become “entrenched” due to water movement, be considered in the salvage methodology; and
- soils be excavated to the C horizon during the archaeological salvage.

A copy of the correspondence received is provided in Appendix C. No further RAP responses were received.

4.0 Existing Environment

The nature and distribution of Aboriginal archaeological materials are closely linked to the environments in which they occur. Environmental variables such as topography, geology, hydrology and vegetation will have played a critical role in influencing how Aboriginal people moved within and utilised their respective Country. Amongst other things, these variables affected the availability of suitable campsites, drinking water, plant and animal resources and raw materials for the production of stone and organic implements. Accordingly, any attempt to predict or interpret the character and distribution of Aboriginal sites in a given landscape must take such environmental factors into account. At the same time, an assessment of historic land use activities and geomorphic processes, both contemporary and historic, allows predictions to be made concerning the survival, visibility and integrity of Aboriginal archaeological materials within the same landscape.

4.1 Physical Setting and Topography

The study area is located approximately 15 km south of the suburb of Muswellbrook within the physiographic region known as the Central Lowlands sub-region of the Hunter Valley (Story, Galloway, van de Graaf, & Tweedie, 1963). Its topography consists principally of flats interspersed with low undulating to steeply sloping hills, ridges and crests over open farmland which is typical of the region. Slope ranges from level and gently inclined on alluvial flats that border both Saddlers and Saltwater Creeks to steep on hills in the central and southern portions of the study area. Elevation ranges from approximately 100 m AHD (Australian Height Datum) near the Hunter River to 200 m (AHD). Following Speight (2009), landform elements present within the study area include:

- **Flats (floodplain**) - associated with Saddlers Creek and its tributaries in the north and west study area;
- **Hilltops, crests, and ridges** - associated with undulating hills in the centre and south study area; and
- **Lower, middle and upper slopes** - associated with undulating hills in the central study area.

A breakdown of the relative representation of these elements within the study area is provided in Table 2. Identified landform units are shown on Figure 3**.**

Table 2 Landform elements identified in the study area

Landform Element	Description	Size (ha)
Hilltop/Ridge/Crests	*Landform that stands above all, or almost all, points in the adjacent terrain.*	234.8
Upper slope	*Slope element adjacent below a crest.*	316.3
Mid slope	*Slope element lying between the upper slope and lower slope.*	283.9
Lower slope	*A waning slope, below a mid slope and above a flat.*	395.7
Flat	*A planar landform that is neither a crest nor a depression and is level or very gently inclined (less than 3% tangent approximately).*	888
Disturbed	*Grossly disturbed*	148.3
Total	***N/A***	**2267**

4.2 Hydrology

The principal watercourse associated with the study area is Saddlers Creek, a 4th order creekline located in the northern and western portions of the study area. While not located within the study area, Saddlers Creek is fed by a number of small ephemeral creeks and drainage lines that traverse the central and northern portions of the study area. These creeks and drainage lines form a complex drainage network that comprises the central reaches of Saddlers Creek catchment area. Dry for much of the year, these watercourses commonly flood after large rain events, and as a result flood Saddlers Creek. The watercourses vary in width from less than a metre at their headwaters to instances of greater than 20 m where they meet Saddlers. Many of the watercourses, including Saddlers Creek, show evidence of heavy erosion associated with historic native vegetation clearance activities, particularly along their mid and lower reaches,. During rain events, soils eroded from the banks of these watercourses are redeposited across the Saddlers Creek floodplain (Mills, 2000).

In the south-eastern portion of the study area, another series of ephemeral creeks and drainage lines drain moderate to steep sloped hills before feeding into Saltwater Creek, a 4th order creekline located outside the study area. As with watercourses feeding Saddlers Creek, these feeder creeks are mostly dry, running only during rain and flood events. Heavy erosion is likewise a feature, particularly along the mid to lower reaches, with transported soils draining to the Saltwater Creek floodplain. Plashett Dam, constructed to supply water to the nearby Bayswater Power Station, occupies a large portion of the original alignment of Saltwater Creek. Both Plashett Dam and Bayswater Power Station are outside the eastern extent of the study area.

4.3 Surface Geology

Reference to the Singleton 1:250,000 geological mapsheet (Singleton 1:250,000 Geological Series Sheet SI 56-1) indicates that the surface geology of the study area comprises two distinct formations: Quaternary alluvial deposits and Permian coal measures, of which the Singleton Supergroup (formerly known as the Singleton Coal Measures) comprises the overwhelming majority. Quaternary alluvial deposits are associated with Saddlers and Saltwater Creeks, and the Hunter River, and comprise gravels, sand, silt and clays derived from Permian shales and sandstones. The Singleton Supergroup incorporates several geological sub-groups including the Newcastle Coal Measures, Tomago Coal Measures, Watts Sandstone and the Wittingham Coal Measures. Lithic materials associated with the Singleton Supergroup include coal seams, claystone, siltstone, sandstone, conglomerate, tuff, and shale.

Two geological features of note are associated with the study area and are likely to have had a direct bearing on the nature and composition of Aboriginal stone assemblages within it: the Hunter River Gravels, and two identified sources of silcrete cobbles. The Hunter River Gravels are a well-known source of indurated mudstone, often referred to as tuff (see Hughes et al. 2011 for a discussion), silcrete, and quartz raw material that was utilised by Aboriginal people in the manufacture of stone tools in the Central Lowlands. The gravels are exposed at numerous locations along the Hunter River, both as active gravel bars within the creek channel and on former terraces. Gravel locations have been noted at Muswellbrook, Denman, Jerrys Plains and Singleton (Pam Dean-Jones & Mitchell, 1993). However, as Esteves (1999) has suggested, when discussing the location of these gravels it is important to note the Hunter River's alignment is considerably different today than it was prior to European settlement. This is due to channel modifications, land management practices, and natural processes, the implication being that the Hunter River gravels may be located adjacent to old channelization and be a considerable distance from its current channel. In addition, current gravels exposures may not necessarily have been accessible to Aboriginal people in the past.

MacDonald and Davidson (2005), in an assessment of several Hunter River gravel bars, found that the bars consist primarily of local materials, reflecting the River's underlying geology, and smaller deposits of non-local material transported from other parts of the system. Both indurated mudstone/tuff and silcrete are considered locally derived; indurated mudstone/tuff being part of the Singleton Supergroup, and silcrete derived from Tertiary fluvial sands and gravels. Surveys undertaken by Esteves (1999) along the Hunter River concluded that while these raw materials are present throughout the Hunter River gravel bars, there is spatial variability in their availability.

Naturally occurring outcrops of silcrete cobbles have been identified at two confirmed locations, and one unconfirmed location within the study area. Mills (2000) recorded two outcrops of silcrete cobbles, one confirmed outcrop east of Edderton Road and associated with Saddlers Creek floodplain, and one unconfirmed location on a spur in the eastern portion of the study area. A further confirmed location was identified during the current survey of Edderton Road realignment. These natural outcrops of silcrete would have been a source of raw material for stone tool production and are an important factor in characterising the local archaeology.

4.4 Soils and Geomorphology

The 1:250,000 Singleton Soil Landscape Series Sheet (SI 56-1) (Kovac & Lawrie, 1991) indicates that the majority of soils within the study area form part of the Brays Hill soil landscape. Land in the north-west of the study area, associated with Saddlers Creek and its tributaries, is associated with soils of the Bayswater soil landscape. In addition, land within the eastern portion of the study area is characterised by the Liddell soil landscape.

The Brays Hill soil landscape is characterised by red clays (*Vertosol*) on the mid-slopes, black earths on steeper slopes and grey and brown clays (*Vertosols*) with linear gilgai (small ephemeral water bodies) and yellow solodic soils (soils with a strong texture contrast between the A and B horizon and a bleached A2 horizon) (*Sodosols*) on some lower slopes. The crests and upper slopes are characterised by red-brown earths (*Chromosols and*

Dermosols) and alluvial soils are present in drainage lines. Soil erodibility varies from low to moderate throughout the soil landscape, although Alluvial subsoils have a high level of erodibility (Environmental Earth Sciences NSW 2012). Soils on cleared hillslopes are susceptible to minor sheet erosion and drainage lines may have moderate gullying. Potential for mass movement of soils is moderate to low (Kovac & Lawrie, 1991). Both erosion and mass movement of soils are factors that potentially contribute to disturbance of archaeological sites.

The Bayswater soil landscape is characterised by yellow solodic soils (*Sodosols)* on slopes with alluvial soils in drainage lines. Within this landscape grouping, yellow solodic soils and red-brown earth (*Chromosols and Dermosols*) intergrades also occur. Brown and yellow earths and prairie soils (a soil type occurring in temperate areas formerly under prairie grasses and characterized by a black A horizon) are present in some drainage lines. Soils on slopes also comprise yellow and brown podzolic soils (*Chromosols)* ((Environmental Earth Sciences NSW, 2012). Moderate sheet and gully erosion is common on slopes (Kovac & Lawrie, 1991). As a result, archaeological sites present on slopes may have been subject to varying degrees of disturbance.

The Liddell landscape grouping is generally duplex in character with varying degrees of change between A and B horizons. Lower-slopes are comprised of Yellow Solodic Soils, which consist of weakly structured dark brown loam A_1 horizons over bleached orange clay loam A_2. Below these, a clearly changed soil profile of blocky bright reddish brown light clay, becoming more yellow at depth is located. Mid-slopes are comprised of Earthy/Siliceous Sands, which consist of brown sand/loamy sand to brown sandy loams, gradually changing to dull yellow-brown sandy loam or bright brown loamy sand in the B horizon. Upper-slopes are comprised of Yellow Soloths, which consist of Brown loamy sand to sandy loam over a bleached light grey/yellow orange sandy loam or sandy clay loam, clearly changing to bright brown/dull orange sandy clay in the B horizon (Environmental Earth Sciences NSW, 2012). Soils on the lower and upper-slopes (Soloths and Solodics) are susceptible to moderate to high erosion, particularly sheet, gully and, to a lesser extent, rill erosion. Soils on the mid-slopes (sands) have a low potential for erosion. Mass movement hazard is low throughout the soil landscape (Kovac and Lawrie 1991). In these contexts, archaeological sites may be well preserved.

A large number of archaeological sites within the Hunter Valley occur within texture contrast (duplex) soils (Hughes 1984, Koettig & Hughes 1985). Texture contrast soils, as defined by Hughes (1984), consist of an A horizon of massive, sandy to silty material overlaying a B horizon of clayey material with a blocky structure. These soils are prevalent in the Central Lowlands and mantle the undulating to hilly landscapes on Permian and Carboniferous rocks and the older alluvial terraces and valley fills (Hughes 1984). Archaeological excavations in the Hunter Valley have consistently shown Bondaian assemblages, dated to the late Holocene, associated with the A soil horizon. This result has led Hughes and others to conclude that soil materials that make up the A horizon are sedimentary in origin and have accumulated over the last 5000 years (Hughes 1984).

Texture contrast soils, particularly the A horizon, due to its loose sandy and silty material, are prone to extensive erosion resulting in the exposure and subsequent disturbance of subsurface archaeological deposit its original context. During excavations in Drayton South in the mid-1980s, Hughes (1984) noted sheet erosion was the dominant erosional process in the area, and resulted in partial stripping of A horizon soils, with only little deep rilling and gullying of the underlying B unit.

As in other parts of the Hunter Valley, existing archaeological, environmental and historic reference materials for the study are suggest that a range of geomorphic processes are likely to have affected the Aboriginal archaeological record of the site. Potentially significant phenomena from an archaeological perspective include bioturbation, erosion, alluvial/colluvial aggradation and aeolian processes. Possible effects of these processes include:

- Increased archaeological site visibility in eroded areas;
- Reduced archaeological site visibility in areas of sediment deposition;
- Horizontal and vertical translocation of artefacts;
- Stratigraphic mixing;
- Truncation of archaeological deposits; and
- Creation of thicker (potentially stratified) archaeological deposits in floodplain, slope base and fluvial/aeolian sand deposit contexts.

4.5 Flora and Fauna

Descriptions of the current flora and fauna found within the study area have been extracted from the ecology impact assessment (Cumberland Ecology, 2012) prepared for the Project.

The original character of the vegetation in the study area has been greatly altered as a result of historical and current land uses. Remnant forest and woodland now exist as scattered patches across the landscape, typically in gully and riparian areas that have historically been difficult to farm. These patches, although fragmented, occur in reasonable proximity to each other and form a relatively well-connected “stepping stone” corridor of vegetation across the local landscape. Some patches are large enough to provide reasonable interior habitat for native fauna and flora and these areas support a diversity of species in the understorey.

The predominant vegetation unit within the study area is native grassland that has been derived from the clearing of the original woodland and forest communities. The native grassland unit is largely dominated by a variety of native perennial grass and forb species but many exotic species are present as is typical of grazing lands. The majority of the remaining remnant woodland across the site is dominated by *Eucalyptus moluccana* (Grey Box) and comprises the community Central Hunter Box-Ironbark Woodland. Many of the woodland communities in the study area conform to communities that are listed as Threatened Ecological Communities (TECs) under the TSC Act and/or the EPBC Act. Some of these vegetation communities conform to the EPBC Act and TSC Act listed Box-Gum Woodland.

A suite of bird species, and to a lesser extent, bats, dominates the faunal assemblage within the study area. Arboreal mammals were restricted to common and disturbance-adapted species such as possums. Small ground dwelling native fauna (mammals, reptiles and amphibians) are not as well represented within the study area. These trends may reflect the high degree of modification to the understorey habitat and general lack of forage and shelter, as well as the fragmented nature of woodland that may restrict movement.

Although available historical records provide only limited insight into Aboriginal exploitation of plants within the Hunter Valley (Brayshaw, 1987: 74), it can be confidently asserted that the original vegetation communities of the study area will have supplied Aboriginal people camping within, and passing through the site, with an extensive array of edible and otherwise useful plant species.

4.6 Land Use and Disturbance

The current dominant land uses within and around the study area include open cut coal mining, industrial power generation, thoroughbred horse breeding, viticulture, cattle grazing and residential development. Since European settlement of the area in the 1820s, the flora and fauna, hydrology regimes and general landform have been subject to considerable modification as a result of European agricultural activities and coal mining operations. Notable recent and historic land uses and associated ground surface impacts include:

- Extensive native vegetation clearance;
- Pastoral activities including livestock grazing, ploughing, fencing, the construction of multiple farm dams and contour banks for erosion control;
- Fluvial erosion activity, particularly along creeklines and on cleared hillslopes;
- Construction of residential dwellings and associated structures, driveways and access tracks;
- Construction of essential services including power lines and roads (e.g., Edderton Road); and
- Construction of the existing Drayton Mine complex and associated coal mine coal mining activities including minor excavation for exploratory drilling activities.

Figure 3 provides disturbance mapping for the Project Boundary.

To varying degrees, all of the above-cited land use activities and associated ground impacts are relevant to the survival, integrity and identification of Aboriginal archaeological evidence within the study area. Key implications for the current assessment include:

- The likely destruction, in areas of grossly modified terrain, of any pre-existing sites and deposit(s);
- The disturbance of pre-existing archaeological deposits through both direct (e.g., ploughing, bulldozing) and indirect (e.g., erosion) means, resulting in a loss of archaeological integrity;
- The likely removal of any culturally scarred trees that once existed within the study area; and
- An increase, in areas affected by erosion, of archaeological site visibility.

4.7 Key Observations

Environmental conditions discussed above, such as access to fresh water and flora and fauna suggest that land within the study area was sufficient to support transient or repeated past Aboriginal occupation. Evidence of occupation is likely to be found concentrated along/adjacent to creeklines where there is easy access to potable water and food resources. More intense evidence of Aboriginal occupation, in the form of higher artefact densities, is anticipated adjacent to major creeklines such as Saddlers and Saltwater Creeks, with lower densities along ephemeral feeder creeks and drainage lines. However, while sites are expected, their condition will be dependent on the level of disturbance they have undergone.

LANDFORM MAP
Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales
FIGURE 3

5.0 Archaeological Context

5.1 Regional Context - The Hunter Valley

Formal archaeological interest in the Aboriginal archaeological record of the Hunter Valley can be traced to the late 1930s, with then Curator of Anthropology at the Australian Museum Fred McCarthy undertaking an archaeological reconnaissance of the Valley in 1939 (Moore, 1970: 29). McCarthy's subsequent investigation, with F.A. Davidson, of an extensive open artefact site on a terrace of the Hunter River at Gowrie, near Singleton, is widely regarded as the first serious archaeological study of stone artefacts in the Hunter Valley proper (McCarthy & Davidson, 1943). McCarthy's early endeavours aside, more detailed investigation of the Valley's Aboriginal archaeological record did not begin until the mid-to-late1960s, a period that witnessed a series of archaeological surveys and site excavations completed as part of the Australian Museum's long term and wide ranging archaeological research project into the Aboriginal prehistory of the Valley (Moore, 1969, 1970, 1981).

Intensive development activities since this time have secured the Hunter Valley's place as one of the most intensively investigated archaeological regions in Australia, with hundreds, if not thousands, of Aboriginal archaeological investigations involving survey and/or excavation having now been undertaken, the majority as part of larger environmental impact assessments associated with coal mining projects. Not surprisingly, these investigations have varied significantly in scale and scope, ranging from targeted small-scale surveys to complex, multi-phase survey and excavation projects over large areas. Nonetheless, together, they have generated a large and diverse body of evidence for past Aboriginal occupation, with thousands of Aboriginal sites now registered on OEH's Aboriginal Heritage Information Management System (AHIMS) database. Together with Dean-Jones and Mitchell's (1993) pioneering environmental study, existing syntheses of the Aboriginal archaeological record of the Hunter Valley (e.g., ERM, 2004; Hughes, 1984; Koettig, 1990; MacDonald & Davidson, 1998) provide a suitable interpretive framework for the current assessment. Key research themes are detailed in brief below.

5.1.1 Open Artefact Sites: Distribution, Contents and Definition

Surface and subsurface distributions of stone artefacts, variously referred to as open artefact sites, open sites and open camp sites, are by far and away the most common and widely distributed form of Aboriginal archaeological site in the Hunter Valley (ERM 2004; Hughes, 1984; MacDonald & Davidson, 1998). Other site types, such as scarred trees, shell middens, quarries, grinding grooves, burials and rock shelters with deposit and/or art or PAD, have also been identified but are comparatively rare. Accordingly, open artefact sites remain the most intensively investigated component of the Aboriginal archaeological record of the Hunter Valley, with site distribution, site structure and the technology of backed artefact manufacture, in particular, comprising key research topics (Baker 1992a, 1992b, 1992c; Hiscock 1986a, 1986b, 1993a; Koettig 1992, 1994; Moore 1997, 2000; White 1999, 2012).

As highlighted by Hughes (1984) and reiterated by numerous other researchers (e.g., ERM 2004;Koettig & Hughes, 1983, 1985; Koettig 1992,1994;Kuskie, 2000; Rich, 1992), existing archaeological survey data for the Hunter Valley indicate a strong trend for the presence of open artefact sites along watercourses, specifically, on creek banks and 'flats' (i.e., flood/drainage plains), terraces and bordering slopes. Although this distribution pattern can be attributed in part to geomorphic dynamics and archaeological sampling bias, with extensive fluvial erosion activity along watercourses resulting in higher levels of surface visibility and, by extension, concentrated survey effort, an occupational emphasis on watercourses is supported by the results of several large scale subsurface salvage projects (e.g., Koettig, 1992, 1994; Kuskie & Clarke, 2004; Kuskie & Kamminga, 2000; MacDonald & Davidson, 1998; OzArk, 2013; Rich, 1992; Umwelt, 2006,Umwelt, in prep). Collectively, these projects have also shown that assemblage size and complexity tend to vary significantly in relation to both the proximity and permanency of potable water sources as well as landform and slope, with larger, more complex[1] assemblages concentrated on elevated, low gradient landform elements adjacent to higher order streams. In the Lower Hunter Valley, a similar pattern has been identified for the permanent to semi-permanent wetlands of the Hunter 'delta' (e.g., Kuskie, 1994; Kuskie & Kamminga, 2000; Umwelt, 2006, in prep). Outside of these contexts, surface and subsurface artefact distributions have typically been found to be sparse and discontinuous and are often referred to as 'background scatter'.

Flaked stone artefacts dominate archaeological assemblages from recorded open artefact sites within the Hunter Valley (Hiscock 1986), with heat fractured rock also well represented. Items such as complete and fragmentary grindstones, hammerstones, edge-ground hatchet-heads and shell have also been identified but are

[1] Those containing a wider variety of raw materials and technological types and/or higher mean artefact densities and features such as knapping floors and hearths.

comparatively rare. With the notable exception of 'knapping floors', a relatively common component of the open artefact site record of the Hunter Valley, associated archaeological features (e.g., hearths) are likewise rare (for examples see Koettig, 1992; Kuskie & Kamminga, 2000).

Defined in slightly different ways by different researchers, knapping floors can be broadly defined as "activity areas in which primacy was given to the reduction of one or more blocks of stone" (White, 1999:152). Recorded knapping floors in the Hunter Valley vary considerably in size and complexity, with some of the largest and most complex examples identified through excavation as opposed to survey. Backed artefacts (i.e., Bondi points and geometric microliths) are a common feature of knapping floors and most of these features were likely specifically associated with their production. At Narama, near Ravensworth, a detailed analysis of the contents of knapping floor and non-knapping floor assemblages revealed significant differences between the two, including variation in the frequency of backed artefacts, other retouched and/or utilised tools and cores, and the application of different reduction strategies (Rich, 1992). Together with differences in the spatial distribution of the two forms of assemblage, this evidence was used to suggest that backed artefact production within the Narama landscape was a highly structured activity, and that knapping floors assemblages were the product of a more restricted range of behaviours than more generalised scatters. Although limited to a single landscape, evidence from other parts of the Valley (e.g., Hiscock, 1986; Koettig, 1992, 1994) provides further support for the suggestion that backed artefact manufacture in the Hunter Valley was a highly structured activity.

Although relevant to a variety of site types, geomorphic processes such as soil erosion, colluvial/fluvial aggradation and aeolian transportation are of particular relevance to the identification and definition of open artefact sites. As in other archaeological contexts (e.g., Attenbrow 2010; Fanning & Holdaway 2004; Fanning *et al*. 2009; Holdaway *et al*. 2000), it is now widely accepted by archaeologists working in the Hunter Valley that the visibility of open artefact sites within the Valley is, for the most part, a product of contemporary and historic geomorphic processes which have variously exposed and obscured them. As demonstrated by numerous large scale archaeological salvage projects within the Valley (e.g., Koettig, 1992, 1994; Kuskie & Clarke, 2004; Kuskie & Kamminga, 2000; MacDonald & Davidson, 1998; OzArk, 2013; Rich, 1992; Umwelt, 2006,Umwelt, in prep), surface artefacts invariably represent only a fraction of the total number of artefacts present within recorded surface open artefact sites, with the majority occurring in subsurface contexts. Artefact exposure, unsurprisingly, is highest on erosional surfaces and lowest on depositional ones. At the same time, in many areas, surface artefacts have been shown through large-scale subsurface testing to form part of more-or-less continuous subsurface distributions of artefacts, albeit with highly variable artefact densities linked to environmental variables such as distance to water, stream order and landform.

Such evidence has posed a significant analytical and interpretive dilemma for archaeologists working in the Hunter Valley. Defining sites on the basis of surface artefacts alone is clearly problematic, with modern site boundaries frequently reflecting the size and distribution of surface exposures as opposed to the actions of Aboriginal people in the past. Nonetheless, for pragmatic reasons, this has been the most commonly used approach, with 'distance' and 'density-based' definitions dominating. In the Hunter Valley, two of the most commonly employed distance-definitions are '*two artefacts within 50m of each other*' and '*two artefacts within 100 m of each other*'. Neither definition is derived from a particular theoretical approach or body of empirical research - they are simply pragmatic devices for site definition. Definitions based on artefact density also vary in their particulars. However, one of most commonly used definitions is that which isolates, within an arbitrarily defined 'background scatter' of one artefact per 100 m², higher density clusters that are subsequently defined as 'sites'.

Kuskie's (1994, 2000) system of open artefact site definition, developed for use in the Hunter Valley and other surrounding regions, is also worthy of note here. In short, this system is predicated on the definition of 'survey areas' within broader 'Archaeological Terrain Units' (ATUs), with the latter comprising discrete, recurring areas of land defined on the basis of landform element and slope class, and the former, an area of a single ATU bounded on all sides by different ATUs (Kuskie, 2000: 65-67). Within this overarching environmental scheme, open artefact sites are defined by the presence of one or more stone artefacts within a survey area, with site boundaries corresponding the boundaries of the broader survey area irrespective of the visible extent of artefacts within it. Spatially discrete occurrences of stone artefacts within a given site boundary are referred to as 'loci' (Kuskie, 2000: 65-66).

5.1.2 Flaked Stone Tool Technology

Flaked stone artefacts are a ubiquitous element of the Aboriginal archaeological record of the Hunter Valley and, such as, have assumed a preeminent role in archaeological reconstructions of past Aboriginal land use in the region. To date, hundreds, if not thousands, of surface-collected and excavated chipped stone assemblages from the Valley have been analysed, with individual assemblage sizes, research questions, aims, analytical

methodologies and terminological schemes varying significantly between researchers and projects. Studies to date have ranged from basic descriptive accounts of assemblage composition in typological terms to detailed reconstructions of specialised knapping techniques through rigorous technological analyses (including conjoining) and, in some instances, experimental research. Particularly informative analyses in the context of the Hunter Valley include those undertaken by Hiscock (1986a, 1986b, 1993a), Koettig (1992, 1994), Moore (1997, 2000), White (1999, 2012) and Baker (1992a, 1992b, 1992c).

As highlighted by Koettig (1994) and others (e.g., Hiscock 1986a; Hughes 1984), available technological and typological data for surface collected and excavated flaked stone artefact assemblages from the Hunter Valley suggest that the majority of these assemblages belong to what is known as the 'Australian small-tool tradition', a term coined by Gould (1969) to describe what was then thought to be first the first appearance, in the mid-Holocene[2], of a new suite of chipped stone tool forms in the Aboriginal archaeological record of Australia, including Bondi points, geometric microliths, adzes and points (both unifacially and bifacially flaked). Complex, hierarchically-organised reduction sequences associated with the production of these tools contrast markedly with the simple sequences of earlier periods (Moore, 2011). Tools of the Australian small-tool tradition, it has been suggested, formed part of a portable, standardised and multifunctional tool kit aimed specifically at risk reduction (Hiscock, 1994, 2006). Stone artefact assemblages from late Pleistocene and early Holocene contexts, in contrast, are described by archaeologists as belonging to the 'Australian core tool and scraper tradition', a term first used by Bowler *et al*. (1970) to describe the Pleistocene assemblages recovered from Lake Mungo in western New South Wales. Bowler *et al*. (1970) saw the main components of these assemblages - core tools, steep-edged scrapers and flat scrapers - as characteristic of early Australian Aboriginal assemblages and as being of a distinctly different character to those associated with small-tool tradition.

In southeastern Australia, including the Hunter Valley, the Australian small-tool and core tool and scraper traditions are most commonly described in terms of McCarthy's (1967) *Eastern Regional Sequence* (ERS) of stone artefact assemblages. Based on appreciable changes in the composition of chipped stone artefact assemblages over time, the ERS hypothesises a three phase sequence of 'Capertian' (earliest), 'Bondaian*'* and 'Eloueran' (most recent) assemblages and was developed on the basis of McCarthy's (1948, 1964) pioneering analyses of stratified chipped stone assemblages from Lapstone Creek rockshelter, on the lower slopes of the Blue Mountains eastern escarpment, and Capertee 3 rockshelter in the Capertee Valley north of Lithgow. At present, the most widely cited characterisation of the ERS is that of a four-phase sequence beginning with the *Pre-Bondaian* (McCarthy's *Capertian*) and moving successively through the Early, Middle and Late phases of the *Bondaian*, the last of which equates to McCarthy's (1967) *Eloueran* phase. The tripartite division of the Bondaian is based principally on the presence/absence and relative abundance of backed artefacts (Attenbrow, 2010: 101). However, other factors, such as changes in the abundance of bipolar artefacts and different stone materials, and the presence/absence of edge-ground hatchet-heads are also relevant.

Table 3 McCarthy's Eastern Regional Sequence (ESR) of stone artefact assemblages

Current phasing	McCarthy's (1967) Phasing	Approximate date range	Backed artefact frequency	Bipolar artefacts	Edge-ground hatchet heads
Pre-Bondaian	Capertian	30,000-8,000 BP	Absent	Rare	Absent
Early Bondaian	Bondaian	8,000-4,000 BP	Very low	Rare	Absent
Middle Bondaian		4,000-1,000 BP	Very high	Increasingly common	Present
Late Bondaian	Eloueran	1,000 BP to European contact	Very low	Very common	Present

Existing assemblage data indicate that Aboriginal knappers occupying the Hunter Valley utilised a diverse range of lithic raw materials for flaked stone artefact manufacture (Hughes, 1984). However, two rock types - silcrete and silicified tuff (also known as mudstone) - overwhelmingly dominate the region's existing stone artefact record and appear to have been routinely selected for this task, likely due to both basic raw material abundance and their desirable flaking qualities (Hiscock, 1986a). Alongside other, less-commonly exploited raw materials, such as quartz, quartzite, chalcedony, chert, petrified wood and various fine-grained volcanics, both are available in

[2] Note that more recent research into the chronology of backed artefacts and points in Australia (e.g., Hiscock & Attenbrow, 1998, 2004; Hiscock, 1993b) has demonstrated a long history of production and use for these implement types, with both now known to have been produced in the early Holocene and likely in the late Pleistocene as well.

alluvial and colluvial gravel deposits[3] associated with the Hunter River and its tributaries as well as other terrestrial conglomerate units (Raggatt, 1938; see also Hiscock 1986a:14-16). Widely distributed and easily accessible, it would appear that these deposits functioned as the primary source of lithic raw materials for Aboriginal flaked stone tool manufacture in the Hunter Valley proper.

In the Hunter Valley, asymmetrical and symmetrical backed artefacts dominate the retouched components of surface collected/recorded and excavated flaked stone assemblages. Accordingly, the technology of backed artefact manufacture has been a particular focus of research (e.g., Baker, 1992a; Hiscock, 1993a; Koettig, 1992, 1994; Moore, 2000). Studies by Hiscock (1993a), Moore (2000) and others (e.g., Baker, 1992a; Koettig, 1992, 1994; White, 1999, 2012) have demonstrated that backed artefact manufacture in the Hunter Valley was a highly structured activity involving a complex system of raw material procurement, transportation, preparation and reduction. Differences in the technological character of recovered cores and conjoin sets across the Valley indicate a significant degree of variability in the strategies used by Aboriginal knappers to produce blanks for backed artefact manufacture (Figure 4). Heat treatment, notably, appears to have been integral component of the backed artefact manufacturing process, with evidence for the thermal alteration of stone packages throughout the reduction process both abundant and widespread. As Hiscock (1993:66) has observed, “the thermal alteration of Hunter Valley silcrete drastically improves flaking qualities and increases the lustre and smoothness of the fracture surface”. Compared with silcrete, evidence for the thermal alternation of indurated mudstone blanks is rare (e.g., Koettig, 1992) and likely reflects the generally higher ‘raw’ flaking quality of this material.

Alongside the reconstruction of backed artefact manufacturing processes, the identification of diachronic change in Bondaian lithic technology in the Hunter Valley has also received considerable analytical and interpretive attention (e.g., Baker, 1992c; Haglund, 1989; Hiscock, 1986a, 1986b). Hiscock’s (1986a) pioneering attribute analysis of a sample of unretouched mudstone flakes recovered from the Sandy Hollow 1 rockshelter excavated by Moore (1970) is of particular significance in this regard and can regarded as the foundation upon which subsequent studies have been carried out. This analysis sought to test a tripartite division of the Sandy Hollow 1 (SH1) assemblage made on the basis of chronological changes in the frequency of backed artefacts. Three phases were recognised: the *Pre-Bondaian*, with no backed artefacts, the *Phase I Bondaian*, with numerous backed artefacts and the *Phase II Bondaian*, with few backed artefacts. Attribute analysis of a sample of 742 complete mudstone flakes from Square AA revealed technological changes consistent with this division, including, but not limited to, changes in the relative frequency of platform preparation and overhang removal as well as flake shape and platform size (see Table 4).

[3] I.e., point and mid-channel gravel bars as well as terrace and ridge/slope gravel deposits.

Table 4 Hiscock's relative dating scheme for the Sandy Hollow 1 flaked stone assemblage (after Hiscock, 1986a: 100)

Phase	Date range	Flake type	Knapping practices employed for flake production	Backed artefact frequency
Pre-Bondaian	>1300 BP	Medium-sized, relatively squat flakes with very large platforms	• Large amounts of force applied with little control; • Most normal or inward directions of force application; • Imprecise blow application; • Use of relatively low platform angles on cores; • Very little platform preparation of any kind; • Many blows delivered to cortical surfaces; • No platform faceting; • Infrequent overhang removal; and • Low to moderate amounts of core rotation.	Absent
Phase I Bondaian	1300-800 BP	Larger and more elongate flakes with medium sized platforms	• Relatively high amounts of force; • Mostly normal or inward directions of force application; • Imprecise blow applications; • High platform angles; • Large amounts of platform preparation (principally facetting and larger platform flaking); • Infrequent overhang removal; and • High amounts of core rotation.	Numerous
Phase II Bondaian	800 BP - Contact	Relatively small and squat flakes with small platforms	• Low to moderate amounts of force; • Outward directions of force application; • Precise application of force; • High platform angles; • Moderate amounts of platform preparation (flaking onto platform but no faceting) • Frequent overhang removal; and • Moderate to low amounts of core rotation.	Few

Having established the validity of the three phase Bondaian sequence at SH1, Hiscock applied the same attribute analysis to a series (n = 15) of flaked stone assemblages recovered from open artefact sites on the Mount Arthur North and Mount Arthur South coal leases and found that individual assemblages could be assigned to one of the three Bondaian phases recognised at SH1. On this basis, Hiscock (1986b) proposed that the attribute analysis employed at SH1 could serve as a relative dating system for open sites in the Hunter Valley. Given the number of open artefact sites within the region, this argument was particularly ground-breaking and has prompted several archaeologists to apply Hiscock's analysis to assemblages from other areas, albeit with mixed success (e.g., Dean-Jones, 1992; Baker, 1992c; Haglund, 1989; Rich, 1991). Difficulties in replicating Hiscock's results, Holdaway (1993:29) has suggested, likely stems from spatial variability in the methods used by Aboriginal knappers to reduce stone, variability itself linked to variables such as raw material type and accessibility, site function and stylistic differences between Aboriginal groups.

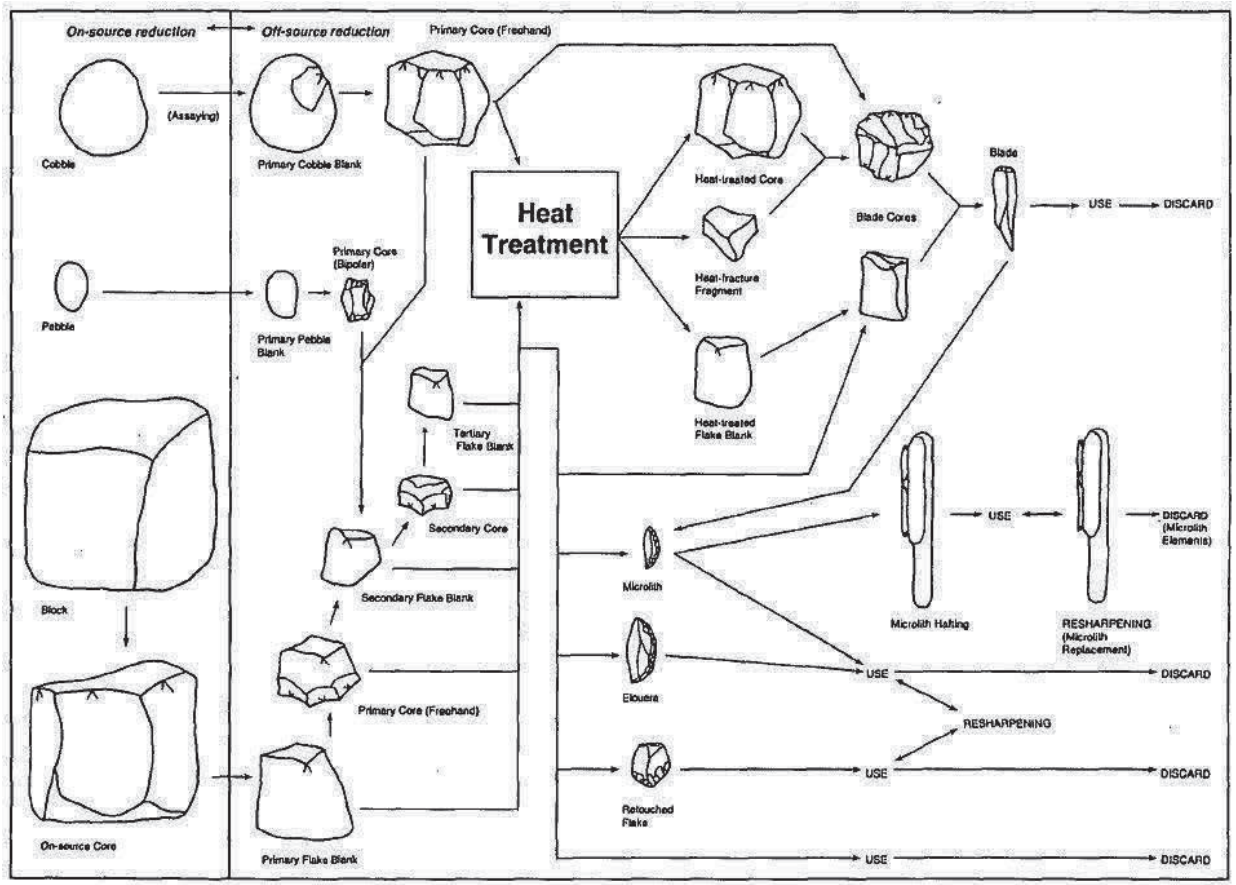


Figure 4 **Moore's (2000) reduction model for the technology of Hunter Valley microlith assemblage (from Moore 2000: 29, Fig. 5)**

5.1.3 Chronology and Texture-Contrast Soils

As in other parts of the state (e.g., Attenbrow, 2010), evidence for late Pleistocene and/or early Holocene Aboriginal occupation of the Hunter Valley is rare, with dated and undated evidence from these periods obtained from only a handful of sites, two of which (i.e., Moffats Swamp Dune & Galloping Swamp) are located on the Valley's coastal plain (Baker, 1994; Koettig, 1986; Kuskie, in prep.; Rich, 1993; Scarp Archaeology, 2009). Studies by Koettig (1990), Baker (1994) and Kuskie (in prep) suggest that the chipped stone technology employed by Aboriginal knappers occupying the Hunter Valley during the terminal Pleistocene/early Holocene was focused on the opportunistic or non-specific reduction of early reduction cores (*sensu* Moore 2000) - some of which were very large. Core reduction appears to have geared towards the production of robust flakes for immediate use or retouch into simple scrapers, with no evidence for the complex, hierarchically-organised reduction sequences typical of the mid-to-late Holocene. Tool edges, Moore (2000:36) notes, were refurbished by unifacial retouching. A preference for volcanic materials over silcrete and mudstone has also been noted (Baker 1994; Koettig, 1990;1992:5), as has the paucity of evidence for deliberate heat treatment (Moore, 2000)

In stark contrast to the late Pleistocene/early Holocene, evidence for mid-to-late Holocene Aboriginal occupation of the Hunter Valley abounds, with numerous excavated sites producing assemblages that can be confidently ascribed to these periods on the basis of radiometric dates and/or their typological/technological profiles. Taken at face value, available radiocarbon determinations suggest a progressive increase in the Aboriginal population of the Hunter Valley over the course of the Holocene (Attenbrow, 2004). However, as argued by Hiscock (2008) on a national scale, it seems likely that the directional population growth suggested by such data is, to a certain extent at least, a product of differential site preservation, with younger sites better preserved than older ones. Other factors, such as the burial of older sites through sediment deposition and aeolian processes and bias in the location of archaeological surveys and excavations, may also be relevant.

Critical to any discussion concerning the antiquity of Aboriginal occupation within the Hunter Valley is the genesis of the texture contrast or duplex soils that are associated with the majority of the Valley's known open artefact sites/deposits. As Kuskie and Clarke (2004: 228) have noted, an understanding of the genesis of these soils, defined by Hughes (1984: 26) as those consisting of "an A horizon of massive, sandy to silty material which gives

way abruptly down the profile to clayey material with a blocky structure", is critical for determining both the antiquity and integrity of any Aboriginal archaeological materials contained within them.

Of particular relevance to archaeologists is the observation that while the 'A' and 'B' horizons of some texture contrast soils do, in fact, form a pedogenetic entity, having formed from *in-situ* weathering of parent materials, this is not always the case, with some 'A' horizons representing later colluvial deposits (Dean Jones & Mitchell, 1993). In the Hunter Valley, available radiocarbon determinations and typological data for flaked stone assemblages recovered from excavated 'A' soil horizons have tended to support Hughes' (1984:28) widely cited suggestion that these horizons accumulated over the last 5,000 years. Nonetheless, the potential for older A horizon soils has also been demonstrated (Koettig, 1992: 61; see also Kuskie & Clarke, 2004).

Drawing, in particular, on the research of Humphreys and Mitchell (1983) and Mitchell (1988), Dean Jones and Mitchell (1993) have considered in detail the archaeological implications of existing genesis models for texture contrast soils, both within and outside of the Hunter Valley. Key observations to be drawn from Dean Jones and Mitchell's (1993) review are as follows:

1. Duplex soils do not necessarily indicate great age;
2. Open sites located on texture contrast soils can never be truly stratified in a chronologically useful sense;
3. Stone artefacts on open sites will behave in the same way as natural stones on a hill slope and will be subject to surface dispersion, downslope movement, and differential burial or exposure by bioturbation agents and will commonly form a stone layer; and
4. The only possible means of dating open sites in any meaningful way will be from artefact cultural sequences developed on the basis of stratified assemblages and/or intact hearths. All other dates, especially those based on detrital charcoal, will be spurious.

More broadly, Dean Jones and Mitchell (1993: 63-64) have highlighted a series of geomorphic contexts within the Hunter Valley that they believe represent favourable locations for the preservation of Pleistocene and/or early Holocene archaeological evidence. These include:

- Rock shelters and large middens;
- Aeolian sand deposits (e.g., source bordering dunes);
- The distal portions of low angle alluvial fans;
- Stream junctions where each tributary has a different rate of sediment supply; and
- Colluvial deposits at the base of steeply inclined surfaces.

5.1.4 Occupation models

A number of Aboriginal occupation models have been proposed for the Hunter Valley over the past three decades, with existing models based on varying combinations of archaeological, environmental and ethnohistoric data. Key models for the Central and Lower Hunter Valley include those developed by Haglund (1992), Koettig (1992, 1994), Kuskie (2000) and Kuskie and Kamminga (2000). These models are summarised in Table 5 below.

Table 5 Aboriginal occupation models for the Hunter Valley

Researcher(s)	Year(s)	Project(s)	Area to which the model applies	Summary of model	Reference(s)
Koettig	1992 & 1994	Salvage of sites within the Camberwell and Bulga Coal Mine Leases	Central lowlands	• Repeated occupation of an area is likely to be represented by continuous, or near continuous, distributions of archaeological sites and/or features; • Sporadic or less intensive occupation of an area is likely to be represented by non-continuous or more widely dispersed archaeological sites and/or features; • Continuous to near- continuous distributions of archaeological evidence along watercourses suggest that Aboriginal people did not camp at specific locations; • Frequency of occupation at a given location is likely to have been related to the availability of subsistence resources (e.g., food, water, lithic raw materials); • Some locations may have been foci for Aboriginal occupation owing to the presence of particular resources (e.g., sandstone exposures suitable for grinding hatchet-heads); and • The duration of occupation at a given location may be evidenced by levels of disturbance to associated archaeological deposits, with sites occupied for shorter duration potentially having more intact deposits, as the length of stay may have been insufficient to disperse artefacts or mask the original form of knapping floors.	Koettig, 1992, 1994
Haglund	1992	Salvage of sites along Doctors Creek, Warkworth	Doctors Creek area, Central Hunter Valley	• Kangaroos, wallabies, and other large and small game would have been abundant in the area during dry periods, and would have been hunted by small hunting parties of men who would prepare and repair their hunting equipment in close proximity to watercourses; • Larger family groups likely visited the area during wetter periods when watercourses would be flowing more reliably and moisture dependent plants occurred in greater abundance; • Women and children would procure and process plant foods, such as ferns, yams and other tubers, in the vicinity of creeks and watercourses; • Sporadic visits would have resulted in debris left behind being incorporated into the turf or buried by leaf litter and Casuarina needles more quickly than more intensive, long term visits; and • While some equipment such as grindstones may have been retained and carried throughout the landscape, flakes and other implements were likely manufactured, utilised and discarded on an “as needed” basis.	Haglund, 1992
Kuskie	2000	Archaeological survey of Mount Arthur North Coal Mine Lease	Mount Arthur Area, Central Hunter Valley	• The area has been occupied for at least the past 5,000 years; • Occupation may extend as far back as 30,000 - 40,000 years; • The area has predominantly been occupied by tribes of the Wonnarua language group, although members of neighbouring groups may also have sporadically visited and occupied the area. • The Mount Arthur North area was likely utilised and occupied by Aboriginal people at varying intensities on a seasonal basis; • Occupation was most intensive within 50m of the main watercourses (3rd and 4th order streams);	Kuskie, 2000

Researcher(s)	Year(s)	Project(s)	Area to which the model applies	Summary of model	Reference(s)
				• Aboriginal occupants had a strong preference for camping on level ground adjacent to reliable water sources and potentially more abundant subsistence resources; • Individual campsites were mainly occupied by single nuclear family groups and multiple family groups (bands); • Larger campsites from broader gatherings of people likely took place along the nearby Hunter River flats; • A greater range and frequency of activities were undertaken at camp sites, rather than in the surrounding landscape; • Camp sites along the major watercourses were occupied by small groups of people for varying lengths of time, during both the course of the seasonal round and in different years. • Occupation of camp sites throughout the entire Mount Arthur north area was predominantly sporadic rather than continuous; • Occupation, such as focussed camping, likely also occurred along level to very gentle drainage depressions (particularly 1st and 2nd order streams). These water sources were likely to be intermittent and occupation along these lower order streams may only have occurred when standing water was available; • Most camp sites involved overnight visits of small hunting parties rather than entire family groups; • Other than focussed camping, activities engaged in across the Study Area involved hunting activities (larger game) by small hunting parties of men, and gathering activities by small parties of women and children, along with transitory movement, procurement of lithic resources, and cultural activities. • The utilisation of areas such as simple slopes, ridge crests, spur crests and minor watercourses was less intense than the valley flats where base camps were situated; • Simple slopes were used during hunting or gathering activities in the course of the normal daily or seasonal round, to access higher ground or stone resources, or to move between camp sites. Ridge and spur crests were also used for these purposes and for accessing vantage points or moving to special ceremonial sites; • Vantage points were important to the Aboriginal occupants of the area, particularly gentle to steep upper slopes adjacent to several ridges, which were mainly accessed by groups of men on hunting expeditions, or for security and/or cultural purposes; • Silcrete and tuff were the preferred stone materials, both of which are locally available and likely procured from local sources during the course of the normal daily or seasonal round, with tuff being the preferred material for manufacture of flaked stone tools; • These materials were also procured from other sources within the region, most notably the alluvial gravels of the nearby Hunter River;	

Researcher(s)	Year(s)	Project(s)	Area to which the model applies	Summary of model	Reference(s)
				• Chert, quartz, petrified wood, chalcedony, and porcellanite were also utilised to a lesser extent and were also procured from local sources, probably during the course of the normal seasonal round; • Silcrete was deliberately heat treated to improve its flaking properties. This may have been undertaken at single locations (e.g. a campsite adjacent to a watercourse) or in different locations reflecting the stages of procurement, heat treatment, reduction and use); • Manufacturing stone tools, particularly flaked implements, was likely a casual or opportunistic activity, conducted on an "as needed" basis; • There was little emphasis on rationing or conservation of the use of most stone materials, due to their wide availability; and • The manufacture of microblades (e.g. hunting spear barbs) was also widely undertaken. While likely a planned and organised activity, it did not necessarily occur at base camps, but may also have occurred in places traversed during the course of hunting expeditions on a more casual or opportunistic basis.	
Kuskie & Kamminga	2006	Salvage of sites impacted by the construction of the Hunter Expressway, near Black Hill	Black Hill - Woods Gully - Hexham Wetlands Locality, Lower Hunter Valley	• The locality was occupied by Aboriginal people of the Pambalong Clan and potentially clans of the broader Awabakal language group; • Occupation focussed on wetlands, swamps, lakes, estuaries, the coastline, and potentially also the junctions of multiple resource zones; • Occupation of the area has predominantly occurred within the past 4,000 years; • Occupation may have extended as far back as 30,000 – 40,000 years, but few landscape contexts exist in which archaeological evidence of older occupation would be conserved; • Occupation encompassed the entire region, but at varying intensities, on a seasonal basis, and across different time periods within the overall time-span of occupation; • Seasonal occupation of some resources and localities may not be evidenced in the extant archaeological record; • Occupation of the area reflects a wide range of activities, including transition between locations, hunting, gathering, procurement and utilisation of lithic and other resources, camping, ceremonial and spiritual activities, and burial practices; • Activities conducted and engaged in by the Aboriginal occupants of the area likely included: food procurement, processing, and consumption; production and maintenance of stone and wooden tools and implements; resource procurement; erection of shelters, children's play, ceremonial and spiritual activity, and social and political activity; • Landscape features and variables such as topography, resources, proximity to water, aspect, slope, and cultural preference likely influenced the activities conducted by the Aboriginal occupants of the area; • Few of the activities engaged in by past Aboriginal people are likely to be evident within the	Kuskie & Kamminga, 2000

Researcher(s)	Year(s)	Project(s)	Area to which the model applies	Summary of model	Reference(s)
				archaeological record, other than those involving the use of stone or where preservation conditions permit; • Locally available indurated rhyolitic tuff was the preferred material for knapping and stone tool production, followed by silcrete, which was also able to be procured locally in terrace and alluvial gravels; • Both tuff and silcrete were likely obtained during both daily and seasonal movements throughout the landscape on an “as needs” basis, not during “special purpose trips”, and conservation of these materials was not a priority due to their wide availability; • Other locally available stone materials including quartz, quartzite, acidic volcanics, chalcedony and chert were also utilised to a lesser extent; • Non-locally available stone materials such as dacite and rhyodacite (used for grindstones) may have been obtained through trade or exchange with other cultural groups, through special purpose trips, or during visits to other areas during the seasonal round; • Ochre was utilised for ceremonial purposes and may have been procured from sources near Lake Macquarie, the Hunter River, or from outside the region; • Heat treatment of silcrete was undertaken to improve flaking qualities and possibly to obtain desired colours; • A reasonably high proportion of silcrete used in knapping activities was deliberately heat treated, but tuff was not; • Microblade production was a widespread, likely planned and organised, activity with the primary goal of producing microliths (e.g. bondi points) for hunting implements/purposes. • Microblade production may have occurred at both campsites and also in places on transitory routes during hunting expeditions, which may represent more casual or opportunistic behaviour; • Production of microliths was time-consuming and the end result was likely highly desirable and socially valuable; • The investment of time and energy in activities such as heat treatment of silcrete and production of microliths for hunting and fighting spears may have more social than utilitarian values, as floral and smaller faunal subsistence resources would probably have been most prominent in the economy of the local Aboriginal people.; • Casual and opportunistic knapping or selection of flakes to meet requirements on an “as needs” basis was widespread. • A high proportion of knapping products were likely discarded at the site of their manufacture, without use; • Use of bipolar technique was uncommon; • Floral subsistence resources were locally abundant, predominantly obtained and processed by	

Researcher(s)	Year(s)	Project(s)	Area to which the model applies	Summary of model	Reference(s)
				women, and were consumed at campsites and at the site of procurement; • Ferns may have been a staple of the local diet, along with the bulbs and roots of other wetland plants; • Plant preparation sites may include camping places around the margins of Hexham Wetland and other swamps. Tools such as Worimi cleavers were utilised to pound the starch-rich rhizomes of bracken and swamp fern and the roots of other plants obtained from the wetlands; • Eloueras may have been used for extracting the perennial herb cumbungi (*Typha australis*), abundant in the freshwater parts of wetlands, or less likely, tall spike rush (*Eleocharis sphacelata*); • Less portable special tools such as Worimi cleavers and grindstones may have been deliberately stored at base camps; • Faunal resources were processed and consumed at temporary hunters or gatherers camps, at nuclear base camps, campsites of larger congregations of people, and at the site of procurement; • Men hunted for larger game, while women played a key role in gathering plants and obtaining smaller game; • Hunting was a planned and coordinated event; • Fish were obtained by several methods, including boating, hooks and lines, spearing, using hand nets, and creating fish traps; • Strategic management of resources such as fish traps were aimed at increasing the reliability and productivity of food resources; • Nuclear family base camps may have been strategically positioned in relation to food resources, at the conjunction of two or more subsistence zones, close to potable water, and on level or very gently inclined ground. Visual aspect and security may have also been important considerations. • Site occupants of nuclear family base camps may have foraged within an area of up to 10km radius from the campsite; • Campsites in more favourable locations may have been subject to more intensive occupation; and • Community base camps or camps of larger congregations of people tended to be situated on level ground adjacent to plentiful food resources and potable water such as river terraces or flats.	

5.2 Local Context

5.2.1 AHIMS Database

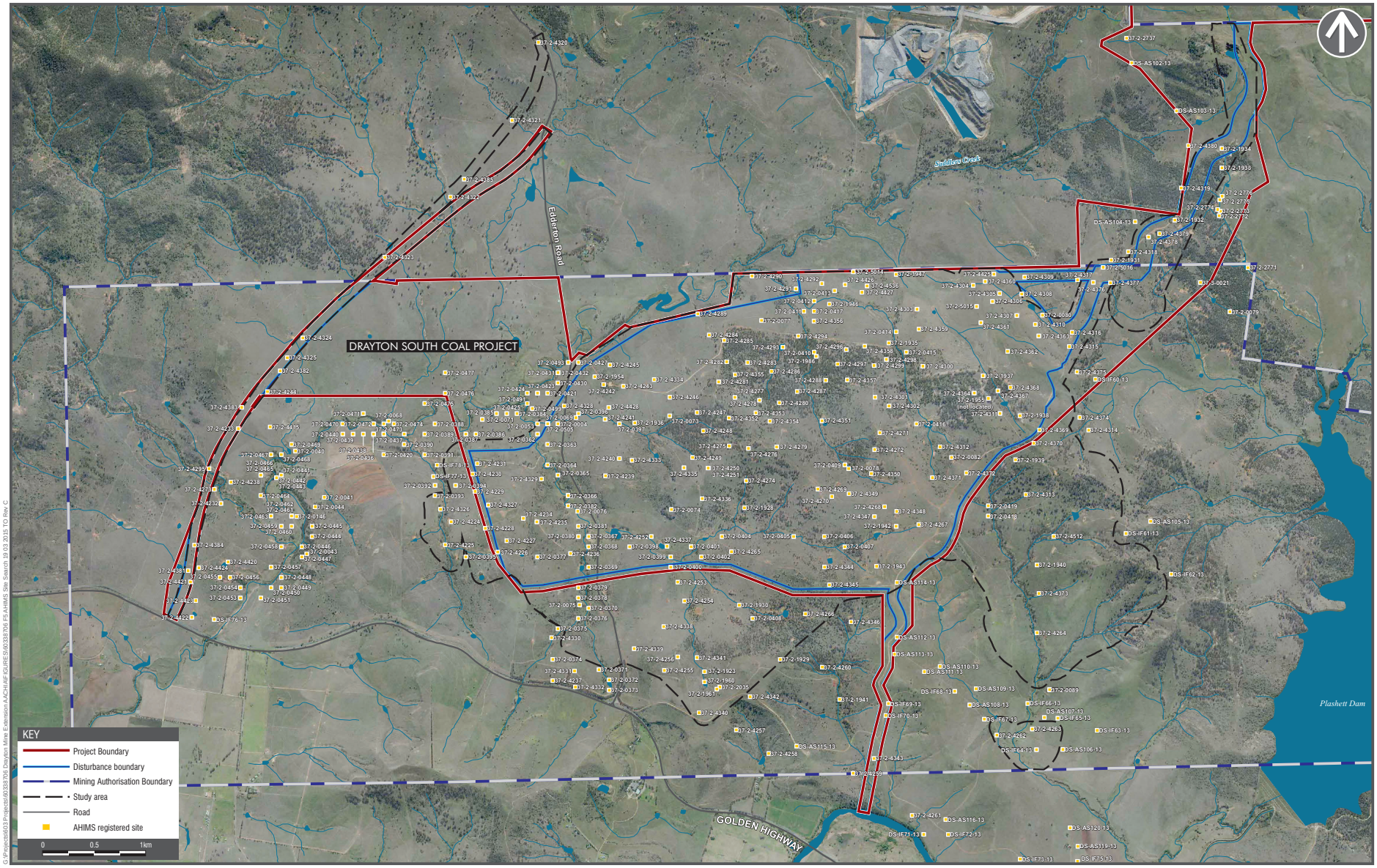
The AHIMS database, administered by OEH, contains records of all Aboriginal objects reported to the Director General of the Department of Premier and Cabinet in accordance with Section 89A of the NPW Act 1974. It also contains information about Aboriginal places which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

A search of the AHIMS database undertaken on 04 March 2015 (AHIMS ID#164558/9) for the Project Boundary identified 194 individual Aboriginal site records directly within the Project Disturbance Boundary. As is typical for the Hunter Valley, open artefact sites (i.e., artefact scatters and isolated finds) are the most common site type represented within Disturbance Boundary accounting for 192 (98.8%) of known sites. The remaining two sites are Aboriginal stone quarry sites.

AHIMS site locations are shown on Figure 5 and the AHIMS search results provided in Appendix D.

5.2.2 Previous Aboriginal Heritage Assessments

Table 6 summarises past Aboriginal archaeological assessments that have been carried out within the study area.



AECOM

AHIMS SITE SEARCH

Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales

FIGURE 5

Table 6 Previous Aboriginal Heritage Assessments

Consultant	Year	Project / Location	Assessment type	Summary of results
L.K. Dyall	1980	Drayton Coal Lease	Survey	Dyall (1980a) undertook a survey of an area immediately south of the Bayswater Colliery and north of the Drayton South area at Drayton Mine. Three sites, all artefact scatters, were recorded on the banks of Saddlers Creek. The sites contained flakes, cores and backed blades of chert, rhyolite (tuff) and quartz.
L.K. Dyall	1981	Mt Arthur Coal Lease	Survey	Dyall (1981) undertook a survey for Mt Arthur Coal of an area immediately south of Mt Arthur. The area, leased by Mt Arthur Coal, was surveyed in anticipation of it being open cut mined. A total of 24 open campsites were found along creeklines (Saltwater and Saddlers Creeks) within the lease area. Two of the sites were large, containing more than 500 stone flakes scattered on the ground surface. Artefact types included stone implements such backed blades, stone axes, choppers and grinding slabs. Other artefact types included waste flakes, and flaking cores.
Koettig & Hughes	(1985b)	Plashett Dam, Mount Arthur North, and Mount Arthur South	Survey & excavation	Koettig & Hughes (1985) undertook an archaeological survey of three separate development areas in the Hunter Valley. The areas included the Plashett Dam site and water storage area on Saltwater Creek; a coal mine development on Mt Arthur North; and a coal mine development on Mt Arthur South (Drayton South). Within the Plashett Dam area, a total of 86 open campsites consisting of stone artefacts scatters were recorded. The sites were concentrated along creeklines, especially Saltwater Creek, with artefacts recorded on bare, eroded exposures. Six of these sites were excavated. Within the Mt Arthur South study area a total of 136 archaeological sites were located and recorded. These comprised 135 open campsites with stone artefact scatters and one site consisting of grinding grooves. The survey focused on areas adjacent to Saddlers Creek. Artefact scatters were the most common site type identified during the survey and were identified eroding out of the A soil horizon. The general pattern of site distribution was one of higher numbers of sites along major creeklines i.e. Saltwater Creek, with numbers decreasing along tributaries. Artefact densities along the whole of Saddlers Creek were typified by sites of high average densities, with a marked increase in the lower section of the creek. Indurated mudstone/tuff and silcrete were the most frequently recorded raw material. Survey of the Mt Arthur North area resulted in the locating of 93 open campsites consisting of stone artefact scatters. A programme of excavation and collection was carried out. The survey focused on areas adjacent to Whites Creek. Koettig and Hughes (1985) noted that sites tended to correspond in area to the surface exposures in which they were identified. Very few sites were recorded on hill slopes, ridges or along the upper portions of some creeklines where there were large areas of eroded ground. Consents to Destroy were granted by the National Parks and Wildlife Service for sites at Plashett Dam and Mt Arthur South. A salvage program of excavation and collection work was carried out and artefacts from eight sites were subsequently collected (MAS12, MAS21, MAS24, MAS39, MAS44, MAS46, MAS47 and MAS48). Artefacts recorded during excavations in all three development areas occurred within the lower portion of the A soil horizon. Indurated mudstone/tuff, silcrete and porcellanite were the most common material in the assemblage. All artefacts were assessed as belonging to Phase I Bondaian.
Mills	2000	Saddlers Creek Mine	Survey	Mills (2000) undertook an archaeological survey to identify Aboriginal sites, and areas of potential archaeological sensitivity within the proposed mine and haul road areas for the Saddlers Creek Mine. The focus of the survey was Saddlers Creek; however, a number

Consultant	Year	Project / Location	Assessment type	Summary of results
				of its tributaries were also surveyed. Forty Aboriginal sites were identified, including seven isolated artefacts, 29 artefact scatters (nine with PAD), two quarry sites, and two scarred trees. The majority of artefact scatters and isolated finds were identified along ephemeral feeder creeks of Saddlers Creek. Mills (2000) found evidence of Aboriginal activity was associated with the full length of these creeklines from their headwaters to the floodplain. In addition, at least two sites were identified on ridges and. eight sites were identified at least 200 m from creeklines. A total of 238 artefacts were recorded, including 127 (53.4%) flakes, 41 (17.2%) block fracture fragments, 28 (11.8%) cores, 19 (8%) flake fragments, seven (2.9%) scrapers, five (2.1%) manuports, four (1.7%) hammerstones, three (1.3%) backed blades, one sharpening stone, one millstone, one anvil and one pebble axe. Indurated mudstone/tuff was the dominant material (48.32%), followed by silcrete (31.51%), quartzite (5.46%), chert (5.04%), quartz (2.94%), porcellanite (2.10%), siltstone (2.10%), sandstone (0.84%), basalt (0.84%), fossilised wood (0.42%), and glass (0.42%).
HLA Envirosciences	2002	Drayton Mine Extension	Survey	HLA Envirosciences (2002) completed an archaeological survey for the Drayton Mine extension. A total of 14 artefact scatters were located during survey. Indurated mudstone/tuff was the dominant material (51%), followed by silcrete (39%), quartz (5%) and porcellanite (5%). Artefacts comprised flakes (49%), flaked pieces (41%), cores (9%), and backed blades (1%). All sites were located along creeklines, ridgelines or crests.
Archaeological Risk Assessment Services	2006	Drayton Mine Extension	Survey	ARAS (2006) undertook an assessment for the Drayton Mine extension. A total of 480 stone artefacts were recorded from 39 sites that were identified, comprising of 22 artefact scatters and 17 isolated finds. A large proportion of the sites contained less than 10 artefacts, though five sites had over 50 artefacts and were associated with drainage lines or gullies. Of the 480 artefacts identified, 38% were complete flakes, 31% broken flakes, 26% flaked pieces and 5% cores. A majority of artefacts were of indurated mudstone/tuff (55%), followed by silcrete (25%), porcellanite (14%) and quartz (4.6%).
Archaeological Risk Assessment Services	2010	Drayton Mine Extension	Survey and salvage	ARAS (2010) undertook a program of salvage excavation for 26 Aboriginal sites for the Drayton Mine Extension Project. The salvage included surface collection of artefacts at 22 sites, mechanical grader scrapes at 11 locations and hand excavation at three locations. A total of 8505 artefacts were recovered as part of the works. Of these, 7500 artefacts were recovered from three distinct knapping locations at Ramrod Creek, identifying the creek as archaeologically sensitive. OSL (optically stimulated luminescence) dating of deposits at Ramrod Creek and Delpah returned dates of 3-1.4 ka years ago placing them in the Late Holocene. Raw materials utilised included porcellanite, silcrete, tuff and chert. At Ramrod Creek, porcellanite was the dominant raw material, while at Delpah, silcrete and tuff were dominant. ARAS (2010) proposed two main site types, reflecting two differing site functions, were present within the study area: fringe sites representing short-term occupation, and sites principally focused on the manufacture of backed artefacts. On the basis of site size (i.e. number of artefacts) and the ratio of discarded tools to waste material, ARAS (2010) proposed that sites adjacent to ridgelines and overlooking ephemeral water systems were the result of ‘short term settlement”. Conversely, ARAS (2010) found sites associated with Ramrod Creek were specific to stone tool manufacturing activities, with particular emphasis on producing Bondi points from porcellanite.

5.2.3 Archaeological Predictions

Key archaeological predictions for the Aboriginal archaeological record of the study area are as follows:

Table 7 Key predictions for Aboriginal site distribution, content and integrity

Site type	Distribution	Content	Integrity
Open artefact scatters	- The majority of scatters will occur in association with creeklines - Scatters are also likely to occur on hillslopes and ridge crests, often at a vantage point over the surrounding landscape.	- Chipped stone artefacts will be the most common form of artefact present within identified scatters. - Indurated mudstone/tuff will be the dominant raw material across the majority of sites, followed by silcrete. - Flake and non-flake debitage will dominate recorded site assemblages whilst retouched artefacts will be rare.	- Open surface scatters along creeklines, slopes and ridgetops will exhibit varying degrees of archaeological integrity, depending on the effects of erosion.
Isolated finds	- The majority of isolated finds will occur within and in association with creeklines.	- The majority of isolated finds will comprise chipped stone artefacts.	- Isolated finds will exhibit varying degrees of integrity.
Archaeological Deposit	- Archaeological deposits are likely to occur along higher order creeklines.	- Archaeological deposit will likely comprise of chipped stone artefacts. Hearths may also be present.	- Archaeological deposits will have varying degrees of integrity, particularly along creeklines, which experience significant erosion.
Scarred trees	- Scarred trees may occur where original remnant vegetation remains.	- Scarred trees will likely be eucalypts i.e. box.	- Scarred trees are likely to be extremely old, dying or dead.
Axe grinding grooves	- Axe grinding grooves on sandstone bedrock will occur in direct association with creeklines.	- Most sites will exhibit more than one groove.	- The majority of axe grinding groove sites will exhibit moderate to high archaeological integrity as such sites are more resistant to impacts.

6.0 Ethnohistoric Context

6.1 Introduction

Information regarding the ways in which Aboriginal people likely used pre-contact landscapes is available to archaeologists through two primary sources: archaeological (i.e., survey and excavation) data and historical records. Section 5.0 has summarised the Aboriginal archaeological context of the study area on both a regional and local scale. This section builds on this foundation by summarising relevant ethnohistoric information for the study area and environs. As in other parts of New South Wales and Australia more broadly, non-Aboriginal people occupying the Lower Hunter Valley began to document Aboriginal culture from first contact, with explorers, missionaries, settlers and the like recording their observations of Aboriginal people and/or their material culture in letters, journals and official reports. Many of these accounts are overtly Eurocentric in tone and the content and veracity of some is, at best, questionable. Nonetheless, taken together, they form an important source of information on Aboriginal lifeways at the time of British colonisation and can, in conjunction with available archaeological data, be used to generate working predictive models of prehistoric Aboriginal land use.

Key sources, both primary and secondary, for the post-contact languages and lifeways of the Aboriginal people occupying the Hunter Valley at contact include: Backhouse (1843), Barrallier (1802), Brayshaw (1987), Caswell (1841), Capell (1970), Dawson (1830), Ebsworth (1826), Enright (1900, 1901, 1932, 1933, 1936, 1937), Elkin (1932), Fawcett (1898a, 1898b), Ford (2010), Gunson (1974) , Hale (1846), Fraser (1892), Haslam et al. (1984), Larmer (1898), Lissarrague (2006), Matthews(1898, 1903), Miller (1887), McKiernan (1911), Threlkeld (1827, 1834, 1836, 1850), Scott (1929) and Sokoloff (1980). Although a detailed review of these sources is beyond the scope of this report, information of particular relevance to the current assessment is summarised below.

6.2 Language Groups & Boundaries

As highlighted by Brayshaw (1987) and a number of other researchers (e.g., ERM, 2004; Kuskie 2012), reconstructing the social and territorial organisation of the Aboriginal groups occupying the Hunter Valley at contact is extremely difficult given the enormous social upheaval that preceded any formal investigations into their languages and lifeways. The sometimes contradictory nature of primary historical records has likewise complicated the situation as has the tendency of early observers to describe all named groups of Aboriginal people, regardless of size and/or composition, as ‘tribes’ (Brayshaw, 1987: 36).

According to Tindale’s (1974) oft-cited tribal map, the current study area is located towards the northern portion of Wonnarua territory (Figure 6). Tindale (1974) describes the territory of the Wonnarua is described as a 5,200 km^2 area stretching from “a few miles” above Maitland west to the Dividing Range and south to the divide north of Wollombi. To the south of the Wonnarua Tindale (1974) places the Darkinjung, whose tribal territory is described as a 4,700 km^2 area extending south of watershed of Hunter River, from “well south” of Jerry's Plains, east toward Wollombi and Cessnock, south to Wisemans Ferry on the Hawkesbury River, and west to the divide east of Rylstone. To the north of the Wonnarua were the Geawegal tribe, who are described as occupying the northern tributaries of the Hunter River to Murrurundi and being present at Muswellbrook, Aberdeen, Scone and Mount Royal Range. To the west Tindale (1974) places the Wiradjuri, who’s territory occupied a 97,100 km² area and to the east the Worimi who occupied a 3,900 km^2 area extending from the Hunter River to Forster, near Cape Hawke, inland to near Gresford and south to Maitland and the Awabakal an 1,800 km^2 area centred on Lake Macquarie, south of Newcastle.

Although widely cited, it should be noted that Tindale’s oft-cited and arguably simplistic division of the Awabakal and Wonnarua into two separate ‘tribes’ does not adequately capture what was at contact a complex system of social and territorial organisation within the Hunter Valley involving numerous local descent groups (i.e., clans) and bands who, critically, appear to have spoken the same language. As Lissarrague (2006: 7) has recently observed, “the evidence from archival sources suggests that the language described by Threlkeld as ‘The language of the Hunter River and Lake Macquarie’ was spoken by people now known as Awabakal, Kuringgai and Wonnarua”. Lissarrague (2006), for her part, has named this language the Hunter River and Lake Macquarie language (HRLM language) and notes that it may also have been spoken by Tindale’s (1974) Geawegal ‘tribe’.

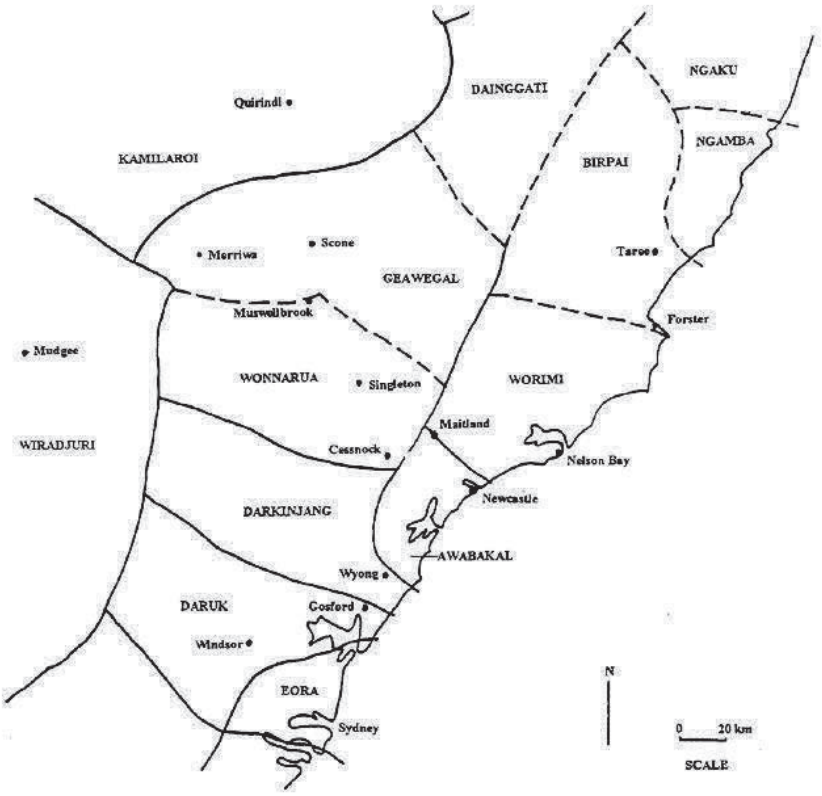


Figure 6 Excerpt from Tindale's (1974) tribal map (from Kuskie, 2012: 38, Fig. 7, after Tindale, 1974)

Critical to current interpretations of the boundaries of the HRLM language are the observations of Reverend Threlkeld. Threlkeld's own account of the boundaries of this language, which comes from his 1838 report to the then NSW Legislative Council's Committee on the Aborigines Question, is reproduced below:

> The native languages throughout New South Wales, are, I feel persuaded, based upon the same origin; but I have found the dialects of various tribes differ from those which occupy the country around Lake Macquarie; that is to say, of those tribes occupying the limits bounded by North Head of Port Jackson, on the south, and Hunter's River on the north, and extending inland about sixty miles, all of which speak the same dialect.
>
> The native of Port Stephen's use a dialect a little different, but not so much so as to prevent our understanding one another' but at Patrick's Plains the difference is so great, that we cannot communicate with each other; there are blacks who speak both dialects (Threlkeld 1838 in Ford, 2010).

Threlkeld's (1825) earlier observation that "the natives here [i.e., at Lake Macquarie] are connected in a kind of circle extending to the Hawkesbury and Port Stephens" is also worthy of note here (Threlkeld, 1825 in Ford, 2010: 328).

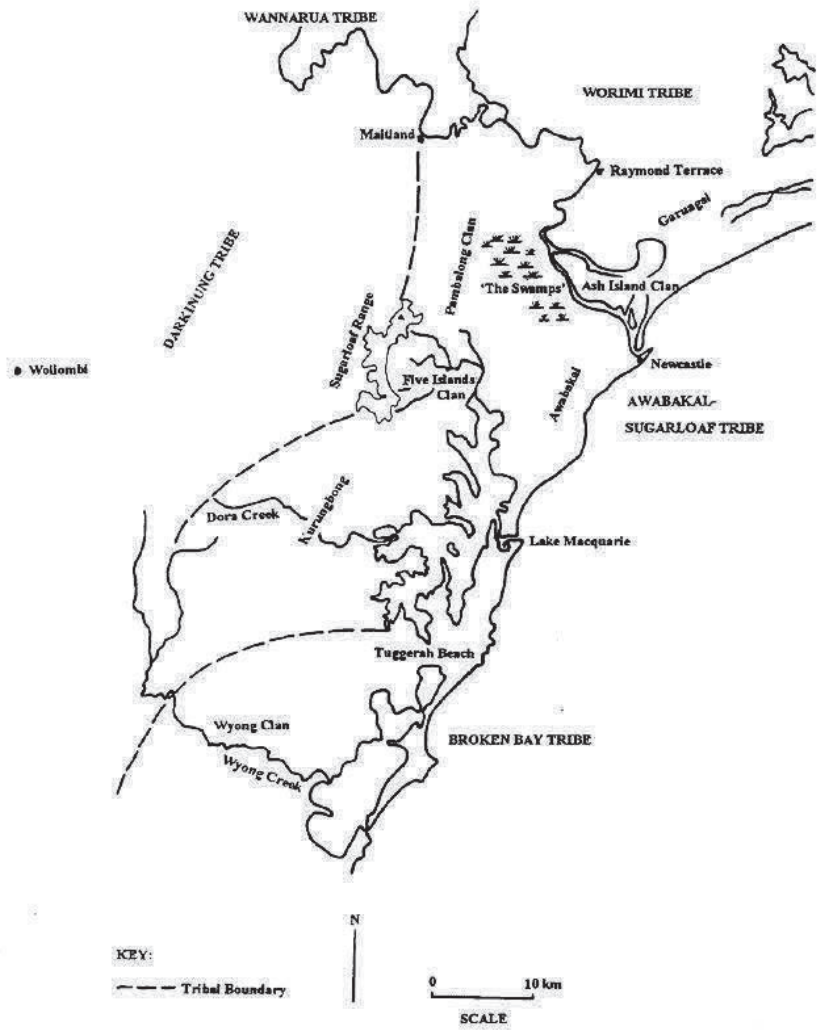


Figure 7 Gunson's (1974) tribal map for the lower Hunter Valley, based on the observations of Reverend Lancelot Threlkeld (from Kuskie, 2012: 39, Fig. 8, after Gunson, 1974).

Threlkeld's observations are clearly of particular relevance to the current assessment and provide strong *primary* evidence for the existence of a single shared language for Tindale's (1974) Awabakal and Wonnarua 'tribes'. At the same time, they suggest that this language differed from that spoken by the Worimi around Port Stephens, being the Kutthung or Kattang language described by Enright (1900, 1901), and those spoken by Aboriginal groups occupying the Mid and Upper Hunter Valley, namely Darkinjung and Kamilaroi (Brayshaw 1987; Ford, 2010). Although Threlkeld's proposed southern extent for the HRLM language does not accord with the observations of other early sources, principally R.H. Matthews, his suggestion of a single shared language for the Aboriginal groups occupying the catchments between the Hawkesbury River estuary of Broken Bay and the estuarine areas of the Lower Hunter River is well supported by available historical records and associated linguistic research (see, in particular, Capell, 1970; Ford, 2010)

Ford's (2010) recently completed historiographic analysis provides further insight into the social and territorial organisation of the Aboriginal groups occupying the Hunter Valley at contact and is also worthy of mention here. Based on his own detailed review of available historical records, Ford (2010) has convincingly argued that, contrary to popular beliefs, the actual 'tribal' and/or language name for the HRLM-speaking Aboriginal groups occupying the estuarine areas of the lower Hunter River at contact was *Wannungine* and not Awabakal, with the latter term coined, alongside 'Guringai' (now Kuringgai), by Scottish ex-school teacher and Maitland resident John Fraser in 1892 (Fraser, 1892). The term *Wannungine,* Ford (2010: 343) notes, was the term that celebrated surveyor and self-taught anthropologist R.H Matthews recorded as the language or tribal name for Aboriginal peoples occupying the coastline southward from the Hunter River estuary to 'Lane Cove', but not extending to the

north shore of Port Jackson, and east to the coastal range[4]. Matthews also identified the term *Wannerawa,* applying it to the southern part of the identified Wannungine area (i.e., around Broken Bay) (Ford, 2010: 344).

Thus, although correctly identified by Matthews, it is Ford's contention that it is Miller's (1887) misapplication of the term *Wannerawa*, *as* 'Wonnarua', to the Mid and Upper Hunter Valley, subsequently reinforced through the publications of disgraced journalist J.W. Fawcett (1898a, 1898b), that has resulted in the historical anomaly of the *Wannerawa* (Miller's (1887) 'Wonnarua') being placed in the Mid and Upper Hunter. Miller's (1887: 352) reference to the principal ornament of the Wonnarua being a "nautilus shell cut into an oval shape and suspended from the neck" is cited as further evidence that Miller should actually have meant his Wonnarua to be coastal people (Ford, 2010: 354). Contrary to Miller's (1887) and Fawcett's (1898a, 1898b) widely cited accounts, Ford's research suggests that, at the time of first European settlement, the mid Hunter was, in fact, occupied by Darkinjung-speaking peoples, whose territory encompassed the ranges bounded by the Hawkesbury River floodplain to the south and the Hunter River floodplain to the north and was bordered to the east/northeast by the coastal *Wannungine (*aka *Wannerawa*) (Ford, 2010: 10). Bordering the Darkinjung to the west/northwest, in the Upper Hunter, were Kamilaroi-speaking peoples, who Ford (2010: 467) suggests had penetrated over the Liverpool Range and were occupying the Hunter Valley as early as 1819.

6.3 Social Organisation

In common with other regions of New South Wales (e.g., Attenbrow, 2010) and Australia more broadly (Peterson, 1976), available historical records suggest that the primary units of social organisation amongst the Aboriginal language groups present in the Hunter Valley at contact were the clan and band. Although these terms are often used interchangeably (e.g., Kohen, 1993), following Attenbrow (2010), a distinction can, in fact, be drawn between the two, with clans comprising local descent groups and bands, land-using groups who, though not necessarily all of the same clan[5], camped together and cooperated daily in hunting, fishing and gathering activities. Individual bands will have habitually occupied and exploited the resources of particular tracts of land within the overall territory of their clan. However, the territorial boundaries of each band will have been permeable or elastic in the sense of complex kinship ties facilitating inter-band territorial movements and the reciprocal use and/or exchange of resources (Brayshaw, 1987: 36).

The size of the individual bands occupying the Upper Hunter at contact appears to have varied considerably and was no doubt activity and season dependent (Brayshaw, 1987). However, an upper limit of around 70 individuals, consisting of several families, is suggested by available historical records (see, in particular, Table B in Brayshaw, 1987). Individual band sizes notwithstanding, much larger groups of Aboriginal people, numbering in the hundreds, are known to have come together for events such as corroborees, ritual combats and feasts (e.g., Anon, 1877; Scott, 1929: 32; Threlkeld in Gunson, 1974: 55).

Fawcett (1898b) notes the existence of four exogamous clans amongst the Wonnarua, with different clan names for men and women:

> The Wonnah-ruah tribe, like most other tribes, was divided into four classes or clans, and the laws of consanguinity, which existed in this tribe, as other tribes, effectually barred a man's marriage with the women of his own class or clan and also with the class or clan of his mother. Every man in the Wonnah-ruah tribe was either an Ippye (Ipai), a Kumbo, a Murree (Murri), or a Kubbee (Kubbi); and every women an Ippatha (Ipatha), a Butha, a Matha or a Kubbeetha (Kubbitha) (Fawcett, 1898b: 180).

6.4 Settlement & Subsistence

Available historical records attest to exploitation, for food and other resources (e.g., skins for clothing), of a large and diverse range of terrestrial, avian and aquatic fauna by Aboriginal peoples occupying the Upper Hunter Valley at contact. A broad economic division between 'coastal' and 'inland' groups is also evidenced, with the subsistence regimes of those living along the coast geared principally towards the exploitation of marine foods and those of inland groups based chiefly on the exploitation of land mammals (e.g., Ebsworth, 1826: 80).

The diet of Aboriginal people occupying the Upper Hunter consisted of a variety of freshwater animal foods, with kangaroos, wallabies, bandicoots, echidnas, possums, flying foxes, kangaroo-rats, koalas, dingos, lizards, goannas and snakes variously reported as having been hunted and/or eaten (see Brayshaw, 1987; Haslam et al., 1984 and Sokoloff, 1980 for primary references). Various species of freshwater and estuarine fish, eels and

[4] From north to south: the Sugarloaf Range, the Watagan Rage and Peats Ridge.
[5] Some individuals may have been related through marriage.

mussels were also consumed, as were turtles (e.g., Anon, 1877b; Cunningham, 1827: 151; Grant, 1803: 61). Possums appear to have been a favoured food, particularly in inland areas, with a number of early accounts detailing their method of capture and remarking on the tree climbing skills of the Aboriginal people involved (e.g., Dawson, 1830: 238; Scott, 1929: 21). Flying foxes, too, appear to have actively sought out by groups in both areas (e.g., Anon, 1877a; Scott, 1929: 23. Macropods were sometimes stalked and speared by individual huntsmen (Dawson, 1830: 216; Threlkeld in Gunson, 1974: 190). However, their capture was more commonly a communal exercise (Dawson, 1830: 182; Scott, 1929: 20; Threlkeld in Gunson, 1974: 191). Threlkeld (in Gunson, 1974: 206) and Fawcett (1898a: 153) report the burning off of particular tracts of land to promote new growth and attract kangaroos and wallabies.

References to the hunting and consumption of a variety of birds, including the emu, are also present in the writings of a number of early observers (e.g., Fawcett, 1898a; Scott, 1929: 23; Threlkeld in Gunson, 1974: 55, 65). Fawcett (1898a: 153) reports the use of nets to trap emus and use of returning boomerangs to bring down “ducks and other birds”. Larvae, namely ‘Cabra’ or shipworm (Teredo navalis) and other tree dwelling grubs, appear to have been a popular foodstuff in both coastal and inland areas (Anon, 1877b; Scott, 1929: 21-22). Honey collected from the hives of native bees was both eaten directly and mixed with water to form a sweetened drink (Breton, 1833: 195; Dawson, 1830: 60; Scott, 1929: 34-35; Threlkeld in Gunson, 1974: 67, 124).

Compared with their faunal counterparts, the plant food resources of coastal and inland groups are poorly represented in the writings of early colonial observers. Nonetheless, available descriptions do suggest that plants formed a regular part of the diets of groups in both areas. Fern roots, likely those of the bracken fern (*Pteridium esculentum*) and various water ferns (*Blenchum spp.*), appear to have played an important role in the diets of those Aboriginal people occupying the estuarine reaches of the Hunter River (Barrallier, 1802: 81-82; Dawson, 1830: 92; Ebsworth, 1826: 71; Threlkeld in Gunson, 1974: 19). Other plant foods mentioned in the writings of early observers include yams, macrozamia seeds, various fruits and the stems of the water lily (Backhouse, 1843: 380; Caswell, 1841; Scott, 1929: 41; Threlkeld in Gunson, 1974: 74). Nectar obtained from the blossoms of the grass tree (Xanthorrhoea spp.) and flower spikes of the dwarf banksia was also consumed (Dawson, 1830: 244).

Regarding levels of residential mobility, available records suggest that this was generally quite high. Fawcett (1898a), for example, notes of the Wonnarua that: “they had no permanent settlements, but roamed about from place to place within their tribal district, in pursuit of game and fish, which was their chief sustenance, making use periodically of the same camping grounds, generation after generation, unless some special cause operated to induce them to abandon them”. Dawson’s (1830: 172) observation that “they [being the Aboriginal people of Port Stephens area] seldom…stay more than a few days at these places [their camps], frequently not more than one night” is similarly suggestive, as is the 1877 observation, by an anonymous long-term resident of Maitland, that the Aboriginal people with whom he was familiar in the Maitland area “appeared to lead a very restless kind of life, constantly on the move, shifting their camps from one place to another, seldom remaining more than three or four days in one camp” (Anon, 1877e). As for the selection of campsites, we limited are to Fawcett’s (1898a: 152) observation that “in choosing the site, proximity to freshwater was one essential, some food supply a second, while a vantage ground in case of attack from an enemy was a third important item”.

6.5 Material Culture

Aboriginal material culture is explicitly linked to the natural environment and resource availability. For the Upper Hunter Valley, available historical records identify an extensive array of hunting and gathering ‘gear’ and provide detailed insight into associated materials and manufacturing processes. The form and construction of everyday domestic structures are likewise well documented. Brayshaw (1987), in particular, provides a useful synthesis of both forms of material culture and highlights regional variability in raw material acquisition and utilisation between coastal and inland groups.

Campsites and domestic structures are well-represented in the accounts of early observers and were often the subject of illustration (Plate 1 and Plate 2). Huts, commonly referred to as "gunyers" or “gunyahs”, were of timber and bark construction. Fawcett (1898a: 152) describes the form and construction of huts as follows:

> A couple, or three, forked sticks, a few straight ones, and some sheets of bark, stripped from trees growing nearby, supplied the requisites for the construction of their home. The forked sticks were thrust into the ground and the straight ones placed horizontally in the forks. The sheets of bark were then set up against the horizontal poles in a slanting position, the bark of the structure being toward the windy point of the compass. The sides were frequently enclosed for further shelter, but the front was generally open. Before each one was a small fire, which was seldom allowed to go out, and which was used for warmth, or to cook by.

Similar hut forms and construction methods can be found in the accounts of several other early observers, for example, Scott (1929: 13), Dawson (1830: 171-72), Caswell (1841) and Threlkeld (in Gunson, 1974: 45).

Alongside its use in hut manufacture, tree bark also served as the primary construction medium for canoes, an integral component of the material culture repertoire of Aboriginal peoples occupying the Hunter Valley at contact. Available descriptions indicate that canoes were manufactured by bending, with the assistance of fire, a suitable sheet of bark into shape and securing the ends with bark cord or other 'wild vines' (Ebsworth, 1826: 82; Dawson, 1830: 79; Fawcett, 1898a; Mrs Ellen Bundock in Brayshaw, 1987: 60; Scott, 1929: 38-39; Threlkeld in Gunson, 1974;). Scott (1929: 39) reports that the gaps between the cord bindings at either end of the canoe were plugged with clay. Clay hearths were also added for warmth and cooking (Threlkeld in Gunson 1974; Scott, 1929: 39). At Lake Macquarie, leaking canoes were repaired by sewing patches of tea tree bark over damaged areas and sealing them with melted grass tree resin (Threlkeld in Gunson, 1974: 54).

Spears, which feature prominently in the literature, were an important component of men's 'gear' and were used in hunting, fishing, combat and ceremony (Scott, 1929: 35; Threlkeld in Gunson, 1974: 67-68). Spears for all purposes, Brayshaw (1987: 65) notes, were of composite manufacture and alongside sea shells, iron tomahawks and pieces of bottle glass, were important trade items, with significant numbers traded inland for possum skin rugs and fur cord (Dawson, 1830: 135-136; Threlkeld in Gunson, 1974: 65). Various hard woods and grass tree stems served as primary spear shafts and were shaped using shell scrapers and pieces of glass (Dawson, 1830: 67, 135; Scott, 1929: 35; Threlkeld in Gunson, 1974: 67-68).

Plate 1 **Joseph Lycett's '*Aborigines resting by camp fire, near the mouth of the Hunter River*', *ca.*1820 (Source: National Library of Australia)**

Plate 2 **Augustus Earle's '*A Native Camp of Australian Savages near Port Stevens, New South Wales*', 1826 (Source: National Library of Australia)**

Threlkeld (in Gunson, 1974: 67) describes the manufacture and use of three different types of spears in the Lake Macquarie area, namely the fishing spear, the hunting spear and the battle spear. Primary shafts, in all three instances, comprised grass tree stems. However, differing types of points were added according to function. For the fishing spear, Threlkeld (in Gunson, 1974) describes the affixing of bone barbs onto three or four 'shorter spears' of fire-hardened wood, themselves fastened to the main spear shaft with bark thread and grass-tree gum, while the hunting spear is described as being equipped with a single hard wood point. The battle spear, Threlkeld (in Gunson, 1974: 67) reports, also had a single hard wood point but differed from its hunting counterpart in having "pieces of sharp quartz stuck along the hard wood joint on one side so as to resemble the teeth of a saw" (Threlkeld in Gunson, 1974: 66). The substitution of glass for quartz on battle spears is also known to have occurred.

Hatchets, like spears, were an important component of men's 'gear' and were used for variety of tasks including bark and wood removal, animal butchery, cutting toeholds in trees to facilitate climbing and extracting game and honey from logs and trees (Anon, 1877a; Dawson, 1830: 202; Scott, 1929: 41; Threlkeld in Gunson, 1974: 67). Known as *mogo*, hatchets were composite implements consisting of an edge-ground stone hatchet head and withe or flat, hardwood handle, the former secured to the latter using grass tree resin and cord (Dawson, 1830: 202; Fawcett, 1898a: 153; Scott, 1929: 40). Hatchets, Scott (1929: 5) notes, were carried by men in belts worn around the waist. Post-contact, stone hatchets appear to have been rapidly replaced by iron substitutes (Brayshaw, 1987: 66; Dawson, 1830: 16).

Other notable items of men's gear described in the accounts of early observers include several types of hard wood clubs, two types of shield (one broad and one narrow) and returning and non-returning hard wood boomerangs (Anon, 1877b; Scott, 1929: 36-38; Threlkeld in Gunson, 1974: 41, 68). Threlkeld (in Gunson, 1974: 68) also describes the use of a "wooden sword" similar to a boomerang but with "a handle at one end with a bend contrary to the blade".

As for women's gear, Brayshaw (1987: 65) notes that, in addition to their daily use in gathering activities, digging sticks, also known as yamsticks, were status symbols that were sometimes used during altercations. These implements, up to 2m long and *c*.4cm in diameter, were manufactured out of hardwoods, were fire-hardened and typically not decorated (Brayshaw, 1987: 65). Cord used in the manufacture of fishing lines and nets was made by women using the bark of various trees (e.g., the Cabbage-tree (*Livistona australis*) and the Kurrajong

(*Brachychiton populneus*) and is reported as having been extremely strong and durable (Ebsworth, 1826: 79; Dawson, 1830: 67; Scott, 1929: 17). Dilly-bags were used by women for carrying small items such as fish-hooks, prepared bark cord, lumps of grass tree resin and food (e.g., fish and shellfish) and were worn slung around the head and draped down the back (Ebsworth, 1826: 79-80).

Fish-hooks were reportedly manufactured out of oyster and pearl shell (Caswell, 1841; Dawson, 1830: 66, 308; Ebsworth, 1826: 79; Threlkeld in Gunson, 1974: 54). Threlkeld (in Gunson, 1974: 54) reports that a suitable shell was simply "ground down on a stone until it became the shape they wished". However, However, Dyall's (2004) analysis of excavated examples from the Birubi Point midden complex suggests a more complex, multi-stage production process. Pieces of fine sandstone, shale and quartzite were used for filing down the hooks (Sokoloff, 1980: 23).

Awls or 'needles' manufactured out of kangaroo bone were used in the repair of canoes and the sewing of skin cloaks (Fawcett, 1898a; Threlkeld in Gunson, 1974: 54). Items of clothing, where worn, included spun possum-fur belts, worn only by men, possum fur headbands and cloaks or rugs made from sewn kangaroo and possum skins (Dawson, 1830: 15-16; Scott, 1929: 5). Cloaks were worn by both men and women.

Alongside women's dilly bags, early accounts indicate the production and use of a variety of other containers, with tea tree bark a common construction material. Threlkeld (in Gunson, 1974: 67, 156), for example, refers to tea-tree bark 'cups' and wooden 'bowls' "formed from some large protuberance of a growing tree" while Dawson (1830: 250) refers to "small baskets" made from tea tree bark.

Although particularly well represented in the archaeological record of the lower Hunter Valley, references to the production and/or use of flaked stone artefacts are virtually absent from the historical record. Excluding hatchets, Threlkeld's (in Gunson, 1974: 67) reference to the use of "pieces of sharp quartz" for barbing battle spears remains the only known primary reference in this respect. Brayshaw (1987: 68), for her part, has proposed that effective absence of flaked stone artefacts from the historical record may be a product of the fact that such artefacts were not being used at the time of European settlement, having been replaced with other materials (e.g. shell, glass, wood and bone)[6]. However, she also acknowledges that their use may simply have escaped the notice or interest of early observers.

6.6 Ceremony & Ritual

Evidence for ceremonial or ritual behaviour amongst the Aboriginal groups occupying the Hunter Valley at contact can be found in the accounts of a number early observers (e.g., Anon, 1877c; Dawson, 1830; Enright, 1936; Fawcett, 1898a, 1898b; Scott, 1929; Threlkeld in Gunson, 1974), with documented 'ceremonial' activities including corroborees, male initiation ceremonies, marriage, ritual combat and various burial, body adornment and modification practices. Although limited in number, references to spiritual beliefs of the Aboriginal groups occupying the region are also present and attest to regional variability in belief systems.

Male initiation ceremonies, in which boys were "initiated into the privileges of manhood" (Fawcett, 1898a: 153), are described by Enright (1936), Fawcett (1898a), Scott (1929) and Threlkeld (in Gunson, 1974). Amongst the Wonnarua, Fawcett (1898a: 152) notes that the male initiation ceremony was known as *Boorool.* Alongside its use in the initiation ceremonies, body painting with animal fat and/or ochre was undertaken as part of corroborees and for the purposes of ritual combat. For men, tooth avulsion, body scarification and septum piercing appear to have been undertaken in ceremonies subsequent to that associated with initiation (Fawcett, 1898b; Scott, 1929). Regarding items of personal adornment, Miller (1887: 3543) notes that the "principal ornament" of the Wonnarua was a "nautilus shell cut into an oval shape and suspended from the neck" while Fawcett (1898a: 153), also writing on the Wonnarua, reports that "the girls often adorned themselves with flowers, bone or reed ornaments, and shell necklaces". References to the dressing of men's hair in a conical form with tufts of grass attached are present in Dawson (1830) and Anon (1877c).

Available historical records suggest that burial in the earth was the most common form of burial practised by Aboriginal groups occupying Hunter Valley at contact, with tea tree bark widely used as a burial shroud (Fawcett, 1898b: 180; McKiernan, 1911: 889; Miller, 1877: 354; Scott, 1929: 3; Threlkeld in Gunson, 1974: 47, 89, 100). Grave goods consisted of items of personal gear such as spear and hatchets (McKiernan, 1911: 889; Threlkeld in Gunson, 1974: 47, 89, 100). Cremation is also known to have been practiced but is poorly represented in the historical record (Threlkeld in Gunson, 1974: 99).

[6] Historic references (e.g., Dawson 1830: 67, 135; Scott 1929: 35) to the use of shell scrapers and/or fragments of bottle glass for the shaping/sharpening of wooden spears provide some support for this suggestion.

Regarding inter-group conflict, Haslam et al. (1981) have noted of the Hunter Valley as a whole that, although skirmishes were common, major clashes were infrequent. Ritual combat appears to have linked principally to unsanctioned territorial incursions and the abduction of women (Fawcett, 1898b).

Gunson (1974) notes a distinct difference between the spiritual beliefs of the Aboriginal groups occupying the inland and coastal portions of the Hunter Valley at contact. In contrast to the Awabakal of Lake Macquarie[7], for example, whose supreme spiritual entity was known as *Koun* (pronounced cone), the inland Wonnarua and Kamilaroi are understood to have venerated the prominent sky cult hero *Biame*.

6.7 Post Contact History

As in other parts of NSW and Australia more generally, the post-contact history of the Aboriginal people of the Hunter Valley is primarily one of dispossession and loss, with traditional hunting and camping grounds rapidly claimed and settled by Europeans and populations decimated by introduced diseases. However, active resistance and friendly relations are also attested in available records.

As highlighted by Brayshaw (1987), the introduction of European diseases had a devastating impact on the Aboriginal population of the Hunter Valley, with diseases such as smallpox, typhoid, influenza, scarlet fever, measles, diphtheria, whooping cough and croup causing or contributing to the deaths of large numbers of Aboriginal people. Major small pox epidemics between April and May 1789 and from 1829 to 1831 are known to have had a particularly deleterious impact on the valley's Aboriginal population (Butlin, 1983).

The loss of traditional hunting grounds and a decline in the abundance of game that populated these areas have also been identified as factors relevant to the marked population decline that accompanied European settlement of the Hunter Valley, as has the sexual violence perpetrated by non-Aboriginal men against Aboriginal women (Turner & Blyton, 1995). The destruction, over time, of the complex systems of social and territorial organisation that existed prior to contact has likewise been attributed to such factors, as has the collapse of traditional settlement and subsistence regimes.

Today, modern Awabakal, Wonnarua and Worimi people retain strong cultural connections to the Hunter Valley and are actively involved in the protection and promotion of their culture for future generations.

[7] Dawson's (1830: 153, 158, 163 219, 220, 322) multiple references to an "evil spirit of woods" known as "Coen" suggest that the Worimi of the Port Stephens area, like the Awabakal, venerated *Koun* as opposed to *Biame.*

7.0 Archaeological Survey

7.1 Aims and Objectives

The overarching aim of the archaeological survey undertaken for this assessment was to identify and record any existing surface evidence of past Aboriginal occupation within the study area. Nested-objectives were as follows:

- To relocate and reassess all extant AHIMS registered sites within the study area;
- To undertake archaeological survey of all land within the study area (where possible);
- To identify areas that, irrespective of the presence or absence of surface artefacts, are likely to contain subsurface archaeological deposit; and
- To provide sufficient data to facilitate the development of appropriate management recommendations for the known and potential Aboriginal archaeological resource of the study area.

7.2 Methodology

Archaeological survey was undertaken over a total of 26 days, initially between 2 May and 4 June 2011, followed by a supplementary survey on 10 and 11 October 2011 to survey Edderton Road re-alignment options. Survey was confined to the study area, which encompasses all areas at Drayton South required for the proposed mining activities and infrastructure. Historically, areas outside the study area were surveyed by Hughes et al., 1985; Dyall 1981b; Mills 2000; HLA 2002; and ARAS 2006.

The survey strategy employed was to undertake pedestrian transects over the entire 2267 ha study area, with the exception of landscapes deemed too steep or dangerous.

All survey was undertaken on foot, with the archaeological survey team walking in line abreast at 10 m to 20 m intervals. The location of each transect completed during survey, including start and end points, was recorded using handheld differential GPS units, with associated transect data (e.g., levels of visibility and exposure) entered directly into the same unit upon the completion of each transect.

All Aboriginal archaeological materials identified during survey were recorded to a standard comparable to that required by the Code of Practice (Requirement 7), with individual artefact locations captured by differential GPS. As with that recorded for individual survey transects, attribute data for identified Aboriginal artefacts within the study area were entered directly into a GPS unit using AECOM's standard digital open site recording form.

7.3 Site Definition

A discussion is provided below of the difficulties of defining a 'site' and a supporting argument for the methodology employed for this assessment.

The definition, in spatial terms, of Aboriginal archaeological 'sites' is a topic of considerable importance to modern cultural heritage management and one that has generated significant debate in Australian archaeology. Aboriginal archaeological 'sites' can be broadly defined as places in the landscape that retain physical evidence of past Aboriginal activity. Such evidence can assume a wide variety of forms, depending on both the nature of the activity (or activities) that produced it. Some archaeological sites are, by their very nature, easy to define in spatial terms. A scarred tree, for example, can be readily delineated from the surrounding landscape.

Difficulties arise, however, for sites whose visible physical extent is difficult to determine. More often than not, the visible extent of a site is determined by the degree of surface visibility, which is regularly limited to areas of erosion and disturbance, and not necessarily representative of the actions of Aboriginal people in the past. Surface scatters of stone artefacts, commonly referred to as open 'camp sites' provide a case in point. As demonstrated by countless large-scale excavations programs in southeastern Australia, and the Hunter Valley in particular, surface artefacts at most open artefact scatters represent only a fraction of the total number of artefacts present within these sites, with the majority occurring in subsurface contexts. At the same time, in many instances, recorded surface artefacts have been found to form part of a more-or-less continuous subsurface distributions of artefacts across the areas being investigated, albeit with highly variable artefact densities linked to key environmental variables such as stream order, landform, aspect and distance to water.

Defining 'sites' on the basis of surface artefacts alone is clearly problematic, with modern site boundaries more commonly reflecting the distribution and size of surface exposures and not the nature of the activity that produced

them in the past. Nevertheless, for pragmatic reasons, this is the most commonly used approach in Australian archaeology. Some of the more commonly employed definitions, for example, are 'artefacts within 50 m of each other', 'artefacts within 100 m of each other' and 'concentrations of artefacts at a higher density than background scatter'. The first two definitions do not require a great deal of explanation. If two artefacts are within 50 or 100 m of each other, then a line is drawn around them and the entire area becomes the 'site'. These distance 'rules' are not derived from any coherent theoretical approach – they are simply a pragmatic device. The density model, in contrast, defines an arbitrary 'background scatter' (commonly 1 artefact per 100 m squared) and draws a line around clusters of artefacts that occur at higher frequencies than the 'background scatter' so defined. The alternative to the distance and density definitions is to 'couch' the definition of sites within a 'cultural landscape' perspective. Kuskie's (2000a) 'environmental context' approach is one such example. In this approach, the study area is divided into a series of ATUs based on landform type and then broken down further into slope classes and survey areas. Landform element and slope are considered the two "important environmental attributes that are assumed to relate to the way in which Aboriginal people occupied the land" (Kuskie 2000a). A survey is then undertaken within each ATU and should surface features be identified, the entire survey area or ATU is regarded as a site. This result is then extrapolated across the entire survey area for the site prediction model, arguing that similar ATUs will have comparable results.

Effective management of cultural heritage requires the identification of 'sites' for reasons of recording (AHIMS database), relocation, protection, and management. To this end, defining discrete 'sites' where there is definitive evidence of Aboriginal activity in the form of surface features perhaps offers the most pragmatic approach to Aboriginal heritage management and limits assumptions about the extent of a 'site'. Surface features can then be easily defined, relocated and managed. For this reason, and given the large number of surface features identified during survey, this assessment has adopted the distance model of 'artefacts within 100 m of each other'.

Subsurface archaeological potential is addressed in the context of this assessment by the concept of 'archaeological sensitivity'. For the purposes of this assessment, archaeologically sensitive areas are those that are deemed to have the potential for archaeological deposit. Archaeological assessments of subsurface archaeological potential are based on analysis of three key factors including the nature and extent of visible surface artefacts at the site, a review of the findings of previous archaeological excavations in analogous landforms in the surrounding area, and on-site observations of post-depositional processes affecting artefact exposure and burial.

7.4 Results

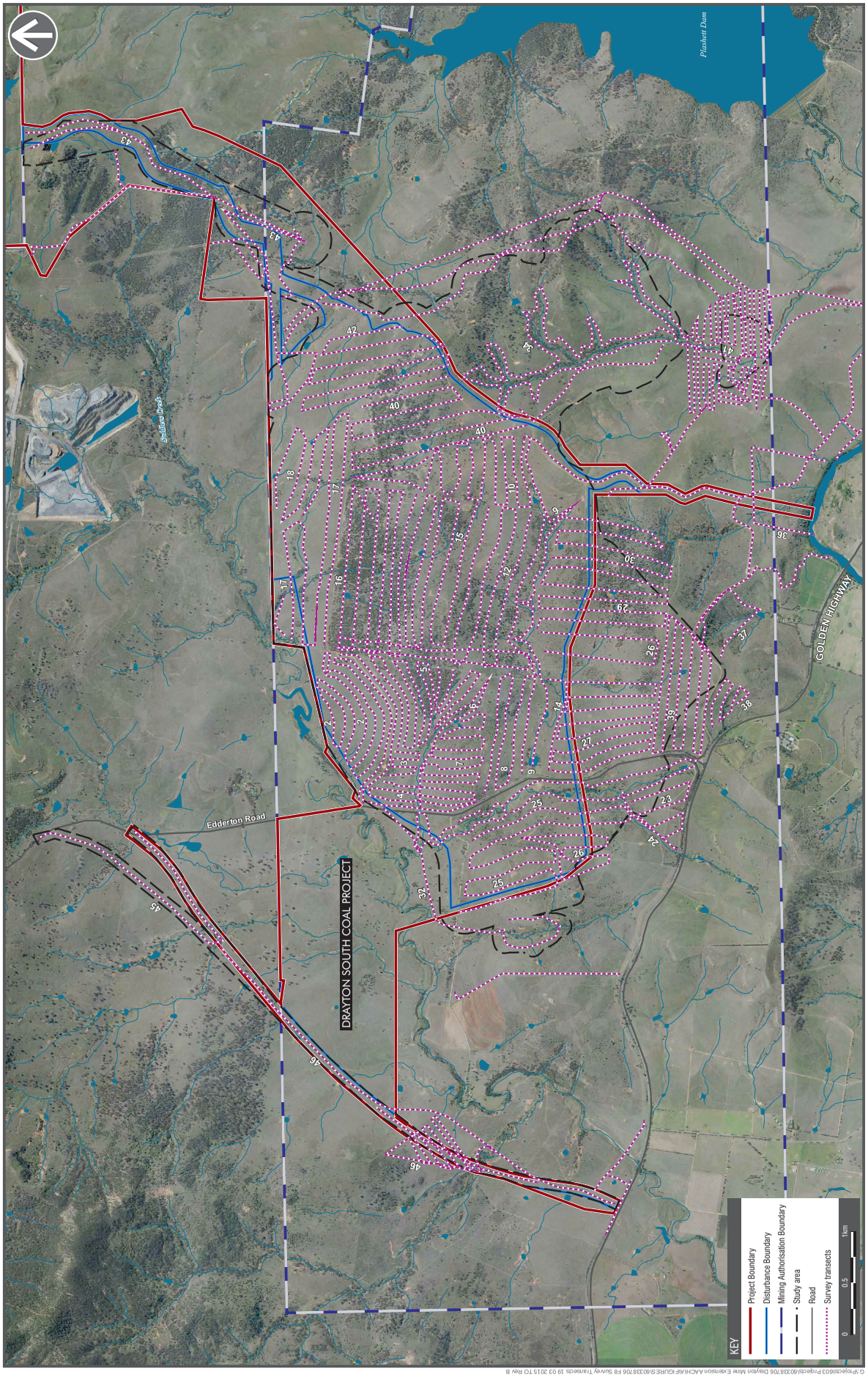
7.4.1 Survey Coverage & Effective Coverage

As shown on Figure 8, a total of 46 pedestrian transects were completed over the 28 day period, with transect lengths ranging from 100 m to approximately 10 km. Together, these resulted in total survey coverage of approximately 1617.9 ha, representing 71.36% of the study area. The remaining 28.64% comprises parts of the southeast corner of the study area that were not surveyed due to steep terrain and limited visibility

Effective coverage is an estimate of the area in which archaeological materials are 'detectable'. Calculation of the *total effective coverage* obtained for the current survey indicates that approximately 251.8 ha of land within the study area was effectively surveyed for Aboriginal archaeological materials. This equates to around 11.1% of the total study area (2,267 ha) and 15.6% of the total area surveyed (1,617.9 ha).

Table 8 Survey coverage by landform

Landform	Total Landform in Study Area (ha)	Total Landform Area Surveyed (ha)	% of Area Surveyed	Area Effectively Surveyed (ha)	% of Landform Effectively Surveyed
Hilltop/Ridge/Crest	234.8	152.4	64.9	8.0	3.4
Upper-slope	316.3	203.2	64.2	7.6	2.4
Mid-slope	283.9	179.0	63.0	6.2	2.1
Lower-slope	395.7	286.8	72.4	11.0	2.7
Flat	888	796.5	172.6	219	35.7
Disturbed	148.3	0	0	0	0
Total	2267.0	1617.9	71.4	251.8	11.1



SURVEY TRANSECTS
Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales
FIGURE 8

G:\Projects\603 Projects\60338706 Dayton Mine Extension AACHIAFIGURES\60338706 F8 Survey Transects 19 03 2015 TO Rev B

7.4.2 Individual Stone Artefacts

A total of 4,519 individual stone artefacts were identified within and adjacent to the study area during the archaeological survey. Of these, basic attribute recording was undertaken for a sample of 2,272 artefacts, representing 50.3% of the total identified assemblage. A typological breakdown of the recorded sample is provided in Table 9 and the location of identified artefacts is shown on Figure 9.

Table 9 shows that complete flakes dominate the assemblage accounting for 50.2% (n = 1140) of the total. Flake debitage (*sensu* Andrefsky 2005: 82) consisting of broken flakes (n = 431, 18.9%) and flake pieces (n = 573, 25.2%) account for 44.1% of the total. Raw material most commonly associated with both complete flakes and flake debitage consists predominantly of indurated mudstone/tuff. Cores (n = 77) are comparatively poorly represented at 3.4%, with indurated mudstone/tuff being the most common raw material. Retouched implements, including 20 miscellaneous retouched flakes, 7 backed artefacts, six scrapers and six Bondi points, are rare accounting for 1.7% of the total. Of these, indurated mudstone/tuff is the most common raw material. Non-ground edge axes (n=9) are represented at 0.5% of the total. Finally, two hammerstones, with clear pitting make up the remaining 0.1% of the assemblage.

The presence of non-ground edge axes is indicative of a well-developed bifacial flaking technology. In the absence of microscopic use-wear analysis, it is difficult to ascertain whether the axes recorded represent unfinished blanks or were utilised without grinding.

Table 9 Breakdown of Recorded Sample Assemblage

Type	Count	Total %	IM	SI	CH	QU	CY	BA	PO	QT	OT
Complete waste flake	1140	50.2	651	362	89	22	2	0	1	1	12
Broken flake	431	18.9	252	117	55	4	0	0	1	0	2
Flaked piece	573	25.2	362	143	49	5	0	0	5	1	9
Core	77	3.4	37	30	7	1	0	1	0	0	1
Misc. retouched flake	20	0.9	4	8	7	0	0	0	0	0	1
Axe	10	0.4	0	0	0	0	0	9	0	0	1
Hammerstone	2	0.1	0	0	0	0	0	1	0	0	1
Scraper	6	0.3	2	2	1	0	0	1	0	0	0
Bondi point	6	0.3	5	1	0	0	0	0	0	0	0
Backed artefact	7	0.3	5	1	1	0	0	0	0	0	0
Total	2272	100	1318	664	209	32	2	12	7	2	27

IM=Indurated Mudstone; SI = Silcrete; CH=Chert; QU=Quartz; CY=Chalcedony; BA=Basalt; PO=Porcellanite; QT=Quartzite; OT=Other

7.4.3 Raw Materials

Table 9 provides a breakdown of the relative frequencies of raw material types in the sampled assemblage. In common with previous studies within and surrounding the study area (AECOM 2009; Koettig & Hughes 1985), the dominant raw material is indurated mudstone/tuff (n = 1318) accounting for 58% of the total assemblage. Hunter Valley indurated mudstone/tuff is commonly a dark red/brown, and often yellowish fine grained hard rock, volcanic or sedimentary in origin (see Hughes et al. 2011). Silcrete (n = 664) is the second most common raw material represented at 29.2%, followed by chert (n = 209), accounting for 9.2%. The remainder of the assemblage is a mixture of small numbers of chalcedony, basalt, porcellanite, quartzite and other sedimentary and volcanic material.

These results are broadly comparable to Koettig & Hughes (1985) excavations in the study area where analysis shows 53% of artefacts were indurated mudstone/tuff, 30% were silcrete and 6% were chert. Conversely, the results differ from ARAS's (2010) findings in Drayton where the overwhelming majority of raw material recorded was porcellanite, with only small representations of indurated mudstone/tuff and silcrete. Kuskie & Clarke (2004)

on the other hand, recorded a predominance of silcrete (59.37%) at Mt Arthur, several kilometres to the north, with only modest frequencies of indurated mudstone/tuff (19.42%) and porcellanite (10.03%).

Past studies have shown differences in the relative representation of raw material types is often a result of differences in the distribution and availability of these materials, in addition to their quality. Surprisingly, this proposition is not reflected by the survey results, which found indurated mudstone/tuff as the predominant raw material. Given the location of at least two confirmed sources of silcrete cobbles within the study area, a predominance of indurated mudstone/tuff rather than silcrete is an unexpected result. There are several possible expansions for this. One explanation is the silcrete cobbles are of poor quality and as a result were not a preferred knapping material by Aboriginal people. Another possible explanation is that the silcrete cobbles were not easily accessible in the past, only being exposed as a result of erosion and slope-wash during the past two centuries. Finally, there may have been a cultural preference for indurated mudstone/tuff by Aboriginal people.

7.4.4 Spatial Analysis

The distribution of Aboriginal archaeological materials within any given landscape can be assessed from two analytical positions. The first, known as a *site-based approach*, utilises the 'site' as the basic unit of analysis while the second, referred to as a *non-site approach*, utilises the individual artefact as the unit of analysis. In this section, the latter approach is employed to investigate the relationship between recorded stone artefact locations (n = 4519) and the key environmental variables of distance to water, stream order, and landform.

7.4.4.1 Distance to Water and Stream Order

The proximity and permanency of potable water sources are routinely cited as key determinants of Aboriginal settlement patterns. Accordingly, Table 10 tabulates the relationship of these variables to recorded artefact locations within the study area. Regarding distance to water, as indicated, the majority (77.1%, n = 3483) of artefacts are located within 100 m of a water source. Data suggests a clear trend for higher artefact counts within 50 m of a water source, which may relate simply to increased fluvial erosion activity along watercourses. Differences in the relative frequency of artefacts between distances classes greater than 100 m from water, meanwhile, are negligible. Most artefacts (94.7%, n = 4281) are associated with lower order (i.e., 1st and 2nd order) streams with this result a product of a lack of higher order creeklines (3rd and 4th order) within the study area.

Table 10 Distribution of Aboriginal Artefacts Associated with Watercourses

Distance to Water Source (m)	Creekline Order				Total	%
	1	2	3	4		
0 – 50	1043	1273	33	99	**2448**	54.2
51 – 100	528	410	70	27	**1035**	22.9
101 – 150	172	262	3	0	**437**	9.7
151 – 200	199	115	0	0	**314**	6.9
201 – 250	37	30	0	0	**67**	1.5
250+	127	85	0	6	**218**	4.8
Total	**2106**	**2175**	**106**	**132**	**4519**	100

7.4.4.2 Landform Analysis

Table 11 presents the relative frequency of artefacts per landform element within the study area. Data indicate that the majority of artefacts were found on lower slopes (n = 3703, 81.9%). The highest artefact density per hectare is within the flat landform where 4.17 artefacts were identified per hectare. Conversely, the lowest artefact density per hectare was within the hilltop/crest/ridge class where 0.07 artefacts were identified per hectare.

As indicated in Table 11 the highest numbers of artefacts were identified within the flat landform unit. However, density calculations which take into to consideration the size of the landform unit show that areas of disturbance (i.e., access tracks, dams etc.) and flats have the highest average densities per hectare. The presence of higher artefact densities in these landform units is not surprising given increased exposure on access tracks and dams within the disturbed landform unit, and increased exposure along creeklines within the flat landform unit.

Table 11 Correlation between Artefact Distribution and Landform Type

Landform Type	No. of Artefacts	% of Artefacts	Landform total (ha) in Study Area	Artefact density per ha
Hilltop/Crest/Ridge	18	0.4	234.8	0.07
Upper slope	34	0.8	316.3	0.11
Mid slope	123	2.7	283.9	0.43
Low slope	511	11.3	395.7	1.29
Flat	3703	81.9	888	4.17
N/A	130	2.9	N/A	N/A
Total	**4519**	**100**	**N/A**	**N/A**

N/A indicates some artefacts were recorded in disturbed landforms or are outside the study area.

7.4.5 Chronology

In the absence of absolute dates obtained through controlled archaeological excavation and/or a detailed geomorphological dating program, establishing a chronological context for the identified surface Aboriginal archaeological resource of the study area is difficult. This said, on typological grounds, some broad statements could be made about occupation dates. A number of artefacts identified during the survey, particularly backed blades such as Bondi points, are part of the 'Australian small tool tradition'. Such artefacts have been dated to the mid to late Holocene (c. 6000 to 0BP), and are commonly found throughout the Hunter Valley. Therefore, in very broad terms, Aboriginal occupation of the study area can be dated to between 6000 BP and 0 BP.

7.4.6 Identified Sites

A total of 4,519 stone artefacts were identified within and adjacent to the study area during the archaeological survey. Employing the 100 m distance convention for site definition and consideration of the location of these items against the mapped and/or described boundaries of valid AHIMS sites provides a total of 194 Aboriginal sites within the study area with a further 62 sites identified adjacent to it (Figure 9). Sites within the study area

comprise 137 artefact scatters, 55 isolated artefacts, and two stone quarries (one of which could not be located 37-2-1955). Site details for all sites within the study area are provided in Table 12.

Table 12 Aboriginal sites within the study area

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m^2)	No. Cultural lithics
			Easting	Northing		
37-2-0053, 37-2-0006, 37-2-0004, 37-2-0362, 37-2-0076, 37-2-0363, 37-2-0364, 37-2-0365, 37-2-0366, 37-2-0382, 37-2-0383, 37-2-0289, 37-2-1936, 37-2-0505	DS-C3	Artefact Scatter	295326	6411061	277928	332
37-2-0074	Saddler's Creek;	Artefact Scatter	296507	6410560	7516	N/A
37-2-0077	Saddler's Creek;	Artefact Scatter	297283	6412403	86656	28
37-2-0078, 37-2-0409	DS-C11	Artefact Scatter	298211	6411041	89636	200
37-2-0080	Saddler's Creek	Artefact Scatter	300132	6412460	7681	N/A
37-2-0082	Saddler's Creek;	Artefact Scatter	299245	6411073	7498	N/A
37-2-0089	Saltwater Creek;	Artefact Scatter	300110	6408993	91252	89
37-2-0369, 37-2-0379, 37-2-0370, 37-2-0075, 37-2-0376, 37-2-0378	DS-C5	Artefact Scatter	295604	6409754	129157	114
37-2-0371, 37-2-0372, 37-2-0373	DS-C6	Artefact Scatter	295826	6409128	125137	70
37-2-0375	MAS 29;Mt Arthur South;	Artefact Scatter	295402	6409397	7378	N/A
37-2-0377	MAS 31;Mt Arthur South;	Artefact Scatter	295203	6410100	6415	N/A
37-2-0381, 37-2-0380, 37-2-0367, 37-2-0368	DS-C4	Artefact Scatter	295673	6410303	118247	185
37-2-0393, 37-2-0394	DS-C2	Artefact Scatter	294351	6410754	34411	29
37-2-0395	MAS 50;Mt Arthur South;	Artefact Scatter	294505	6410089	6514	N/A
37-2-0396, 37-2-0069	DS-C17	Artefact Scatter	295589	6411481	11878	N/A
37-2-0397, 37-2-1936, 37-2-0073	DS-C7	Artefact Scatter	296391	6411293	196898	156
37-2-0398	MAS 54;Mt Arthur South;	Artefact Scatter	296110	6410199	7600	N/A
37-2-0408	MAS 64;Mt Arthur South;	Artefact Scatter	297457	6409563	41672	18
37-2-0410, 37-2-1986	DS-C14	Artefact Scatter	297932	6412066	50666	157

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m²)	No. Cultural lithics
			Easting	Northing		
37-2-0411, 37-2-0417, 37-2-0412	DS-C12	Artefact Scatter	297789	6412557	80793	85
37-2-0416	MAS 72;Mt Arthur South;	Artefact Scatter	298805	6411638	92035	41
37-2-0419, 37-2-0418	DS-C15	Artefact Scatter + PAD	299665	6410642	65876	106
37-2-0427	MAS 76;Mt Arthur South;	Artefact Scatter	295636	6411985	20141	20
37-2-1923, 37-2-1960	DS-C9	Artefact Scatter	296844	6408947	19871	3
37-2-1929	SC-OS-6	Artefact Scatter	297570	6409098	7609	N/A
37-2-1930	SC-OS-5	Artefact Scatter	297152	6409684	28205	11
37-2-1931	SC-OS-25	Artefact Scatter	300869	6412944	18232	4
37-2-1932	SC-OS-24	Artefact Scatter	301428	6413394	7272	N/A
37-2-1934, 37-2-1933, 37-2-1956, 37-2-1957	DS-C16	Artefact Scatter	301839	6414007	29307	24
37-2-1938	SC-OS-17	Artefact Scatter	299900	6411470	17261	4
37-2-1939	SC-OS-16	Artefact Scatter	299872	6411052	7607	N/A
37-2-1940	SC-OS-12	Artefact Scatter	300016	6410024	25480	7
37-2-1942	SC-OS-10	Artefact Scatter	298659	6410356	25286	8
37-2-1943, 37-2-0399, 37-2-0400, 37-2-0401, 37-2-0402, 37-2-0403, 37-2-0404, 37-2-1928, 37-2-0405, 37-2-0406, 37-2-0407	DS-C8	Artefact Scatter	297494	6410390	466414	981
37-2-1946,37-2-0413,37-2-1937,37-2-0414,37-2-0415,37-2-1935	DS-C13	Artefact Scatter	299015	6412142	356857	211
37-2-1947	SC-OS-27	Artefact Scatter	298674	6412823	31645	13
37-2-1954	SC-QS-2 Quarry	Stone Quarry	295763	6411858	7417	N/A
37-2-1955 (*not located during survey)	SC-QS-1	Stone Quarry	299510	6411430	8484	N/A
37-2-2035, 37-2-1961	DS-C10	Artefact Scatter	296961	6408820	11164	N/A
37-2-2666	SC20.	Isolated Find	294493	6413773	7719	N/A
37-2-4224	DS-AS1-11	Artefact Scatter	294363	6410434	11139	2
37-2-4225	DS-AS2-11	Artefact Scatter	294305	6410209	53620	29
37-2-4226	DS-AS3-11	Artefact Scatter	294816	6410138	24888	4

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m^2)	No. Cultural lithics
			Easting	Northing		
37-2-4227	DS-AS4-11	Artefact Scatter	294906	6410248	7661	2
37-2-4228	DS-AS5-11	Artefact Scatter	294696	6410369	8113	3
37-2-4229	DS-AS6-11	Artefact Scatter	294596	6410729	13650	3
37-2-4230	DS-AS7-11	Artefact Scatter	294572	6410899	10581	3
37-2-4231	DS-AS8-11	Artefact Scatter	294618	6411002	17245	6
37-2-4233	DS-AS10-11	Artefact Scatter	292285	6411343	7878	2
37-2-4234	DS-AS11-11	Artefact Scatter	295067	6410466	7896	2
37-2-4235	DS-AS12-11	Artefact Scatter	295198	6410432	13252	6
37-2-4236	DS-AS13-11	Artefact Scatter	295528	6410124	9211	4
37-2-4239	DS-AS16-11	Artefact Scatter	295869	6410882	14431	2
37-2-4240	DS-AS17-11	Artefact Scatter	296004	6411051	10454	2
37-2-4241	DS-AS18-11	Artefact Scatter	295865	6411434	8930	12
37-2-4242	DS-AS19-11	Artefact Scatter	295851	6411773	9481	4
37-2-4243	DS-AS20-11	Artefact Scatter	296044	6411757	8918	4
37-2-4244	DS-AS21-11	Artefact Scatter	292570	6411704	14640	23
37-2-4245	DS-AS22-11	Artefact Scatter	295914	6411965	10089	5
37-2-4246	DS-AS23-11	Artefact Scatter	296497	6411650	13701	2
37-2-4247	DS-AS24-11	Artefact Scatter	296763	6411501	23145	15
37-2-4248	DS-AS25-11	Artefact Scatter	296824	6411321	65803	36
37-2-4249	DS-AS26-11	Artefact Scatter	296719	6411061	7816	3
37-2-4251	DS-AS27-11	Artefact Scatter	296871	6410958	22337	4
37-2-4252	DS-AS28-11	Artefact Scatter	296315	6410289	10253	2
37-2-4253	DS-AS29-11	Artefact Scatter	296574	6409844	14825	3
37-2-4254	DS-AS30-11	Artefact Scatter	296640	6409660	22506	16
37-2-4255	DS-AS31-11	Artefact Scatter	296444	6408982	8451	4
37-2-4256	DS-AS32-11	Artefact Scatter	296574	6409114	28409	5
37-2-4262	DS-AS38-11	Artefact Scatter	299689	6408350	102476	72
37-2-4263	DS-AS39-11	Artefact Scatter	300034	6408409	35672	6
37-2-4264	DS-AS40-11	Artefact Scatter	300081	6409349	19816	3

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m²)	No. Cultural lithics
			Easting	Northing		
37-2-4265	DS-AS41-11	Artefact Scatter	297098	6410141	10137	4
37-2-4266	DS-AS42-11	Artefact Scatter	297820	6409534	18057	3
37-2-4267	DS-AS43-11	Artefact Scatter	298927	6410406	70160	26
37-2-4268	DS-AS44-11	Artefact Scatter	298592	6410580	19715	3
37-2-4269	DS-AS45-11	Artefact Scatter	297941	6410753	12807	2
37-2-4270	DS-AS46-11	Artefact Scatter	298078	6410679	11119	2
37-2-4271	DS-AS47-11	Artefact Scatter	298547	6411303	7724	2
37-2-4272	DS-AS48-11	Artefact Scatter	298496	6411138	8526	2
37-2-4273	DS-AS49-11	Artefact Scatter	292051	6410750	14635	11
37-2-4274	DS-AS50-11	Artefact Scatter	297243	6410834	15073	13
37-2-4275	DS-AS51-11	Artefact Scatter	297076	6411173	19167	5
37-2-4276	DS-AS52-11	Artefact Scatter	297264	6411150	19662	3
37-2-4277	DS-AS53-11	Artefact Scatter	297132	6411648	7996	3
37-2-4278	DS-AS54-11	Artefact Scatter	297372	6411620	8094	6
37-2-4279	DS-AS55-11	Artefact Scatter	297540	6411164	9099	2
37-2-4280	DS-AS56-11	Artefact Scatter	297567	6411595	22211	6
37-2-4281	DS-AS57-11	Artefact Scatter	296974	6411800	14713	21
37-2-4282	DS-AS58-11	Artefact Scatter	297052	6411996	23323	5
37-2-4283	DS-AS59-11	Artefact Scatter	297257	6411988	16653	4
37-2-4284	DS-AS60-11	Artefact Scatter	296881	6412258	23070	11
37-2-4285	DS-AS61-11	Artefact Scatter	297027	6412205	19118	6
37-2-4286	DS-AS62-11	Artefact Scatter	297489	6411902	48815	12
37-2-4287	DS-AS63-11	Artefact Scatter	297740	6411706	69399	64
37-2-4288	DS-AS64-11	Artefact Scatter	298018	6411815	33130	49
37-2-4289	DS-AS65-11	Artefact Scatter	296770	6412464	24139	9
37-2-4290	DS-AS66-11	Artefact Scatter	297298	6412833	12558	4
37-2-4291	DS-AS67-11	Artefact Scatter	297727	6412708	18220	25
37-2-4292	DS-AS68-11	Artefact Scatter	297980	6412760	9964	3
37-2-4293	DS-AS69-11	Artefact Scatter	297600	6412139	22093	10

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m^2)	No. Cultural lithics
			Easting	Northing		
37-2-4294	DS-AS70-11	Artefact Scatter	297752	6412247	15347	2
37-2-4295	DS-AS71-11	Artefact Scatter	291999	6410952	30345	20
37-2-4296	DS-AS72-11	Artefact Scatter	298219	6412114	19291	4
37-2-4297	DS-AS73-11	Artefact Scatter	298135	6411973	17207	6
37-2-4298	DS-AS74-11	Artefact Scatter	298610	6412019	18053	9
37-2-4299	DS-AS75-11	Artefact Scatter	298490	6411959	8187	2
37-2-4300	DS-AS76-11	Artefact Scatter	298966	6411953	14296	2
37-2-4301	DS-AS77-11	Artefact Scatter	298499	6411650	7857	4
37-2-4302	DS-AS78-11	Artefact Scatter	298636	6411564	12822	3
37-2-4303	DS-AS79-11	Artefact Scatter	298909	6412509	52885	102
37-2-4304	DS-AS80-11	Artefact Scatter	299458	6412742	9851	4
37-2-4305	DS-AS81-11	Artefact Scatter	299715	6412663	23124	10
37-2-4306	DS-AS82-11	Artefact Scatter	299646	6412585	10656	2
37-2-4307	DS-AS83-11	Artefact Scatter	299883	6412447	19984	3
37-2-4308	DS-AS84-11	Artefact Scatter	299931	6412657	22057	17
37-2-4310	DS-AS86-11	Artefact Scatter	300064	6412361	13416	3
37-2-4311	DS-AS87-11	Artefact Scatter	299719	6411491	7720	2
37-2-4312	DS-AS88-11	Artefact Scatter	299134	6411165	15435	2
37-2-4313	DS-AS89-11	Artefact Scatter	299972	6410699	13886	2
37-2-4315	DS-AS91-11	Artefact Scatter	300396	6412145	8234	2
37-2-4316	DS-AS92-11	Artefact Scatter	300424	6412283	8299	2
37-2-4317	DS-AS93-11	Artefact Scatter	300476	6412796	9877	2
37-2-4318	DS-AS94-11	Artefact Scatter	300972	6413070	15056	3
37-2-4319	DS-AS95-11	Artefact Scatter	301488	6413693	7842	2
37-2-4320	DS-AS96-11	Artefact Scatter	295215	6415115	18165	6
37-2-4321	DS-AS97-11	Artefact Scatter	294957	6414353	19420	8
37-2-4322	DS-AS98-11	Artefact Scatter	294357	6413605	14650	26
37-2-4323	DS-AS99-11	Artefact Scatter	293715	6413016	20022	39
37-2-4324	DS-AS100-11	Artefact Scatter	292915	6412228	15985	6

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m²)	No. Cultural lithics
			Easting	Northing		
37-2-4325	DS-AS101-11	Artefact Scatter	292763	6412035	15239	19
37-2-4326	DS-IF1-11	Isolated Find	294259	6410556	7520	1
37-2-4327	DS-IF2-11	Isolated Find	294726	6410597	7612	1
37-2-4328	DS-IF3-11	Isolated Find	295466	6411564	7641	1
37-2-4329	DS-IF4-11	Isolated Find	295244	6410852	7571	1
37-2-4333	DS-IF8-11	Isolated Find	296128	6411034	7590	1
37-2-4334	DS-IF9-11	Isolated Find	296345	6411822	7540	1
37-2-4335	DS-IF10-11	Isolated Find	296635	6410961	9876	1
37-2-4336	DS-IF11-11	Isolated Find	296813	6410660	7570	1
37-2-4337	DS-IF12-11	Isolated Find	296469	6410194	7497	1
37-2-4338	DS-IF13-11	Isolated Find	296438	6409410	7396	1
37-2-4339	DS-IF14-11	Isolated Find	296149	6409194	7222	1
37-2-4340	DS-IF15-11	Isolated Find	296783	6408569	7665	1
37-2-4341	DS-IF16-11	Isolated Find	296762	6409107	7410	1
37-2-4344	DS-IF19-11	Isolated Find	298007	6409991	7530	1
37-2-4345	DS-IF20-11	Isolated Find	298055	6409818	6931	1
37-2-4347	DS-IF22-11	Isolated Find	298494	6410484	7552	1
37-2-4348	DS-IF23-11	Isolated Find	298711	6410535	7500	1
37-2-4349	DS-IF24-11	Isolated Find	298247	6410707	7679	1
37-2-4350	DS-IF25-11	Isolated Find	298463	6410904	7431	1
37-2-4351	DS-IF26-11	Isolated Find	297982	6411419	7631	1
37-2-4352	DS-IF27-11	Isolated Find	297075	6411447	7415	1
37-2-4353	DS-IF28-11	Isolated Find	297337	6411497	7556	1
37-2-4354	DS-IF29-11	Isolated Find	297474	6411417	7583	1
37-2-4355	DS-IF30-11	Isolated Find	297134	6411870	7687	1
37-2-4356	DS-IF31-11	Isolated Find	297904	6412393	7440	1
37-2-4357	DS-IF32-11	Isolated Find	298229	6411818	7544	1
37-2-4358	DS-IF33-11	Isolated Find	298398	6412148	7435	1
37-2-4359	DS-IF34-11	Isolated Find	298928	6412315	7471	1

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m^2)	No. Cultural lithics
			Easting	Northing		
37-2-4360	DS-IF35-11	Isolated Find	299574	6412781	7129	1
37-2-4361	DS-IF36-11	Isolated Find	299532	6412377	7503	1
37-2-4362	DS-IF37-11	Isolated Find	299793	6412098	7349	1
37-2-4363	DS-IF38-11	Isolated Find	300098	6412248	7502	1
37-2-4364	DS-IF39-11	Isolated Find	299468	6411690	22640	1
37-2-4367	DS-IF40-11	Isolated Find	299699	6411712	7587	1
37-2-4368	DS-IF41-11	Isolated Find	299822	6411745	7412	1
37-2-4369	DS-IF42-11	Isolated Find	300105	6411330	7525	1
37-2-4370	DS-IF43-11	Isolated Find	300049	6411200	7247	1
37-2-4371	DS-IF44-11	Isolated Find	299059	6410865	7291	1
37-2-4372	DS-IF45-11	Isolated Find	299391	6410911	7113	1
37-2-4373	DS-IF46-11	Isolated Find	300100	6409734	7560	1
37-2-4376	DS-IF49-11	Isolated Find	300630	6412771	7548	1
37-2-4377	DS-IF50-11	Isolated Find	300797	6412767	7149	1
37-2-4378	DS-IF51-11	Isolated Find	301169	6413214	6770	1
37-2-4379	DS-IF52-11	Isolated Find	301277	6413247	7122	1
37-2-4381	DS-IF54-11	Isolated Find	291795	6409956	7677	1
37-2-4382	DS-IF55-11	Isolated Find	292694	6411907	7682	1
37-2-4383	DS-IF56-11	Isolated Find	292318	6411550	7649	1
37-2-4384	DS-IF57-11	Isolated Find	291858	6410205	7710	1
37-2-4385	DS-IF58-11	Isolated Find	294490	6413779	7806	1
37-2-4421	SSD-AS2-12	Artefact Scatter	291818	6409847	7995	2
37-2-4425	DSD-IA5-12	Artefact Scatter	299660	6412851	5297	2
37-2-4426	DSD-IA6-12	Isolated Find	298207	6412749	5865	1
37-2-4427	DSD-AS2-12	Artefact Scatter	298371	6412674	5942	2
37-2-4512	DS-AS-9911	Artefact Scatter	300239	6410317	23225	4
37-2-4536	DSD-AS1-12	Isolated Find	298421	6412736	5241	1
39-2-4428	DSD-IA7-12	Isolated Find	295901	6411549	8047	1
37-2-4998	DS-AS104-13	Artefact Scatter	301040	6413363	20516	3

AHIMS ID	Site Name	Type	Centroid Coordinates (MGA Zone 56)		Site area (m²)	No. Cultural lithics
			Easting	Northing		
37-2-5016	DS-IF59-13	Isolated Find	300725	6412916	7610	1
37-2-5000	DS-AS106-13	Artefact Scatter	300331	6408210	17428	3
37-2-5020	DS-IF64-13	Isolated Find	300075	6408207	7524	1
37-2-5007	DS-AS114-13	Artefact Scatter	298711	6409841	10954	3
37-2-5015	DS-AS122-15	Artefact Scatter	299490	6412535	7725	2
37-2-5014	DS-AS121-15	Artefact Scatter	298287	6412874	7725	2

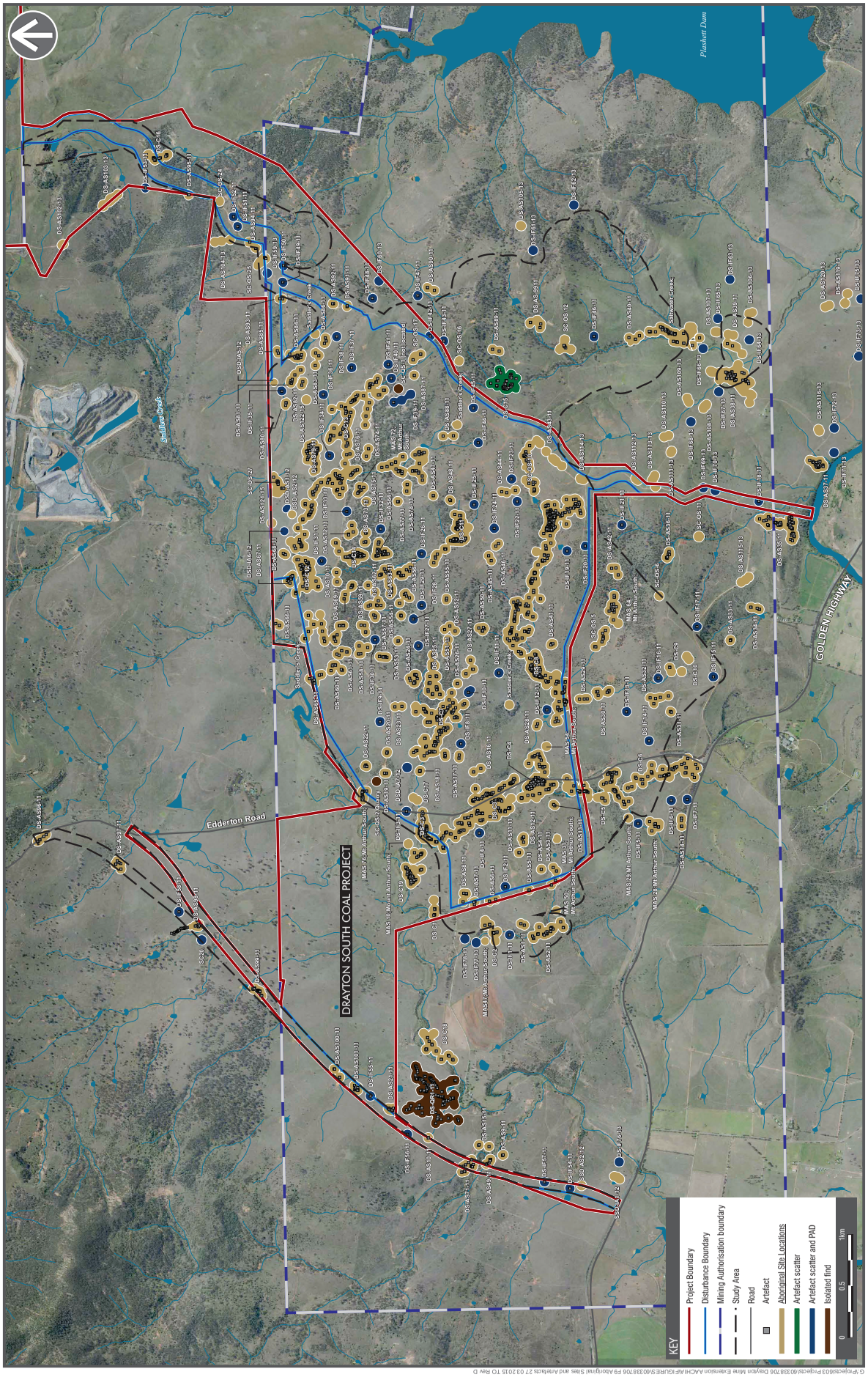
7.4.6.1 Site Size

Table 13 shows the number of artefacts recorded for each surface site within the study area. Results indicate that the majority of sites contain less than 10 artefacts.

Table 13 Discrete Site Assemblage Size

No. Of Artefacts	No. of Sites
<11	138
11-20	14
21-50	13
51-100	5
101-500	9
501-1000	1
N/A	14
Total	**194**

N/A indicates sites where number of artefacts is unknown.



ABORIGINAL SITES AND ARTEFACTS
Drayton South Coal Project
Aboriginal Archaeological and Cultural Heritage Impact Assessment
New South Wales
FIGURE 9

AECOM

7.4.7 Assessment of Archaeological Predictions

In Section 5.2.3 a series of predictions regarding the Aboriginal archaeological record of the study area were made. Table 14 compares the predictions made with the results of the archaeological survey undertaken as basis for informing future archaeological investigations within and around the study area.

Table 14 Evaluation of Predictive Model

Prediction	Assessment
Site types likely to occur include open artefact scatters, isolated finds, archaeological deposit, scarred trees, and axe grinding grooves.	Supported. Open artefact scatters dominate the surface archaeological record within the study area.
The majority of open artefact scatters will occur within 200 m of a creekline.	Supported. The results of the archaeological survey found that the majority of artefacts are situated within 100 m of creeklines.
Artefact scatters are also likely to occur on hillslopes and ridge crests, often with a vantage point over the surrounding landscape.	Supported. However, the number of artefacts in these landform contexts is comparably small.
Chipped stone artefacts will be the most common form of artefact present within identified scatters.	The results of the current survey support this prediction
Indurated mudstone/tuff will be the dominant raw material across these sites, followed by silcrete.	Supported. The results of archaeological survey support this prediction with indurated mudstone/tuff accounting for the majority of the assemblage.
Flake and non-flake debitage will dominate recorded site assemblages; retouched artefacts will be rare.	Supported. The results of the archaeological survey support this prediction with 94.2% of the assemblage consisting of flake and non-flake debitage. Only 1.7% of the assemblage is retouched artefacts.
The majority of isolated finds will comprise chipped stone artefacts	The results of the current survey support this prediction
Archaeological deposit is likely to occur along higher order creeklines.	Although a large scale subsurface testing program would be required to robustly assess the validity of this prediction, together with their respective find contexts, the widely distributed nature of identified surface sites across the study area is suggestive of a more-or-less continuous subsurface distribution of artefacts across site, albeit one with highly variable densities reflective of variable land use.
Scarred trees may occur where original remnant vegetation remains.	N/A
Axe grinding grooves on sandstone bedrock will occur in direct association with creeklines.	N/A
Scarred trees will likely be eucalypts i.e. Box Gum.	N/A
Most axe grinding groove sites will exhibit more than one groove.	N/A
Scarred trees are likely to be extremely old, dying or dead.	N/A
The majority of axe grinding groove sites will exhibit moderate to high archaeological integrity as such sites are more resistant to impacts.	N/A

N/A indicates that sites where not identified during the survey.

7.4.8 Archaeological Sensitivity

Subsurface archaeological potential is addressed in the context of this assessment by the concept of 'archaeological sensitivity'. Figure 10 provides archaeological sensitivity mapping based on three key factors including the nature and extent of visible surface artefacts at the site, a review of the findings of previous archaeological excavations in analogous landforms in the surrounding area, and on-site observations of post-

depositional processes affecting artefact exposure and burial. Using these variables, the level of archaeological sensitivity has been graded into three categories:

- nil, where Land with no potential for subsurface archaeological deposit(s) due to past ground disturbance(s);
- low, where subsurface archaeological deposit(s) may be present. Relative to areas of high sensitivity, lower artefact counts, densities and assemblage richness values expected. Integrity of deposit(s) will be dependent on the nature of localised land disturbances; and
- high, where subsurface archaeological deposit(s) likely to be present. Relative to areas of low sensitivity, higher artefact counts, densities and assemblage richness values expected. Integrity of deposit(s) will be dependent on the nature of localised land disturbances.

Areas of high archaeological sensitivity are defined here as those that:

- have not been grossly disturbed;
- are located within 200 m of a creekline; and
- have been shown, through past archaeological excavation, to contain significant cultural deposits.

Relative to areas of low sensitivity, it is predicted that subsurface archaeological deposits located within areas of high sensitivity will exhibit higher mean artefact counts, densities and assemblage richness values (i.e., with respect to the representation of technological types and raw materials). Archaeological features such as knapping floors and hearths are also more likely to occur in these areas.

Areas of ‘nil’ archaeological sensitivity within the study area comprise those that have been grossly disturbed by modern and/or historic European land use practices. Aboriginal archaeological materials are unlikely to survive in these areas.