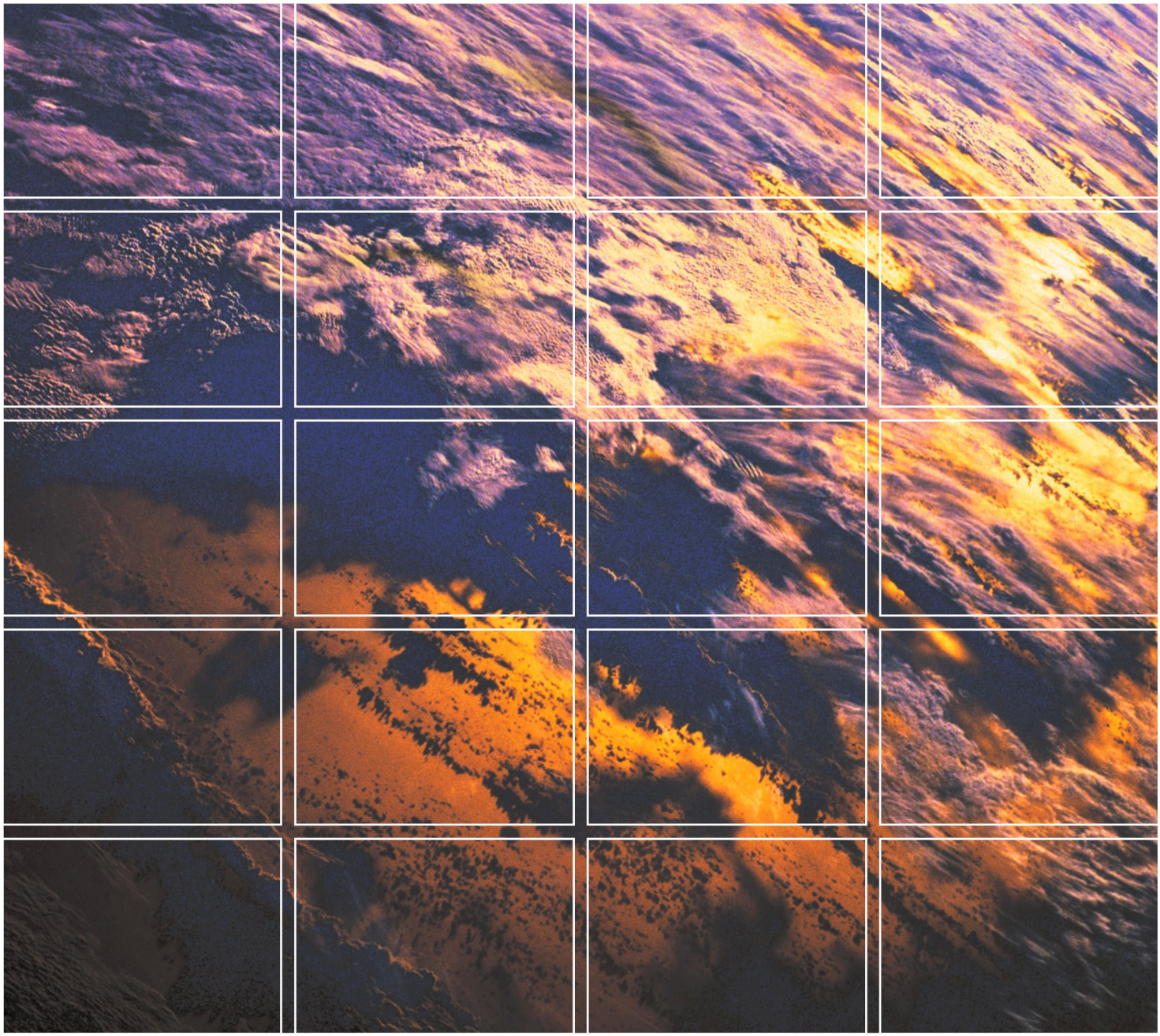

Crookwell 3 Wind Farm

Supplementary Aboriginal and Historical Cultural Heritage Assessment

Crookwell Development Pty Ltd

February 2014

0193328

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Crookwell 3 Wind Farm

Prepared by:	*Adam Coburn*	
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Date:	*13 February 2014*	
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Position:	Partner	
Signed:		
Date:	*13 February 2014*	

Supplementary Aboriginal and Historical Cultural Heritage Assessment

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FINAL REPORT

Crookwell Development Pty Ltd

Crookwell 3 Wind Farm
Supplementary Aboriginal and Historical Cultural Heritage Assessment

February 2014

Reference: 0193328

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EXECUTIVE SUMMARY

Environmental Resources Management Pty Ltd (ERM) was commissioned by Union Fenosa Wind Australia Pty Ltd (the client) on behalf of Crookwell Development Pty Ltd to prepare an Aboriginal and Historical Cultural Heritage Assessment (CHA) for the proposed Crookwell 3 wind farm (the study area). This assessment has been prepared as a supplementary document to Anderson's (2010) Indigenous and non-indigenous archaeological heritage for proposed Crookwell 3 Wind Farm (the Andersen Report). The proposed Crookwell 3 wind farm covers an area of approximately 1500 hectares (ha) and comprises 30 wind turbines with associated infrastructure including vehicle access tracks, a substation and a laydown area.

Having regard to the findings of the Andersen Report and ERM's subsequent investigations, consultation and fieldwork, the aim of this report is to ascertain whether there are any heritage values associated with the study area that could be affected by the development and to provide mitigation measures for the management of those impacts.

This report presents the results of a detailed desktop assessment and archaeological field survey of the study area, undertaken to identify the potential impacts of the proposed project on any known or unknown heritage values. Recommendations are provided to avoid or mitigate these potential impacts.

Under Part 3A of the Environmental Planning & Assessment Act (NSW 1979), this assessment has been undertaken in accordance with the Director General's Requirements (DGRs) provided for this project. In line with the DGRs, ERM's approach to this heritage assessment is based on the following legislative documents:

- *DECCW (now the Office of Environment and Heritage (OEH)) Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005); and*

- *Interim Community Consultation Requirements for Applicants (DECCW 2004); and*

- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (2011).*

As part of the CHA, consultation has been undertaken with Aboriginal groups in accordance with the Interim Community Consultation Requirements for Applicants (DECCW (now Office of Environment and Heritage) 2004). This consultation process initially involved identifying and contacting potential Aboriginal stakeholder groups. This resulted in four registrations of interest, received from the following organisations: Peter Falk Consultancy, Pejar Local Aboriginal Council, Buru Ngunawal Aboriginal Corporation and Koomurri Ngunawal Aboriginal Corporation. These groups were contacted during the project and provided input into the cultural values of the study area.

The desk based assessment has identified that the study area is known to have been used by Aboriginal people in the past, as evidenced by archaeological sites previously recorded within the study area and surrounding region. The landscapes surrounding the study area have previously been documented as having significance to local Aboriginal groups (for example see McDonald and Garling 1997; 1998; Biosis, 2004; Biosis 2005).

A search of the OEH's Aboriginal Heritage Information Management System (AHIMS) database was conducted on 8 November 2013 for an area 20 kilometres by 20 kilometres around the study area. This search identified that 61 Aboriginal sites have previously been recorded within the wider geographical region. These sites include open camp sites, isolated stone artefact finds and a culturally modified tree. Several previously recorded sites lie within the study area for this project and will be impacted by the proposed development. These sites are Wollondilly; Wollondilly 9; Hillview Park and Hillview Park 2 – 8 and comprise isolated stone artefact finds or stone artefact scatters.

Following the AHIMS search and desk based assessment a field survey of the study area was undertaken over the five day period between Monday 2 December and Friday 6 December 2013. The field survey was undertaken by two ERM Archaeologists, Janene May and Alister Bowen, and one Pejar Local Aboriginal Land Council (LALC) representative. The survey aimed to visually inspect (for cultural heritage remains) all areas that may be impacted by the proposed development. Particular focus was given to any areas of high ground visibility or areas identified as having cultural or archaeological sensitivity.

The field assessment identified sixteen previously unrecorded Aboriginal cultural heritage sites (Crookwell WF 1-16). Several of the previously recorded sites (Hillview Park 6, Hillview Park 5, Hillview Park 4, Hillview Park 3 and Wollondilly 9) could not be re-located due to the effects of either low ground surface visibility (relating to vegetation cover) or subsequent disturbance due to vehicle, erosional or agricultural activities.

Three newly identified areas of Potential Archaeological Deposit (PAD) were identified within the study area (Crookwell WF PAD 1, 2, and 3). PAD areas were also identified in association with eight recorded archaeological sites (Wollondilly 9, Wollondilly, Crookwell WF3, Crookwell WF4, Hillview Park 2, Hillview Park, Crookwell WF14 and Crookwell WF15). These areas have been recorded as having a moderate to high potential to reveal sub-surface Aboriginal archaeological deposits. These PAD areas generally exist within slightly raised flat or gently sloping terrain adjacent to a water source and sheltered from the elements, or within crests and sloping landforms with views of the surrounding landscape.

A heritage strategy of sub-surface investigations – to determine the presence, nature and extent of archaeological remains is recommended before ground disturbing elements of the development can occur within an identified PAD area.

If, during sub-surface investigations, significant archaeological deposits are located, then two management options are recommended:

1. Consultation with Aboriginal stakeholders should be undertaken prior to any sub-surface investigations to contribute to the development of an appropriate research design and methodology, after which salvage excavation should be undertaken.

2. If any heritage objects and/or relics, as protected under NSW legislation, are uncovered, then work in the area should cease and the advice of a qualified heritage professional should be sought in accordance with the Chance Find Procedure provided at Section 11.2 of this report.

The primary proposed mitigation strategy for sensitive areas is:

- *Avoidance;*
- *Mapping on all relevant construction plans to ensure avoidance; and*
- *Fencing to inhibit access (if deemed appropriate by consultation with Aboriginal stakeholder groups).*

No historical archaeological sites were identified during the fieldwork and therefore no Historical archaeological constraints exist for this development.

The study area has been mapped in respect to its archaeological sensitivity and all currently known archaeological sites and PAD areas have been recorded.

ABBREVIATIONS

AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
Burra Charter	Australian best heritage practice reference that provides guidance for the conservation and management of places of cultural significance (cultural heritage places).
CHA	Cultural Heritage Assessment
COPAI	Code of practice for the Archaeological investigation of Aboriginal Objects in NSW (OEH 2010)
DA	Development Application
DECCW	Department of Environment, Climate Change and Water
EP&A Act	Environmental Planning & Assessment Act (NSW, 1979)
ERM	Environmental Resources Management
LEP	Local Environmental Plan
LGA	Local Government Area
LHRS	Lower Hunter Regional Strategy
NP&W Act	National Park and Wildlife Act (NSW, 1974)
NPWS	NSW National Parks & Wildlife Service
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
RNE	Register of the National Estate

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Union Fenosa Wind Australia Pty Ltd (the client) on behalf of Crookwell Development Pty Ltd to prepare a supplementary Historical and Aboriginal Cultural Heritage Assessment (CHA) report to compliment Anderson's (2010) report *Indigenous and non-indigenous archaeological heritage for proposed Crookwell 3 Wind Farm*. This supplementary report has been prepared to determine the potential impacts to heritage values of the proposed Crookwell 3 Wind Farm, located near Crookwell, New South Wales (NSW) (referred to hereafter as 'the study area'). The report presents the results of a detailed desktop assessment, field survey and consultation with local Aboriginal stakeholder groups.

The archaeological assessment has determined whether the proposal is likely to harm Aboriginal objects (as defined by the *NSW National Parks and Wildlife Act 1974* (the NPW Act)). It provides mitigation and management measures necessary to avoid or manage impacts to Aboriginal objects.

1.1 STATUTORY CONTROLS

This work has been conducted to conform with the Director General Requirement's (DGR's) for this project. The heritage assessment has been undertaken in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Environment and Conservation 2005). Aboriginal community consultation for the project has been undertaken in accordance with the *Interim Community Consultation Requirements for Applicants* (DECCW (now OEH) 2004).

This report provides a combined assessment of the tangible and intangible cultural heritage values relating to the study area as defined during desk based and field investigations undertaken during December 2013.

1.2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The current proposed development involves an area of 1500 hectares. The study area is located on two separate land parcels known as Crookwell 3 East and Crookwell 3 South. Both areas are located within the Upper Lachlan Shire local government area. The location of the study area is shown in *Figure 1.1*.

The proposed wind farm project will involve ground impacts associated with the construction of 29 individual turbines, 29 individual kiosks, internal unsealed tracks, access roads, upgrades to local infrastructure as necessary and two temporary concrete batching plants established during the construction phase.

1.3 OBJECTIVES

The proposed development is defined as a Major Project under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). The Director General, Department of Planning and Infrastructure (DP&I) has stated that an archaeological/cultural heritage assessment is required for the project to addresses the potential impact of the proposed development on Aboriginal heritage values and items.

In accordance with the NSW NPWS guidelines for archaeological reporting (NSW NPWS 1997) and the NSW DECCW Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (NSW DEC 2005) this report aims to document:

- the consultation process undertaken with Aboriginal communities for the project and their involvement in the project; and
- a description of the proposal and whether or not it has the potential to result in impacts to Aboriginal cultural heritage.

A description of historic impacts to the study area;

- the archaeological methodology implemented during the study;
- the landscape and natural resources of the study area in order to establish background parameters;
- a review of archaeological and relevant literature and heritage listings on the NSW DECC AHIM S database;
- a synthesis of local and regional archaeology;
- a review of the study area's non-Indigenous history and the results of relevant heritage database searches;
- a predictive model for Aboriginal site types and location relevant to the study area;
- the cultural and archaeological sensitivity of landforms that may be subject impacts;
- the field survey results;
- the significance of any located Aboriginal objects and places;
- an assessment of the impact of the proposal on Aboriginal objects and places;

- a description of the outcomes and justification of the proposed alternatives; and
- a series of recommendations based on the results of the investigation.

1.4 REPORT STRUCTURE

This report is structured in the following way:

Chapter 2	NSW legislative framework and statutory requirements;
Chapter 3	Aboriginal community consultation undertaken for the heritage assessment;
Chapter 4	Environmental and landscape background relating to the study area;
Chapter 5	Archaeological context of the study area, including known and potential heritage sites within and in near vicinity to the study area;
Chapter 5	Aboriginal heritage predictive model;
Chapter 6	Historical Background of the study area;
Chapter 7	Survey methodology and results;
Chapter 8	Significance assessment of heritage sites located within the study area;
Chapter 9	Project information and impact assessment;
Chapter 10	Avoiding and minimising harm;
Chapter 11	Heritage management and impact mitigation recommendations;
Chapter 12	References;
Annex A	Aboriginal Stakeholder Consultation;

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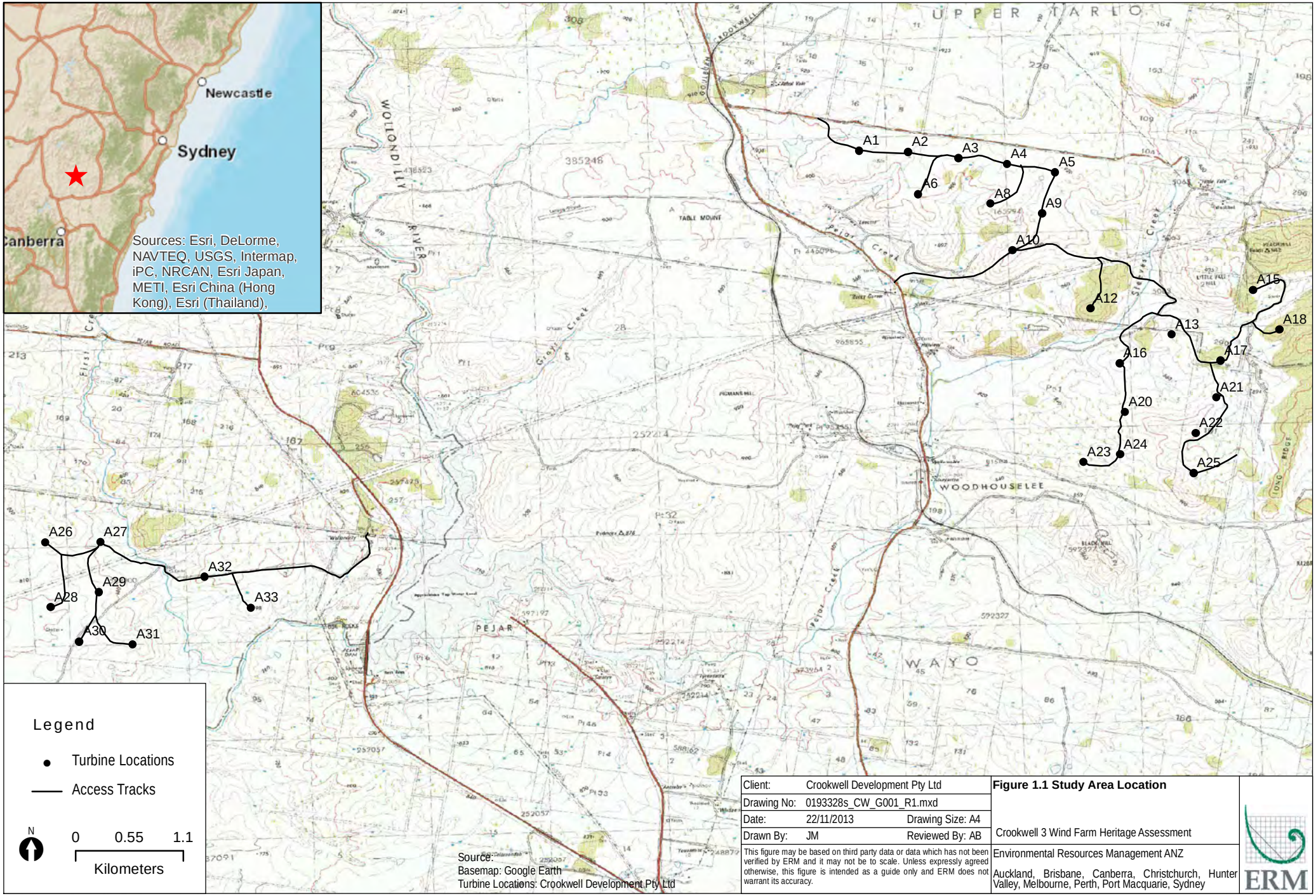

Source:
Basemap: Google Earth
Turbine Locations: Crookwell Development Pty Ltd

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Date:	22/11/2013	Drawing Size: A4	
Drawn By:	JM	Reviewed By: AB	

Figure 1.1 Study Area Location

Crookwell 3 Wind Farm Heritage Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

2 LEGISLATIVE CONTEXT

Aboriginal cultural heritage in NSW is protected by the *National Parks and Wildlife (NP&W) Act 1974*. Land managers are required to consider the effects of their activities, or proposed development, on the environment under various legislation, principally the *(EP&A Act, 1979*. Cultural heritage, which includes indigenous heritage, is subsumed within the definition of "environment". In certain circumstances, Commonwealth legislation protecting indigenous heritage may also apply to indigenous heritage places in NSW. The key legislation applying to the Crookwell 3 Wind Farm is summarised below in Section 2.1.

The Crookwell 3 Wind Farm project is a transitional Part 3A project, under the EP&A Act, 1979. Several requirements relating to the heritage matters of this project were provided as part of the Director General Requirements (DGR's). These are discussed below in Section 2.4.

2.1 ABORIGINAL AND TORRES STRAIT ISLANDER HERITAGE PROTECTION ACT 1984 (COMMONWEALTH)

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* protects areas and/or objects which are of significance to Aboriginal people and which are under threat of destruction. This *Act* can, in certain circumstances override state and territory provisions, or it can be implemented in circumstances where state or territory provisions are lacking or are not enforced. A significant area or object is defined as one that is of particular importance to Aboriginal people according to Aboriginal tradition. The *Ac*t must be invoked by or on behalf of an Aboriginal or Torres Strait Islander or organisation.

2.2 NATIONAL PARKS AND WILDLIFE ACT 1974 (NSW)

All Aboriginal objects within the state of New South Wales are protected under Part 6, and particularly Section 90, of the *NP&W Act 1974*.

Under Section 5 of the Act, "Aboriginal Object" means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Sites of traditional significance that do not necessarily contain archaeological materials may be gazetted as 'Aboriginal places' and are protected under Section 84 of the Act. This protection applies to all sites, regardless of their significance or land tenure.

Under Section 90, a person who, without first obtaining the consent of the Director-General, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence.

Amendments introduced by the *NP&W Amendment Act 2001* which strengthen the provisions of Section 90 (e.g. removing the term "knowingly") have yet to commence.

The Office of Environment and Heritage (OEH) is the responsible authority, with the Director-General of that department the consent authority.

2.3 *HERITAGE ACT 1977 (NSW)*

The *Heritage Act 1977* (amended 2009) protects the natural and cultural history of NSW with emphasis on non-Indigenous cultural heritage through protection provisions and the establishment of a Heritage Council.

The *Heritage Act 1977* provides protection for subsurface relics and for heritage items of state significance listed on the State Heritage Register. The Act defers to local planning instruments under the *EP&A Act* 1979 for the protection of items of local significance ('items of the environmental heritage').

The Act defines a relic as any deposit, artefact, object or material evidence that:

(a) relates to the settlement of the area that comprises New South Wales, not being an Aboriginal settlement; and

(b) is of State or local heritage significance.

While Aboriginal heritage sites and objects are protected principally by the *NP&W Act 1974*, if an Aboriginal site, object or place is of great significance it can be protected by a heritage order issued by the Minister on the advice of the Heritage Council.

The Heritage Act does not apply to Aboriginal heritage items found within the study area.

2.4 *ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979 (NSW)*

The *EP&A Act 1979* requires that environmental impacts are considered in land-use planning, including impacts on Aboriginal and non-Aboriginal heritage. Various planning instruments prepared under the *Act* identify permissible land use and development constraints.

The NSW NPWS provide guidelines for Aboriginal heritage assessment, including those conducted under the *EP&A Act* 1979. Where Aboriginal heritage assessment is conducted under the Integrated Development Approval process, a more detailed set of NPWS guidelines applies.

The Crookwell 3 project is a transitional project under the former provisions of Part 3A of the EP&A Act, 1979. Despite the repeal of Part 3A in 2012 and the introduction of State Significant Development (SSD), the Government declared a number of existing Part 3A Projects, including Crookwell 3, to continue to be declared and considered as under the former provisions of Part 3A of the EP&A Act, 1979.

Under the former provisions of Part 3A of the EP&A *Act*, Section 75U takes effect meaning a permit under Section 90 of the NPW Act will not be required for this project. However, the DGR's for this project state that:

> *The EA must include an assessment of the potential impact of the project components on indigenous heritage values (archaeological and cultural). The EA must demonstrate effective consultation with indigenous stakeholders during the assessment and in developing mitigation options (including the final recommended measures) consistent with Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (DECCW 2005).*

This report has therefore been prepared in accordance with the requirements of the *Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (2005).*

3 *ABORIGINAL COMMUNITY CONSULTATION*

This chapter contains specific details of the Aboriginal community consultation undertaken in regard to the Aboriginal cultural heritage of the study area.

The NSW DECC (now OEH) requires proponents to undertake consultation with the Aboriginal community 'as an integral part of the impact assessment' process (NSW OEH 2004). When administering its approval functions under the NPW Act, the NSW OEH requires applicants to have consulted with the Aboriginal community about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and places present in the area subject to development (NSW DEC (now OEH 2004). This consultation process was formalised with the introduction in late 2004 of the *Interim Guidelines for Aboriginal Community Consultation – Requirements for Applicants* (NSW DEC 2004).

Fulfilment of the consultation requirements has been undertaken as follows:

1. Notification and Registration of Interests

On behalf of the proponent, ERM has actively sought to identify stakeholder groups or people wishing to be consulted about the project and has invited them to register their interest as follows:

In the process of identifying stakeholder groups written notification about the project dated to 16 October 2013, was supplied to the following bodies:

- Pejar Local Aboriginal Land Council;
- Lachlan Catchment Management Authority;
- Upper Lachlan Shire Council;
- National Native Title Tribunal;
- Office of the Registrar, *Aboriginal Land Rights Act (1983)*; and
- NSW OEH (Queanbeyan).

A local press advertisement requesting Aboriginal party participation was placed in the *Crookwell Gazette* on 9 October 2013. The response period for Aboriginal parties to register an interest in the project was open for two consecutive weeks. No responses were received from any interested Aboriginal parties. The advertisement is shown in *Figure 4.1*.

Figure 3.1 Newspaper advert requesting registrations from interested Aboriginal Parties.

Notice of Aboriginal Consultation
Crookwell 3 Wind Farm

Environmental Resources Management Pty Ltd, on behalf of Union Fenosa Wind Australia Pty Ltd, is proposing to undertake an Indigenous cultural heritage assessment in an area approximately 18 km south east of Crookwell, within the Upper Lachlan Local Government Area. The proposed assessment is required as part of a proposed Wind Farm development, owned and operated by Union Fenosa.

Local Aboriginal parties wishing to be consulted for this assessment are invited to register a written expression of their interest by 11th November 2013.

Please respond in writing to:
Attn: Adam Coburn
Environmental Resources Management Australia
Locked Bag 24
Broadway NSW 2007
Or by fax on 02 8584 8800, or
email to **Adam.coburn@erm.com**

From initial consultation undertaken with the relevant government agencies (listed above) the following list of potentially interested Aboriginal parties was made, see *Table 3.1*.

Table 3.1 Identified Aboriginal parties after initial letter to Government Agencies

Aboriginal Stakeholder Group	Contact Person
Peter Falk Consultancy	Peter Falk
Pejar Local Aboriginal Land Council	Delise Freeman
Gundungurra Aboriginal Heritage Association Inc. Secretary Sharyn Halls	Sharyn Halls
Buru Ngunawal Aboriginal Corporation (BNAC), Primary contact Mr Walter R Bell	Walter Bell
Alice Williams	Alice Williams

A project notification letter giving details of the proposal and requesting interested Aboriginal parties to register for the project was sent to the above listed organisations on 24 October 2013. Several registrations of interest were received, as shown in *Table 3.2*.

Table 3.2 Registered Aboriginal Parties

Registered Aboriginal Party (RAP)	Contact Person
Peter Falk Consultancy	Peter Falk
Pejar Local Aboriginal Land Council	Delise Freeman
Buru Ngunawal Aboriginal Corporation (BNAC),	Water Bell
Koomurri Ngunawal Aboriginal Corporation	Glen Freeman

On 19 November 2013, each registered Aboriginal group was provided with written details (by post and email where available) concerning the proposed project, including an outline of the scope and impacts of the project and a survey methodology.

No comments were received on the proposed methodology from any of the registered Aboriginal stakeholders. The proposed study area is situated within the Pejar Local Aboriginal Land Council boundary. Accordingly a representative of this land council participated in the field assessment.

Among other items in letters sent out on 24 October 2013 and subsequently on 19 November 2013, all identified RAPs were asked to provide written or verbal comments on the cultural significance of the study area. A draft copy of this report has been provided to all registered Aboriginal parties.

4 ENVIRONMENTAL BACKGROUND

Interactions between people and their surroundings are of integral importance in both the initial formation and the subsequent preservation of the archaeological record. The nature and availability of resources, including water, flora, fauna, and stone materials had (and continues to have) a significant influence over the way in which people utilise the landscape.

Alterations to the natural environment also impact upon the preservation and integrity of cultural materials within that environment. Current vegetation and erosional regimes also affect the visibility and detectability of Aboriginal sites and objects. For these reasons, it is essential to consider environmental factors as a component in any heritage assessment.

4.1 BIOREGION

Bioregions and sub-bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The Interim Biogeographic Regionalisation for Australia (IBRA) provides a regional and national planning framework for the systematic development of a comprehensive, adequate and representative National Reserve System. Bioregions delineate salient environmental characteristics which can highlight patterns in Aboriginal site patterning.

The study area is located within the South Eastern Highlands bioregion, which is located inland from the coastal regions and bordered by the Australian Alps and the South Western Slopes. The region includes parts of NSW, most of the Australian Capital Territory (ACT) and extends into Victoria. The total area of this bioregion is 8,749,155 hectares (equating to 6.11% of NSW) (NSW NPWS. 2003).

Table 4.1 Summary of Attributes for the South Eastern Highlands Bioregion

Characteristic	*Description*
Geology	The bioregion overlies part of the Lachlan fold belt comprising a series of metamorphasised Ordovician to Devonian sandstones, shales and volcanic rocks with granite inclusions and episodes of folding, faulting and uplift.
Landforms	The region overlies dissected ranges and plateau of the Great Dividing Range, extending to the Great Escarpment in the east and the western slopes of inland drainage basins. The region covers a variety of landforms such as steep to gently slopes, ridges and valley floors.

Characteristic	*Description*
Soils	Mottled red and yellow texture contrast soils with red earths are found on Palaeozoic slates, sandstones and volcanics. Shallow red earths occur on ridges while yellow texture contrast soils can be found on all slopes with deep coarse sands in alluvium contexts. Shallow red-brown to black stony loams are present on Tertiary basalts and within swampy valley floors soils generally consist of alluvial loams and black clays. Shallow organic loams may be present in high altitude contexts.
Vegetation	The region contains a diverse range of vegetation communities such as yellow box, red box, Blakely's red gum, white box and white gum to the west of the region, brown barrel to the east, river oak along streams, grey gum and Blaxland's Stringybark in lower areas and brown barrel, mountain gum, narrow-leaved peppermint and ribbon gum on elevated areas.

4.2 CLIMATE

Crookwell has a varied climate with temperatures ranging from below zero in winter to over 30 degrees in summer. The annual level of rainfall is 852mm, most of which occurs during the summer months. Climatic conditions are not extreme in the region and would have allowed for hunter gatherer occupation in the local area. A breakdown of climatic variables for the bioregion is given in *Table 3.2*.

Table 4.2 North Coast bioregion - Climate Variable Information*

Climate information	*Variable*
Mean annual temperature	6-16°C
Minimum average monthly temperature	-3.8–4.7°C
Maximum average monthly temperature	18–31.3°C
Mean annual rainfall	460-1883mm
Minimum average monthly rainfall	23-98mm
Maximum average monthly rainfall	55-220mm

** from http://www.environment.nsw.gov.au/resources/nature/southEasternHighlands.pdf accessed 11 November 2013 at 10.22am*

4.3 GEOLOGY AND SOILS

Geologically, the wider South Eastern Highlands Bioregion (in which the study area is located) is characterised by Palaeozoic granites, metamorphosed sedimentary rocks and Tertiary basalts. Geology across the study area varies with several different formations occurring (Thomas and Johnston 2013).

The majority of the western portion of the study area is situated within Wologorong Granite of the Parkesbourne Suite deposits dated to the Siluro-Devon period of the Palaeozoic.

The lithologies of this deposit underlying the study area include cream porphyritic biotite leucogranite with plagioclase phenocrysts. The remainder of the study area including the wind turbines A28 and A30 overlie Kialla Quartz Diorite deposits of ungrouped Devonian intrusions dated to the Siluro-Devon period of the Palaeozoic (refer to *Figure 1.1*) (Thomas and Johnston 2013).

The eastern portion of the study area overlies several geological deposits including the Abecrombie Formation and the Bumballa Formation with Crookwell Basalt underlying the track to the north. These formations are described below.

- The Abecrombie Formation is from the Adaminaby Group, also of the Ordovician period of the Palaeozoic. This formation consists of brown and buff to grey thinly to very thickly bedded fine to coarse grained mica quartz sandstone, interbedded with siltstone and mudstone.

- The Bumballla Formation dates to the Ordovician period of the Palaeozoic. It consists of grey to cream ripple laminated to graded fine grained sandstone interbedded with grey to black laminated siltstone and mudstone with very minor chert. There are also some areas of fine to coarse grained quartzose sandstone. This material has been used for stone tool manufacturing by Aboriginal people in the past (Attenbrow 2002).

- The Crookwell Basalt formation consists of a silica-saturated olivine basalt and dolerite with minor trachyte and ignimbrite. This deposit dates to the Cainozoic period (Thomas and Johnston 2013).

The underlying geologies of the study area would have provided various lithic resources that would have been suitable for hunter gatherer groups to manufacture stone tools. The formations underlying the study area include lithic materials such as quartz, mudstone, chert, silcrete and sandstone, each of which are known resources for stone tool manufacture (Thomas and Johnston 2013).

The majority of the study area contains residual soils of the Siluro-Devonian Granites. Coffey Geotechnics (2010) prepared the geotechnical assessment for the proposed Crookwell 3 wind farm development. This study found that the stratigraphy of soils across the study area is varied. Within areas of Tertiary age volcanics, stratigraphic deposits were found to consist of a layer of clayey silt topsoil to a depth of 0.25 m to 0.3 m overlying residual clay soils to a depth of between 0.5 m and 1.3 m. Underlying these residual soils are weathered basalt deposits.

Within areas of Ordovician Age geological deposits, soil deposits consisted of an upper layer of clayey silty topsoil to a depth between 0.2 m to 0.3 m overlying silty clay, sandy clay and clayey sand soils to depths of between 0.9 m and 1.4 m. Surface soils across the study area were also examined as part of this assessment and were found to be a mix of silty sands, clayey sands and sandy clays overlying granite rock deposits (Coffee Geotechnics 2010).

4.4 TOPOGRAPHY AND LANDFORMS

The study area comprises a generally undulating landscape with elevations varying between Real Level (RL) 828 m and RL 940 m, with ground slopes up to 30 degrees to the horizontal (Coffey Geotechnics 2010). These rolling hills (undulating landscape) are dissected by valleys and several water courses. This topographical setting incorporates a variety of landforms which have been classified in this assessment according to the definitions set out in Speight (2009). Speight (2009) states that a landscape can be classified by its landform pattern, and then further classified by individual landform elements. The wider landform pattern, for instance, could be one of flood plans or hills. These landscapes can be further categorised into individual landform elements within the wider landform pattern, for instance cliff, footslopes or valley flats. According to these definitions, topographic mapping conducted for this project indicates that the study area is comprised of several landforms that include crests, ridges, open depressions, simple slopes, upper, mid and lower slopes and flats (Speight 2009). These landforms would have provided suitable areas for hunter gatherers to undertake a range of subsistence activities (for example camping, hunting and tool making.). Certain landforms such as flat or gently sloping areas near a water source may have been more frequently occupied than others such as areas away from water, where land use may have been more transient in nature.

4.5 HYDROLOGY

Several creeks and water courses run through the study area and would have provided subsistence resources to Aboriginal people inhabiting the region. The Wollondilly River runs north-south through the study area and is a permanent source of water in the region. Tributaries of the Wollondilly River dissect the study areas rolling hills and include First Creek, Pejar Creek, Grays Creek and Steeves Creek. Middle Creek is a major tributary of the Wollondilly River and runs north-south approximately 1.2 km west of the study area.

4.6 FLORA AND FAUNA

Prior to European initiated land clearance, the study area would have supported a range of flora and fauna that would have been be utilised by Aboriginal people for subsistence purposes. A broad range of plants would have been available such as Stringybark, Xanthorrhoea, Banksia, Hakea, Melaleuca and Grevillea. Bark obtained from Stringybark trees could have been used for construction purposes (shelters, canoes etc) and Xanthorrhoea were probably used for weaving baskets and fish traps. Banksia, Hakea, Melaleuca, Grevillea Yams, seeds, possums, kangaroos, wallabies, fish, mussels, crayfish and insects would have provided a varied diet to Aboriginal people inhabiting the region (NSW NPWS. 2003).

4.7 LAND DISTURBANCE

The study area generally consists of a cleared pastoral landscape utilised for sheep and cattle grazing and crop growing. Large areas of the upper soil horizon has been affected by ploughing. The impacts of ploughing only disturbed the upper 300 millimetres of soil horizons (i.e. 300 millimetres is the maximum plough depth). Therefore, deeper soil deposits may retain *in situ* Aboriginal archaeological sites. For this reason, the plough zone is not considered as an area of significant disturbance, however, any artefacts located within the top 300 millimetres of a plough zone should not be considered as *in situ.* Other land disturbances to the study area include the construction of roads, housing, land clearance, dam construction, fencing, and the installation electrical services and underground pipes. Other ground disturbances have also occurred within the study area such as soil erosion or bioturbation (bioturbation is the reworking of soils and sediments by animals and plants). These post depositional processes have likely adversely affected the archaeological record in the study area.

4.8 SUMMARY OF ENVIRONMENTAL BACKGROUND

In summary, the location of the study area is within a wider region of rolling hills dissected by valley depressions. Within this setting, the Wollondilly River and associated landscapes would have been a primary focus for Aboriginal subsistence activities. Several permanent and ephemeral tributaries of the Wollondilly River cut through the study area and run adjacent to raised crests, ridge lines and associated hill slopes.

Soil deposits within study area's valley depressions, flats and basal slopes – especially those adjacent to creek lines – would have provided a primary focus for past Aboriginal subsistence activities. A further focus would have been elevated crests and ridges affording views of the surrounding landscape, and areas of localised provisions such as stone resources and shelter from the wind.

5 ARCHAEOLOGICAL BACKGROUND

The preliminary archaeological and cultural landscape context discussed in this report has been established through a review of documentation relating to regional ethnographic accounts, information from the AHIMS database, and previously conducted archaeological projects and reports. It is noted that there are several limitations to the use of this existing information such as:

- Aboriginal people involved in previous studies may not have disclosed relevant cultural knowledge and the cultural significance of certain areas; and
- the AHIMS search results presented below are based on previous archaeological work and is therefore limited to specific locations and field conditions (visibility, time constraints etc.) and therefore may not necessarily a true reflection of the archaeological record.

5.1 ETHNO-HISTORY

Ethnographic information relating to the Aboriginal occupation of the study area has been obtained predominantly from documentation written by early European settlers and government officials during the mid to late 18th century (Barwick 1984).

Archaeological evidence suggests that Aboriginal people had occupied all of Australia's environmental zones by 31 000 years before present (BP) (Flood 1995: 286). Human occupation of south east Australia dates from at least 20,000 years before present. Evidence of early Aboriginal occupation of the State has been provided by sites such as the Burrill Lake rock shelter (Lampert 1971), Cloggs Cage (Flood 1980) and New Guinea 2 (Ossa 1995).

Australian Aboriginal people occupied land according to a system of spatial organisation and land occupancy (Clark 1990: 11-14). Individual groups were intimately familiar with their own geographical regions and the seasonal availability of resources within it. Tribal boundaries were often defined through linguistic associations, social relations, and spiritual links to the land. These boundaries were most likely fluid, changing position over time. If this was the case, then tribal boundaries recorded by European people at, or after, the point of contact can only be considered as current to that period and were probably quite different prior to European observation. To make things more ambiguous, the few European accounts of Aboriginal groups in the broad study region are limited in detail, often confused in regard to Aboriginal group names and give varying interpretations of territorial boundaries (Flood 1980: 2).

The major Aboriginal groups thought to traditionally occupy the wider South Eastern Highlands Bioregion were the Walbanga in the centre, the Ngarigo in the centre and southern parts and the Ngunawal and Gandangara to the north (NSW NPWS). Tindale's (1974) map places the study area within the boundaries of the Gandangara people (refer to *Figure 5.1*).

The Gandangara people (also referred to in the historical literature as the Gundungurra) are believed to have occupied a large area to the south west of the Blue Mountains. The Gandangara boundaries were bordered by the Darug to the north, the Wiradjuri to the west, the Ngunawal to the south and the Wodiwodi to the east (Tindale 1974) (see Figure 5.1). The precise nature and location of the traditional Gandungurra boundaries are not known, and there are several variations to Tindale's (1974) tribal boundary assessments (see for example Attenbrow 2002).

The Ngunawal boundaries as mapped by Tindale (1974) are located within close vicinity of the study area. These people are thought to have lived in small, highly mobile, kin-based groups. Individual groups came together regularly to participate in trade, marriage and ceremonial gatherings. An early ethnographic account from Bennett (1834: 173) records their diet as including flying squirrel, kangaroo, wallaby, wombat, koala, possum, emu, duck, swan, snake, goanna, platypus, ant eggs, insects, fish, mussels, yabbies, plant tubers, berries and seeds (ERM 2012).

The area believed to have been inhabited by the Gandangara people (which includes the study area) is described by Bowdler (1983) as a 'zone of interaction'. The 'zone' referred to by Bowdler is the boundary between the Wiradjuri, the Darug and the Gandangara (as recorded by Tindale 1974) and is a broad zone of interaction, rather than a strictly defined area (Bowdler1983).

The first European person to enter Gandangara territory is thought to have been John Wilson in 1792 (RMS 2012). Wilson was an ex-convict who lived with the Gandangara for several years in the Bargo-Picton area (RMS 2012). Dr George Bass was next into the region when he travelled through the Burragorang Valley in 1796. Lt Ensign Francis Barrallier then led an expedition up the Nepean Valley through to the Nattai River in 1802. Two Aboriginal men accompanied Barrallier on this journey and on subsequent expeditions in the region. Aboriginal people often assisted the early explorers to decide on routes to cross the mountains and to help prepare shelters (Johnson 2007). In 1819, Charles Throsby undertook an expedition into the Bathurst region and was accompanied by a Gandangara guide. The party followed a known Aboriginal route through the Southern Highlands (RMS 2012).

The Gandangara were observed to have lived in small social groups (referred to as bands, clans or kinship groups) and utilised a complex system of social organisation in interaction. R.H. Mathews (1905), an ethnologist who studied the Gandangara, noted that marriages were based on betrothals decided by a council of male elders. Johnson (2007) notes that betrothal and marriage, or *nanaree in the Gandangara language*, precluded relationships between individuals who were too closely related.

Govett (1836) has indicated that the Gandangara people buried their dead in specially selected places. Generally these locations were as close to the Wollondilly or Mulwaree Rivers as possible. Johnson observed that burials were generally located on the opposite side of the river from where the person died. It was believed by the Gandangara people that this would prevent the spirits of dead people from returning and haunting them. In the 1830s William Govett undertaking surveys in the area observed Aboriginal women mourning at Mt Way (approximately 3.7km south of the study area). Govett described the scene as three women sitting around a mound of earth and striking their heads with a tomahawk while wailing loudly. This mound of earth:

'*might have been about three feet high; it was shaped as a dome, and built of a reddish clay: it was surrounded by a kind of flat gutter or channel, outside of which was a margin, both formed of the same material. The staves of the women were leaning upon it, and their nets, with their contents, thrown aside…the trees all around the tomb were marked in various peculiar ways, some with zigzags and stripes, and pieces of bark otherwise cut…*' (Govett 1836).

Following European occupation, early relations between local Aboriginal groups and non-Aboriginal people in the study region appear to be amicable. During this early period, Aboriginal people have been recorded to have shared their bush knowledge and survival skills with the Europeans. However, as Europeans settled in the region, farming activities and other development lead to significant changes to the landscape. In an article from the *Sydney Mail* dated to 12 December 1896, William 'Billy' Lynch (1841-1913) described the massive reduction of native flora and fauna species in this region. Lynch (1841-1913) indicates for the Gandangara people:

"*next to the fruits and berries the Aboriginal people relied on the possum – and that the white man's guns had made scarce – fish, the kangaroo, the 'bugong' (porcupine), the 'balu' and the ducks*".

Prior to European occupation, ducks, kangaroos and shags were plentiful and black fish, perch, sprats, mullet and eels were readily available in the rivers. Bird life such as lowries, king parrots, rosellas, cockatoos and lyrebirds were also abundant.

Figure 5.1 ***Tribal boundaries of the south east NSW region, showing the approximate location of the study area (Tindale 1974).***

5.2 REGIONAL ARCHAEOLOGICAL CONTEXT

Several heritage studies have been undertaken in the wider Southern Tablelands region of NSW that attest to Aboriginal occupation of the area. The most common Aboriginal site type recorded in the Southern Tablelands region is by far stone artefacts (isolated artefacts or scatters) (Biosis 2005; Austral Archaeology 2010). Large stone artefact sites, including densities of up to thousands of artefacts, have been recorded in the region. Other site types in the region have been recorded such as stone quarries, stone grinding grooves, scarred trees, bora grounds and burials (Lance and Koettig 1986). Burial and ceremonial sites are rare and generally located on river banks or possibly on hill tops and away from occupation sites (McDonald 2003).

McDonald (2003) has suggested that sites across the Southern Tablelands region are likely to cluster along waterways. According to Wittner (1980), larger occupation sites in the study region are most likely to occur in river valleys, within gently sloping landforms and in the proximity of water sources. Smaller, more transient sites tend to occur on escarpments, saddles, and also in close proximity to water. Dallas (1985) similarly notes that sites across the study region occur mostly in valley bottoms and slopes. Dallas further notes that sites will occur less frequently on rolling hills and ridges, with most being located within 100m of water.

Austral Archaeology (2010) state that across the Southern Tablelands region, stone artefact sites occur in all landforms, although they vary in density depending on landform – i.e., they are most common within 100m of a watercourse on lower slopes and flats, at drainage confluences, alluvial landforms and hill top landforms (Austral Archaeology 2010). Austral Archaeology (2010) also suggests that sites located within hilly landforms can generally be considered representative of transient occupation.

There have been several Aboriginal heritage assessments within the Southern Tablelands region for proposed wind farm developments. Several of these have a close proximity to the current study area and are discussed below in *Section 5.3*. Archaeological work in relation to the Woodlawn and Capital Wind Farms are located within the current study area region – but not local area – and are considered here due to their similar development nature and land formations within the wider Southern Tablelands region.

Reeves and Thomson (2004) undertook a survey for the Woodlawn Wind Farm, at the site of the former Woodlawn open cut mine 9km west of Tarago. This study identified arterfacts within crests, slopes and drainage depressions and determined that there was no strong spatial patterning of sites in relation to landform. The sites were considered to form part of a 'background scatter' distribution of artefacts (a widespread stone artefact scatter which may vary in density depending on landform type and other environmental factors). Stone materials included rhyolite, quartz, silcrete, volcanics and tuff.

URS (2004) prepared an Environmental Impact Statement (EIS) for the Woodlawn Wind Farm. As part of this same project Biosis Research Pty Ltd (2005) undertook an Aboriginal and non-Aboriginal assessment of 33 proposed turbine locations. This study identified 15 stone artefact sites, which were all considered to be part of a 'background scatter' of artefacts occuring in most landform types in the Southern Tablelands. The majority of these sites were located on low ridge flats and open depressions. It was concluded that the area was likely transiently used by Aboriginal people travelling between resource zones.

Austral Archaeology (2009a) undertook an addendum Aboriginal Archaeological and Cultural Assessment for the Capital Wind Farm near Tarago, NSW. Five Aboriginal heritage sites were recorded that included two small stone artefact scatters and three isolated finds. Four of the sites were recorded within gently sloping topography adjacent to creek tributaries, and one site was recorded on a moderate sloping ridge top. Austral Archaeology determined that areas of high and moderate sensitivity were located on slightly elevated gently sloping landforms near local resources, with areas of low sensitivity located on high, steep or rocky ridgelines at a distance to resources. Subsequent subsurface testing of their study area yielded 348 artefacts (Austral Archaeology 2009a). Most of these artefacts were quartz (66%) with some silcrete (22%), chert (11%) and quartzite (1%).

5.3 LOCAL ARCHAEOLOGICAL CONTEXT

Several researchers have previously observed that compared to other locations within the Southern Tablelands region, the Crookwell area has been relatively poorly researched (McDonald and Garling 1997; Biosis 2004; Biosis 2005). Nevertheless, several studies have been conducted relating to the development of the Crookwell wind farms (1 and 2), the Gunning wind farm and the Gullen Range wind farm (Biosis 2004; Biosis 2005 and Dibden 2007). These developments have each involved the assessment of Aboriginal heritage values and provide an overview of the expected archaeological site types and their distribution within the study area. See *Table 5.1* for a summary of previously completed heritage reports relevant to the local study area. Consideration of these studies will contribute to a predictive model outlined in *Section 5.5*.

Table 5.1 Summary of heritage reports relevant to the study area

Author and Date	Location of Study Area	Findings
Koettig, 1983	South and East of Goulburn	Koettig undertook a survey for the proposed highway by-pass route to the south and east of Goulburn. This study found 22 new sites which all comprised stone artefact scatters located within 200 m of a watercourse. Of these sites, 54% were on slopes, 23% were recorded on ridges and 23% were recorded along creeks or river flats. Most sites were low density, except G17 which was located at the confluence of two watercourses and found to be a high density site with a stratified deposit. Six hundred and fifty artefacts were located at G17 and later excavations (Paton 1990) recovered 15,000 artefacts, 85% of which were quartz (followed by silcrete at 10%).
Lance 1984	Wollondilly River	Lance surveyed proposed pipeline routes between Sooley Dam and Rossi Weir on the Wollondilly River. This study found a single quartz flake adjacent to Sooley Creek, approximately 7km south of the study area.
Lance and Koettig, 1986	City of Goulburn	Lance and Koettig prepared an Aboriginal Resources Planning Study for the City of Goulburn. They determined that land adjacent to major watercourses, areas of lower slope adjacent to watercourses, and hill tops were most likely to contain sites and have the highest archaeological sensitivity. It was concluded that these areas have the highest likelihood of containing significant sites, or sites of importance. Lance and Koettig (1986) observed that sites in the region existed mostly on gentle well drained lower slopes (48%) followed by ridge tops (24%), creek flats (19%) and terraces (9%). As part of their study, it was noted that 94% of sites were located within 200m of a water source. Of these sites, 75% were located within 100m of a water source, and 50% within 50m from a water source.
Silcox 1988	Chatsbury, about 10km east of the study area	Silcox undertook a survey at a slate quarry in Chatsbury and found 3 surface level stone artefacts scatters (C1, 2 and 3). Quartz was the most common material found, followed by smaller numbers of silcrete, chert and volcanic rock. These sites were located within 50m of the Tarlo River in lower slope landforms. The study area's landscape was described as rounded hills with moderate to steep slopes and sloping valley floors. Two areas of potential archaeological deposit were identified on a moderately sloping landform along the original course of the Tarlo River, and on an expanse of flat terrain on the west bank of the Tarlo River.
Silcox 1989	Chatsbury, about 10km east of the study area	Test excavations were carried out at areas of previously identified archaeological potential (identified by Silcox 1989). However, only 5 artefacts were recovered. These artefacts were located uphill of moderately sloping terrain along the Tarlo River.
Fuller, 1989	City of Goulburn	Fuller proposed to refine the model of Aboriginal site locations in the region surrounding Goulburn based on the model outlined by Lance and Koettig (1986). The initial study divided the area into zones based on landform type. These zones were assessed as having high, moderate or low sensitivity (archaeological potential) and significance (importance of site). The alluvial flats adjacent to the major rivers, Wollondilly and Mulwaree were assessed as having potential to contain stratified sites from which information on cultural changes and

Author and Date	Location of Study Area	Findings
		continuity could be extracted. Stone artefact scatters are also suggested to be most likely located near the junction of major water courses, and at the junction of minor creeks. Within landforms of undulating hills and plains (the landform pattern of the study area), lower hill slopes adjacent to watercourses are assessed as the favoured campsite location where stone artefact sites are suggested to be common. This landform type is considered to have a high level sensitivity, and moderate potential for significant sites. Also within this landform pattern, mid slopes are noted to have yielded few archaeological sites. Fuller notes that the distance from water and absence of level ground are likely to have restricted Aboriginal use of this landform type, therefore giving it a low sensitivity and potential significance. Hill slopes are noted as potential locations for burials and ceremonial activities. Fuller further notes that due to ground disturbances since European occupation, these sites have likely been disturbed or destroyed. If undisturbed sites are located in these areas (though considered unlikely) they will likely be of high significance. This landform type is therefore assessed as having a low potential sensitivity and a high potential significance. Built up areas are considered to have a moderate potential sensitivity, but a low potential for significance. Fuller's refined model, based on further field surveys and assessment, determined that major watercourses have a high potential sensitivity and significance, lower slopes adjacent to watercourses have a high sensitivity and moderate potential significance (favoured for campsites), gently undulating land or plains have a low potential sensitivity and significance. Fuller notes that sites occur in conjunction with features other than water – and that do not conform to the predicted environmental zones for archaeological sites. The report identifies that resources, such as stone or a particular plant or food, medicine or shelter may have provided an incentive to camp in an otherwise unlikely location. Hills generally have a low potential sensitivity and significance, however high hills and hill tops have a high potential significance due to their likelihood to contain burial or ceremonial sites. Of the sites assessed and identified as part of this study, the majority were stone artefact sites where chert or quartz were the most common raw material. However, the nearby Goulburn by-pass survey (Koettig) found that silcrete and quartz were the most common raw materials. Fuller notes that this may be the result of different terminologies.
Silcox 1991	Wollondilly River, near Goulburn.	Test excavations were undertaken at the location of a proposed detention pond for storm flow situated within an elevated landform overlooking the Wollondilly floodplain. No artefacts were located during a field survey. However, sub-surface testing recovered 97 artefacts from 30 pits. Artefact materials were dominated by quartz (78%) with some smaller numbers of silcrete.

Author and Date	Location of Study Area	Findings
White, 1996	Crookwell I wind farm	White undertook an archaeological survey of the proposed wind farm area. One site was recorded which comprised of a stone artefact scatter containing 20 pieces of quartz flaking debris. White considered this site represented a single event of stone knapping. Due to poor visibility, White recommended that sub-surface testing be conducted to better understand the archaeological record.
McDonald and Garling, 1997	Crookwell I wind farm	Based on recommendations provided by White (1996), McDonald and Garling undertook archaeological sub-surface testing for the proposed Crookwell I Wind Farm. As part of this study, three 1m x 1m pits were excavated at each of the proposed turbine locations. The highest number of artefacts (32) was recorded at Site CWF1, as well as a previously unidentified tool type (the 'Pejar Point'). Generally, 3 or less artefacts were recovered from each test pit. Based on these investigations, McDonald and Garling concluded that the material found within the test pits could be described as background scatter. This description refers to the nature of the Aboriginal archaeological record which, generally, is considered to be a virtually continuous distribution of artefacts across the landscape – with alterations in density depending on the environmental zone. McDonald and Garling recommended that the site CWF1 be excavated prior to impact.
McDonald and Garling 1998	Crookwell I wind farm	Subsequent to recommendations provided by McDonald and Garling (1997), excavation was undertaken at site CWF1 for the proposed Crookwell I wind farm. A total of 25m2 of soil was excavation from excavation squares dug to approximately a 30cm depth. The excavations yielded 2154 stone artefacts that generally occurred within the top 20cm of soil. These artefacts were made of quartz, silcrete and chalcedony. Evidence of stone tool manufacturing process were identified for artefacts such as backed blades, the Pejar Point and an item as 'rectangular'. The site was considered to represent a singular behavioural episode of artefact manufacture and woodworking.
Navin Officer Heritage Consultants 2000	Sooley Dam	A survey was undertaken at Sooley Dam for a proposed raising of the dam wall. The landscape of the study area was describes as low hills and gently undulating terrain. The area was assessed to hold low archaeological potential and no sites or areas of sensitivity were recorded.
JMCHM, 2003	Gunning wind farm	Jo McDonald Cultural Heritage Management (JMCHM) undertook an archaeological survey for the Gunning wind farm. The landscape of this study area was found to be a range of crests and valley topographies. As a result of this survey, 8 surface sites were recorded, which included a quarry site, 4 small artefact scatters and 3 isolated artefacts. One of the sites was identified as a quartz quarry as blocky quartz was found to outcrop at the site. The majority of recorded artefacts were of quartz material, however some silcrete and red agate was also located. Steep hill tops were considered to be of low archaeological potential while elevated contexts close to water were considered to be of higher sensitivity. It was concluded that several of the wind turbine generator locations had potential for sub-surface archaeological deposits.

Author and Date	Location of Study Area	Findings
Biosis 2004	Crookwell II wind farm	Biosis undertook an archaeological survey for the proposed Crookwell II Wind Farm. The overall effective survey coverage was calculated at 11% of the surveyed area, equalling 4% of the 1059 ha impact area. Twenty-five previously unrecorded sites were recorded including stone artefact sites and two scarred trees. These sites were situated within drainage lines (42%), upper slope (42%) and hill/ridge top (16%) landforms. Two of these sites also contained a scarred tree. An additional scarred tree site was identified within an upper slope landform. Based on observations of landform features and recorded sites, it was concluded that the dominant character of the archaeological record in the region was that of a 'background scatter' with a single large surface site. They predicted that sites were most likely to be located on creek lines, in close proximity to drainage line convergences, on ridge lines or in sloping areas. Sub surface testing was recommended in locations where archaeological sites were to be impacted by development, and also that sub-surface testing be considered for all proposed turbine sites, as well locations proposed for road construction.
Austral Archaeology, 2005	Gunning Wind Farm, about 18km south-west.	Subsequent to the field survey undertaken by JMCHM (2003), Austral Archaeology undertook the second phase of archaeological work at Gunning wind farm which saw the relocation of several sites and also located one new site. This project included sub-surface testing which consisted of 15 grader scrapes across 6 areas of proposed turbines. No new artefacts were found.
Biosis, 2005	Crookwell II Wind Farm	Biosis undertook sub-surface testing for the proposed Crookwell II wind farm. As part of background research for this study, Biosis found that basalt derived soils are the most archaeologically sensitive soils in the region.. Of 25 sites recorded by Biosis (2004), 3 scarred trees and 10 stone artefact sites were located within basalt soils. The largest of these sites (PJ1) was 500m from water, as were PJ23 and PJ24. It was recommended to undertake sub-surface testing where impact areas overlaid basalt soils. This study identified 28 new archaeological sites. These sites were mostly situated on broad flat ridges between major watercourses. The new sites recorded were located away from permanent water, but in close proximity to ephemeral water as observed by Biosis. Biosis determined that sites in the Crookwell II study area would most likely be located on hill slopes, and within 100m of water. Creek flats and hill top landforms are also likely to contain sites. Higher density sites would probably be located at the confluence of watercourses. Well drained areas with soft soils are the most likely location for larger camp sites. Within this study area, landforms consisting of eroded Tertiary basalt and dolerite would be the most archaeologically significant locations. Biosis considered that the study area landforms that met several of the criteria noted above would have a moderate to high archaeological potential.

Author and Date	Location of Study Area	Findings
Dibden, 2007	Gullen Range Wind Farm	Dibden undertook an archaeological assessment for a proposed wind farm at Gullen Range, near Kialla. The study area was found to be located within a north-south trending ridge system. The study area was divided into four localities for which the archaeological potential of sites identified was assessed. Within the Kialla area, 10 stone artefacts were recorded. It was predicted that this area was likely used for low levels of occupation including intermittent hunting and gathering activities away from a base camp. This type of activity will physically appear as low level of artefact discard.
Austral Archaeology, 2009b	Gunning wind farm	Subsequent to the field survey undertaken by JMCHM (2003), Austral Archaeology undertook a survey for a proposed transmission line within the Gunning Wind Farm development area. This study identified 13 open artefact scatters, 9 isolated finds, 2 areas of PAD and a scarred tree. The open artefact scatters and isolated finds yielded a total of 51 stone artefacts. Grey silcrete was the most common lithic material identified.
Anderson, 2010	Crookwell 3 wind farm	Anderson undertook an archaeological survey for the proposed Crookwell 3 Wind Farm (the current study area). This project included a field survey which identified 10 Aboriginal archaeological sites (Hillview Park, Hillview Park 2, Hillview Park 3, Hillview Park 4, Hillview Park 5, Hillview Park 6, Hillview Park 7, Hillview Park 8, Wollondilly Farm and Wollondilly Farm 9). These sites were predominantly recorded on landforms described as crests or flats. The sites were all stone artefact sites consisting of mostly silcrete (88%) and some quartz (12%).
Biosis 2010	Crookwell II wind farm	Subsequent to the 2005 sub-surface testing program (Biosis 2005), Biosis undertook archaeological salvage excavations for several proposed turbine locations. Two new sites were found and additional artefacts were located in association with the previously recorded (and sub-surface tested) sites PJ10 and PJ09.

5.4 AHIMS DATABASE SEARCH

The OEH AHIMS database provides information concerning previously recorded Aboriginal sites in NSW. AHIMS stores data regarding a sites location, site type, site features and a unique site identification number for all registered Aboriginal heritage sites in NSW. Mapping of an AHIMS database search results will identify any known sites which could be impacted by a proposed works as well as help to determine the overall pattern of Aboriginal sites in an area. A summary of the various site types likely to be located in the Crookwell 3 study area can be found in *Table 5.2* and was used in the development of a site prediction model for the study area.

Table 5.2 Parks and Wildlife Group Site Type Definitions

Site types	Definition
Stone artefact scatters (or Open Camp Sites)	Stone artefact scatter sites, also known as open campsites, are usually indicated by surface scatters of stone artefacts and sometimes fire blackened stones and charcoal. Where such sites are buried by sediment they may not be noticeable unless exposed by erosion or disturbed by modern activities. The term campsite is used as a convenient label which, in the case of open sites, does not necessarily imply that Aboriginal people actually camped on the sites; rather it indicates only that some type of activity was carried out there.
Isolated finds	Sites consisting of only one identified stone artefact, isolated from any other artefacts or archaeological evidence. They are generally indicative of sporadic past Aboriginal use of an area.
Shell middens	Middens consist of accumulations of shell that represent the exploitation and consumption of shellfish by Aboriginal people. Shell species may be marine, estuarine or freshwater depending on the environmental context and middens may also include other faunal remains, stone artefacts, hearths and charcoal.
Shelter sites	Sandstone shelters and overhangs were used by Aboriginal people to provide campsites sheltered from the rain and sun. The deposits in such sites are commonly very important because they often contain clearly stratified material in a good state of preservation.
Grinding grooves	Grooves resulting from the grinding of stone axes or other implements are found on flat areas of suitable sandstone. They are often located near waterholes or creek beds as water is necessary in the sharpening process. In areas where suitable outcrops of rock were not available, transportable pieces of sandstone were used.
Quarries	These are areas where stone was obtained for flaked artefacts or ground-edge artefacts, or where ochre was obtained for rock paintings, body decoration or decorating wooden artefacts.
Art sites	Aboriginal paintings, drawings and stencils are commonly to be found where suitable surfaces occur in sandstone shelters and overhangs. These sites are often referred to as rock shelters with painted art.

Site types	Definition
	Rock engravings, carvings or peckings are also to be found on sandstone surfaces both in the open and in shelters. These are referred to as rock engraving sites.
Scarred trees	Scarred trees bear the marks of bark and wood removal for utilisation as canoes, shields, boomerangs or containers. It is commonly very difficult to confidently distinguish between Aboriginal scars and natural scars or those made by Europeans.
Burial sites	Burials may be of isolated individuals, or they may form complex burial grounds.
Stone arrangements, carved trees and ceremonial grounds	These site types are often interrelated. Stone arrangements range from simple cairns or piles of rocks to more elaborate arrangements; patterns of stone laid out to form circles and other designs, or standing slabs of rock held upright by stones around the base. Carved trees are trees with intricate geometric or linear patterns or representations of animals carved into their trunks. Ceremonial grounds and graves were often marked by such trees. Bora grounds are a common type of ceremonial site and they are generally associated with initiation ceremonies. They comprise two circles, generally edged with low banks of earth but sometimes of stone, a short distance apart and connected by a path.

A search of the AHIMS database for an area of approximately 20 km by 20 km around the study area was undertaken on the 8 November 2013 by Janene May (ERM Archaeologist). This search identified 61 previously recorded Aboriginal Heritage sites within the vicinity of the study area. All previously recorded sites in this area contain stone artefacts. The majority are recorded as open camp sites (67%) and isolated finds (33%). One of the open camp sites was recorded as containing a culturally modified tree (PJ03), and one site was recorded as containing an artefact scatter and a stone quarry (PJ20). The sites identified by this search are outlined in *Table 5.3*.

The spatial distribution of these sites show a correlation with previous archaeological research that indicates a concentration of higher density sites within elevated landforms such as crests, hill tops and upper slopes and in the close proximity of creek lines.

The stone quarry site (PJ20) was located in close proximity of the study area and contains quartz raw material. The site is located on a crest landform within rolling hills, at the convergence of two drainage lines. The sites surrounding landscape consists of ridgelines which drop to form large, steep drainage gullies. Large quartz cobbles and boulders were found exposed at the point of convergence between the two tributaries that flow into the Wollondilly River.

Table 5.3 Description of Sites Identified by AHIMS Search

Site Name	Landform	Site Type	Site Contents and Description
PJ 09	Upper slope	Open Camp Site	Artefact scatter consisting of 7 stone artefacts (Biosis 2004). This site was considered to have potential to hold deposits of in situ material.
PJ 10	Hill/Ridge Top	Isolated Find	Isolated stone artefact (Biosis 2004).
PJ 16	Upper Slope	Isolated Find	Isolated stone artefact (Biosis 2004)
PJ27	Crest	Isolated Find	Isolated stone artefact consisting of 1 quartz flake found 600m away from Middle Creek (Biosis 2005).
PJ28	Crest	Isolated Find	Isolated stone artefact consisting of 1 quartz broken flake 5 – 10cm below surface. Site found 600m away from a water source (Biosis 2005). Quartz outcrops identified in the local area (Biosis 2005)..
PJ29	Hill Crest	Isolated Find	Isolated stone artefact consisting of 1 complete quartz flake found 0-50mm below surface (Biosis 2005). Site found 600m away from water source (Biosis 2005). Quartz outcrops identified in the local area (Biosis 2005)..
PJ30	Crest	Open Camp Site	Artefact scatter consisting of 9 quartz pieces including 5 broken flakes, a core and some shatter. The site is situated on the western edge of an isolated rocky hill and 600m from Middle Creek. Artefacts were found at a depth of 0-50mm. The stratigraphy of the site consisted of an upper moderately compact brown coarse silty soil, with a base layer of a compact orange mottled brown silt containing abundant charcoal fragments and small fragments of quartz (Biosis 2005)..
PJ31	Crest	Open Camp Site	An artefact scatter containing 14 sub-surface artefacts 600m from First Creek (Biosis 2005).
PJ32	Crest	Isolated Find	Isolated yellow quartzite flake found 5-10cm below surface. Site located 600m from First Creek (Biosis 2005).
PJ33	Crest	Open Camp Site	This site consists of 38 artefacts throughout a linear transect 270m long (Biosis 2005).
PJ34	Crest	Isolated Find	This site consists of a quartz flake from a sub-surface context (Biosis 2005).
PJ35	Ridge Crest	Open Camp Site	23 artefacts (Biosis 2005).
PJ36	Crest	Isolated Find	This site consists of one quartz broken flake (Biosis 2005)..
PJ38	Ridge (top)	Open Camp Site	33 stone artefacts found in sub-surface context (Biosis 2005).
PJ41	Hill (top)	Open Camp Site	Site consists of 6 artefacts from a sub-surface context, all made of quartz and comprising flakes and flake shatter (Biosis 2005).
PJ42	Ridge (top)	Open Camp Site	Site consists of 10 artefacts along a linear transect 300m long. These are all made of quartz and include flakes, broken flakes, one flaked piece and one core fragment (Biosis 2005).

Site Name	Landform	Site Type	Site Contents and Description
PJ43	Rolling Hills (top)	Open Camp Site	Site consists of 18 artefacts in a sub-surface context. These are mostly made of quartz (12), silcrete (5) with 1 rhyolite artefact. Artefacts include flakes, flaked pieces, tools and a core fragment (Biosis 2005).
PJ44	Crest	Open Camp Site	Site consists of one quartz core fragment and one silcrete broken tool found in a sub-surface context(Biosis 2005).
PJ45	Hills (top)	Open Camp Site	24 artefacts found sub-surface (Biosis 2005).
PJ46	Crest	Open Camp Site	Site consists of 2 silcrete flakes, and 1 quartz broken flake (Biosis 2005).
PJ47	Lower Slope	Open Camp Site	Site consists of 4 quartz flakes and 4 quartzite flakes (Biosis 2005).
PJ48	-	Open Camp Site	Site consists of two broken quartz flakes from a sub-surface context (Biosis 20045).
PJ49	Upper flat	Open Camp Site	16 artefacts found in a sub-surface context. All artefacts were quarts flakes or broken flakes, except one chalcedony flake and one silcrete core (Biosis 2005).
PJ50	-	Isolated Find	Site consists of one sub-surface quartz broken flake (Biosis 2005).
PJ51	Upper Flat	Open Camp Site	323 sub-surface artefacts.
PJ52	Upper Slope	Open Camp Site	2 sub-surface artefacts including 1 quartz broken flake and 1 chalcedony complete flake (Biosis 2005)
PJ53	-	Open Camp Site	2 broken quartz flakes (Biosis 2005)
PJ26	Upper Flat	Isolated Find	1 red chalcedony broken flake on flat area adjacent to a dam, close to a small drainage line which flows into Middle Creek. Find was sub-surface at 100-150mm depth (Biosis 2005).
PJ37	Crest	Open Camp Site	50 sub-surface artefacts (Biosis 2005)
PJ01	Upper Slope	Open Camp Site	Artefact scatter 24 (Biosis 2004)
PJ02	Drainage Line	Isolated Find	Isolated artefact (Biosis 2004)
PJ03	Drainage Line	Open Camp Site; Modified Tree	Artefact Scatter, culturally modified tree (Biosis 2004)
PJ08	Upper Slope	Open Camp Site	Artefact Scatter 5 (Biosis 2004)
PJ09	Upper Slope	Open Camp Site	Artefact scatter 7 (Biosis 2004)
PJ10	Hill/Ridge Top	Isolated Find	Isolated artefact (Biosis 2004)
PJ11	Drainage Line	Open Camp Site	Artefact scatter 2 (Biosis 2004)
PJ13	Drainage Line	Isolated Find	Isolated artefact (Biosis 2004)
PJ14	Drainage Line	Open Camp Site	Artefact scatter 2 (Biosis 2004)
PJ15	Drainage Line	Open Camp Site	Artefact scatter 5 (Biosis 2004)
PJ16	Upper Slope	Isolated Find	Isolated artefact (Biosis 2004)
PJ17	Upper Slope	Open Camp Site	Artefact scatter 9 (Biosis 2004)
PJ18	Drainage Line	Open Camp Site	Artefact scatter 2 (Biosis 2004)
PJ19	Drainage Line	Open Camp Site	Artefact scatter 3 (Biosis 2004)

Site Name	Landform	Site Type	Site Contents and Description
PJ20	Drainage Line	Open Camp Site; Stone Quarry	Artefact scatter of 11 stone artefacts and also large quartz cobbles and boulders – exposed at the convergence point of two drainage lines which then form one tributary of the Wollondilly River. The artefacts found are situated adjacent to the outcrop of white quartz and may have been manufactured from this raw material source. The outcrop contains rocks as large as 300-400mm in size (Biosis 2004.
PJ21	Upper Slope	Isolated Find	Isolated artefact (Biosis 2004)
PJ22	Upper Slope	Open Camp Site	Artefact scatter 2 (Biosis 2004)
PJ23	Upper Slope	Open Camp Site	Artefact scatter 8 (Biosis 2004)
PJ24	Upper Slope	Open Camp Site	Artefact scatter 11 (Biosis 2004)
PJ25	Hill/Ridge Top	Isolated Find	Isolated artefact (Biosis 2004)
PJ 54	-	Open Camp Site	Sub-surface stone artefact scatter (Biosis 2005)
PJ 55	-	Open Camp Site	Sub-surface stone artefact scatter(Biosis 2005)
Hillview Park	Mid slope	Open Camp Site	Artefact scatter containing 17 stone artefacts – all broken flakes except one flake tool. All made of grey silcrete Anderson (2010).
Hillview Park 2	Crest	Open Camp Site	Artefact scatter containing 8 artefacts including 2 cores made of quartz, 1 flake tool also made of quartz and 5 broken flakes made of grey silcrete (Anderson 2010).
Hillview Park 3	Crest	Isolated Find	Isolated stone artefact consisting of a brown silcrete flake tool (Anderson 2010).
Hillview Park 5	Flat	Open Camp Site	Artefact scatter consisting of 2 grey silcrete broken flakes (Anderson 2010).
Hillview Park 4	Crest	Open Camp Site	Artefact scatter consisting of 1 grey silcrete broken flake and one grey silcrete flake tool (Anderson 2010).
Hillview Park 6	Valley Flat	Isolated Find	Site consisting of a grey silcrete core (Anderson 2010).
Hillview Park 7	Flat	Isolated Find	Site consisting of a brown silcrete broken flake (Anderson 2010).
Hillview Park 8	Stream channel/ low drainage depression	Open Camp Site	Artefact scatter consisting of 41 brown silcrete stone artefacts predominantly flakes and flake debitage (Anderson 2010).
Wollondilly Farm	Stream Bank	Isolated Find	Isolated site consisting of one grey silcrete broken flake fragment. The site is in proximity to First Creek and is highly disturbed (Anderson 2010).
Wollondilly Farm 9	Crest	Open Camp Site	Stone artefact scatter found on the crest of a hill (Anderson 2010).

5.5 SUMMARY OF ABORIGINAL HERITAGE DESKTOP RESULTS

The study area is represented by a rolling hills landscape that is dissected by valleys and water courses, most of which are tributaries of the large and permanent Wollondilly River that runs south through the centre of the study area. The topographical nature, geology, flora and fauna of the study area would have provided shelter from the elements and a range of subsistence and lithic resources to Aboriginal people.

Previous archaeological work and the distribution of sites within the study area (see Figure 5.2) suggests that flat, gently sloping terrain and lower hill slopes in close proximity of watercourses (especially at the convergence of two watercourses) will exhibit the highest archaeological potential.

Areas of archaeological potential will be sheltered from the elements and located close to resources such as water, food, medicinal and lithics). The study area's proximity to the Wollondilly River and several of its tributaries would have made it a prime source of water and food resources for Aboriginal groups. The study area's cultural landscape is rich in subsistence resources and this is evidenced by the widespread and often densely distributed archaeological sites within the study area region.

Archaeological research into the region has determined that the archaeological record comprises a widespread 'background scatter' of stone artefacts which varies in density according to landform type and environmental characteristics (McDonald and Garling 1997; Hardy and Thomson 2004; Reeves and Thomson 2004). In line with this, the study area is likely to contain low density stone artefact scatters across all of its landform units. These artefact scatters will increase in density within flat and gently sloping landforms, crests, hill top and upper flat locations (particularly those that are sheltered from the elements) (e.g. PJ35, PJ38, PJ45, PHJ51 and PJ37), and at the confluence of two watercourses. This widespread 'background scatter' of stone artefact sites has been located within surface and sub-surface contexts, and their identification has been largely influenced by ground visibility factors. Although the upper layers of soil horizons across the study area have likely been disturbed by non-Aboriginal agricultural activities such as ploughing, in situ archaeological deposits may be present within deeper stratigraphic layers. It is also likely that stone artefacts have not been moved far from their original depositional position by ploughing. Previous archaeological sub-surface testing and larger scale excavations in the local area – and wider region – have found that stone artefact sites tend to occur at depths between 0 cm and 15 cm below surface level (e.g. sites PJ28, PJ29, PJ30, PJ32 and PJ26). The stratigraphic soil deposits of the study area indicate that in areas where environmental features favour a higher archaeological potential, in situ sub-surface artefacts are likely to be present.

Site types other than stone artefact sites are generally rare in the local area. However burials and scarred trees may occur. Ethnographic information relating to Aboriginal burials in the area has indicated that amongst the Gandangara, burials were generally located in the vicinity of the Wollondilly or Tarlo Rivers, on the opposite side of the river to which the person had died. One burial observed by Govett in the 1830s (cited in Johnson 2007) was described as an earth mound made of clay, with surrounding trees scarred in patterns. Unfortunately, due to vegetation clearing, there are limited mature trees within the study area.

A stone quarry site (PJ20) has been identified 750 m north of the study area. The site is located in a crest landform unit within a wider landscape of rolling hills dissected by valley basins and drainage lines (as with the current study area). The site is located at the convergence of two drainage lines with surrounding ridgelines which are large adjacent to steep drainage gullies is steep. Large cobbles and boulders of quartz exposed at the point of convergence of two tributaries that form on leading into the Wollondilly River.

In line with previously recorded sites and site distribution models for the southern tablelands region – sites are likely to occur in gently sloping or flat landforms adjacent to resources (such as water) (Fuller 1989). Sites in hilly landforms, crests or ridges, may reflect more transient occupation and movement through the landscape, the proximity of resources such as lithic raw materials or a particular type of food or medicine, or potentially ceremonial or burial sites (source). Elevated landforms such as hill tops, crests, ridges or upper flats may also represent larger campsites where they are sheltered from the elements and provide views of the surrounding landscape.

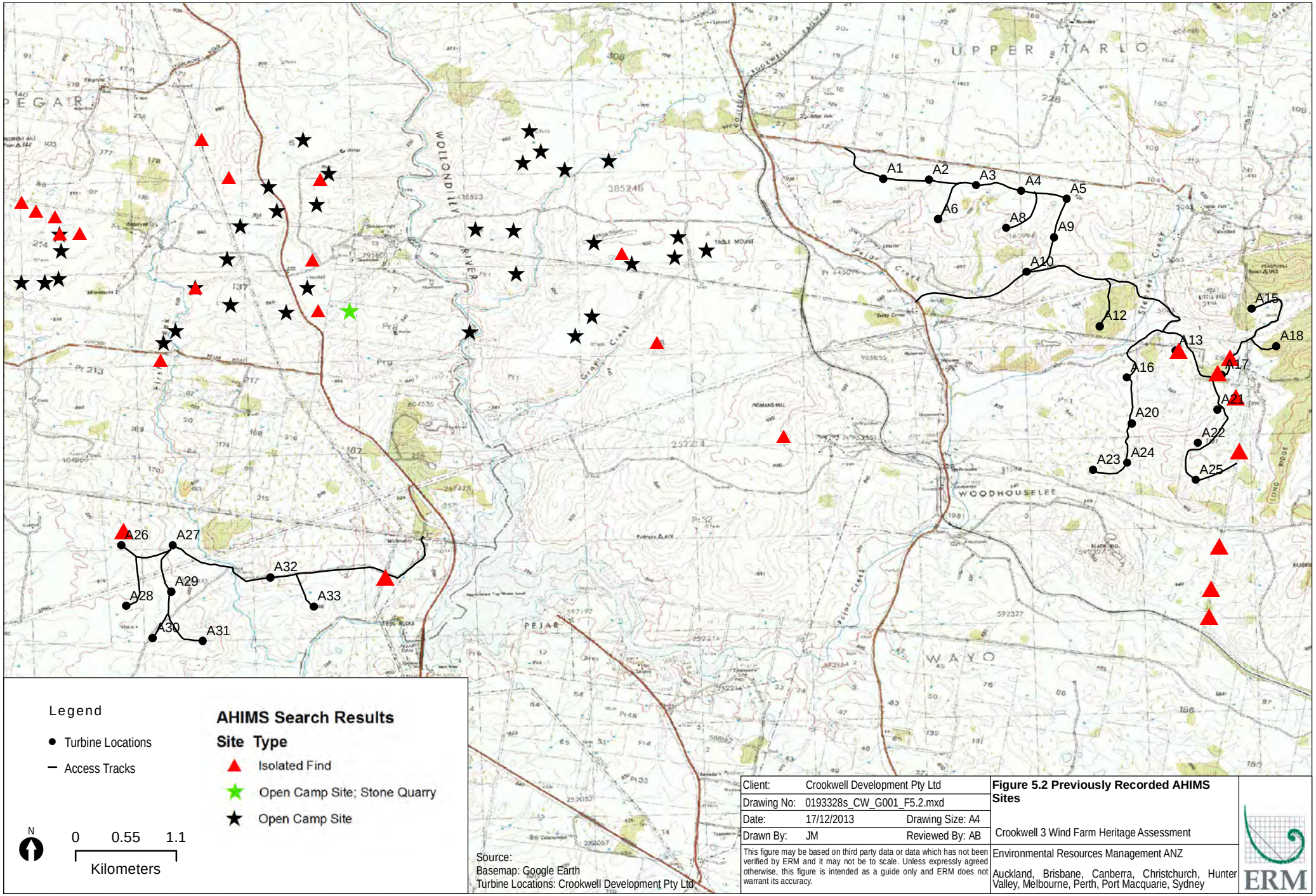
Across the wider region (fuller 1989) the most common lithic raw material is quartz and chert, though other studies (Koettig 1983; Biosis 2004; Biosis 2005; Anderson 2010) have found that quartz and silcrete are the most frequent. This may be a reflection of different terminology used to describe the raw material, and it is possible that the silcrete and chert could be recorded as the same material. Dearling (2007) also notes that some previous studies could have incorrectly recorded quartz broken pieces as artefacts, due to the difficulty in distinguishing between natural and cultural modification of quartz. Nevertheless, stone artefacts found across the study area will most likely be quartz or silcrete, in line with previous studies. There is also a known quartz quarry less than 1km north of the study area (PJ20).

5.6 *ABORIGINAL HERITAGE PREDICTIVE MODEL*

The knowledge gained from examining landforms, geology, regional archaeological patterns, and prior archaeological reports have enabled a set of parameters to be established to predict the potential location of Aboriginal sites within the study area. The background results suggest that:

- Aboriginal sites are most likely to be stone artefact sites;
- stone artefact sites are most likely to occur within 400 m of a permanent water course, although smaller creek margins may display scatters of stone artefacts, particularly if near to larger water courses;
- surface expressions of artefacts are most likely to be found on flat or gently sloping terrain in close proximity to water or within elevated landforms such as hill tops, crests, or upper flats where there is shelter from the elements;
- elevated areas that afford views of the surrounding landscape are likely to contain stone artefact sites;
- culturally scarred trees may occur on mature trees with the study area;
- areas of sub-surface stone artefact deposits (with or without a display of surface level stone artefacts) may be present in the study area. Such sites are likely to be located at depths of between 0 and 15 cm below ground surface level;
- human burials are rare, but if present would most likely be in the alluvial soils that make up the study area's flood plain, creek and river terraces or found in crests and hill tops Burials may be indicated by the presence of clay earth mounds or scarred trees ;
- ceremonial sites (bora grounds) may be present in hill tops in the study area (refer to *Section 5.1*), though are very unlikely due to their rarity and previous disturbances across the landscape;
- areas associated with lithic outcropping (with raw stone material suitable for tool making). Where these sites occur they are likely to be in the form of stone procurement sites with archaeological expressions of initial reduction of stone materials (e.g. large amount of cortex on artefacts; testing of material quality – discarded material; reduction of larger cobbles and boulders – large pieces of discarded material and evidence of removal);
- the most common stone material used for the manufacturing of artefacts within the study area is quartz and silcrete; and

Much of the material used by Aboriginal people to produce survival equipment (such as wood, bone, shell and fibre material) are highly perishable and do not often survive in the archaeological record. Material culture that has survived, often found in locations where Aboriginal people camped, are generally stone artefacts and scarred trees. Stone artefacts, and to a lesser extent scarred trees, are the most likely artefact types to be located within the study area. Aboriginal archaeological sites within the study area are likely to have been impacted upon (disturbed) due to past European farming practices, the development of transport infrastructure (such as rail and road constructions) and trenching for utility services.



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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.2 Previously Recorded AHIMS Sites

Crookwell 3 Wind Farm Heritage Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

6 HISTORICAL BACKGROUND

This chapter considers the potential non-Aboriginal heritage values for the study area. It includes a review of available heritage assessments, reports, publications, historical maps and aerial imagery for the local area. This material was used to establishthe study area's history and development over time. The following databases were also searched to determine whether known non-Indigenous heritage sites are located within the study area:

- Commonwealth Heritage List (CHL);
- NSW State Heritage Register and Inventory;
- Upper Lachlan Local Environmental Plan 2010;
- Crookwell Local Environmental Plan 2004;
- Register of the National Estate (RNE); and
- The National Trust of Australia.

6.1 HISTORICAL OVERVIEW

The first Europeans to explore the NSW south-east highlands region were Hamilton Hume, Charles Throsby, James Meehan and John Oxley between 1817 and 1820. During these early explorations, it was recognised that the area had potential for grazing and agriculture. From the early 1820s the region was settled with John Macarthur establishing himself at Taralga in 1822. By the 1830s various Europeans had settled in the Braidwood area. Cattle and sheep grazing was the dominant land use within the region and structures associated with this use such as shearing sheds and sheep dips may still be present in the study area. Crops were grown by early settlers and were initially commercially produced with great success. However, declining yields during the 19th century slowed industry (NSW NPWS 2003).

The Goulburn Plains region (including the study area) was seen as an attractive area for settlement due to its lightly timbered environment with an abundance of natural grasses and water. Surveyor Meehan camped and examined the land at nearby Grabben Gullen (approximately 12km south-west of Crookwell) in April of 1820. Land grants in the region subsequently commenced in 1822 and the township of Goulburn was established in 1824. Subsequent European expansion into the region was rapid, with land taken up before grants were even established (Navin Officer 2003). In order to implement some control over rapid settlement, the Government introduced 'tickets of occupation' in 1827, which was subsequently replaced by grazing licenses in 1828.

The land around Crookwell was divided up into 19 Counties and settlement rights of these areas were granted by Governor Macquarie. By 1849, the Government surveyor Armstrong had visited the area with a government party and reported that farms and homesteads had been established across the region and were being offered for sale (Dibden 2007). Early buildings across the region were generally constructed of basic natural materials such as slab walls and bark roofs. Around this time (the mid-1800s), James Ritchie, an early settler to the region, described the area as 'open' suggesting that the region could be travelled through without encountering any fences. Homesteads usually incorporated a cultivation paddock and often also a 'bush' paddock. Sheep were shepherded and cattle often roamed freely.

In 1851 the region flourished as a result of the Australian Gold Rush. Towns in the region expanded rapidly as miners set up one room houses in urbanised villages between the 1850s and 1900. These houses were often constructed simply of materials such as bark, weatherboard and iron sheet. The Scott Nature Reserve, to the west of the study area, was set up as a reserve for mining in 1899. Four gold mining leases were issued in this area in 1898, one of which ran intermittently through until 1938. Remnants of mining activities remain in the landscape today and include mine shafts, tunnels, spoil heaps and structural infrastructure (NSW NPWS 2010).

The western portion of the study area was originally located within the historical Parish of Pomeroy in the County of Argyle. The general region of the western portion of the study area forms part of the original land grants of the early 19th century given to Thomas Moore and George McLeay, with the southern portion of the study area forming part of the Argyle Camden and King Goldfield grants (refer to *Figures 6.1 and 6.2*). The eastern section of the study area was later under the ownership of Henry Harvey in the later 19th century who utilised a portion of his land as a Bird and Animal Sanctuary.

The eastern portion of the study area was originally located within the historical Parishes of Upper Tarlo (to the north) and Wayo (to the south) in the County of Argyle. The general region of the eastern portion of the study area forms part of the land grants to G. Muckle and an Arthur Kemmis, with the area to the north forming grants to John Tod (referred to as a trustee for the children of the late John Rogers) and minor grants to Eli Peach and J.W. Coggan (refer to *Figures 6.3 and 6.4*).

The landscape of the study area reflects the past 180 years of occupation. From a review of aerial imagery, the changing landscape is evident through visible erosion of topsoil, hillside gullying and extensive clearing of natural tree cover for pastoral purposes and as well as gold mining activities and timber harvesting. Evidence of historical development in the study area may be found in relation to early agricultural pursuits, domestic dwelling remains, the division of land for the establishment of towns and subsequent transport links, and mines and other infrastructure relating to the Australian Gold Rush.

Figure 6.1 *19th century parish map of the west portion of the study area (source: http://www.lpi.nsw.gov.au/mapping_and_imagery/parish_maps)*

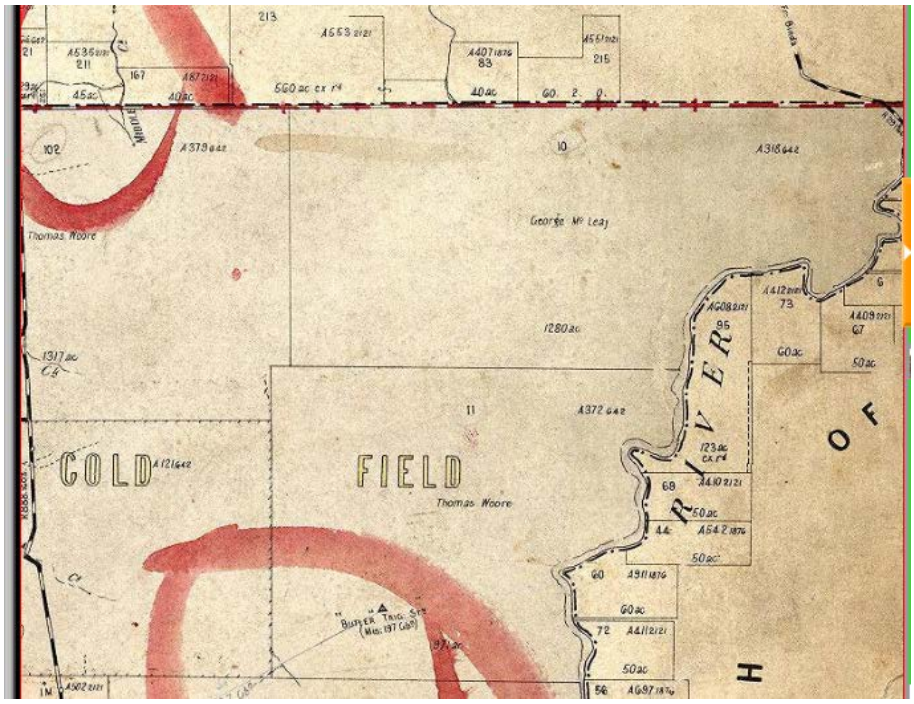


Figure 6.2 *19th century parish map of the west portion of the study area (source: http://www.lpi.nsw.gov.au/mapping_and_imagery/parish_maps)*

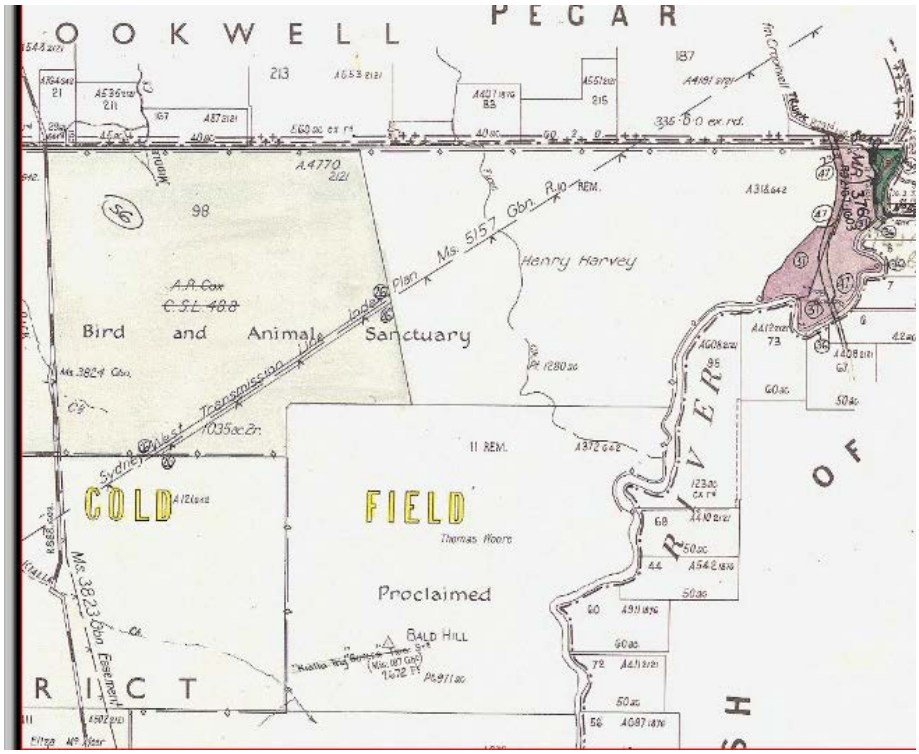


Figure 6.3 *19th century parish map of the west portion of the study area (source: http://www.lpi.nsw.gov.au/mapping_and_imagery/parish_maps)*

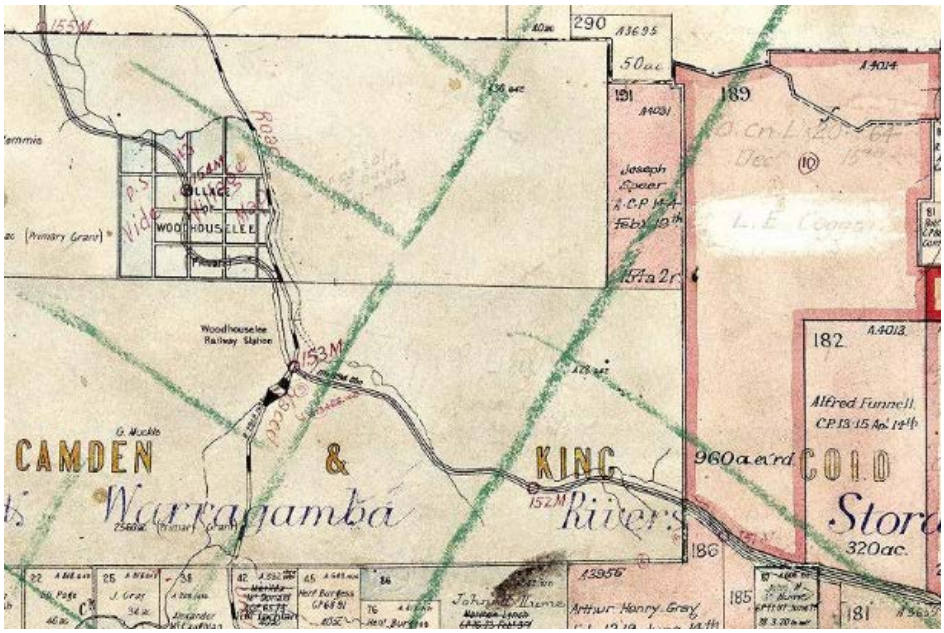
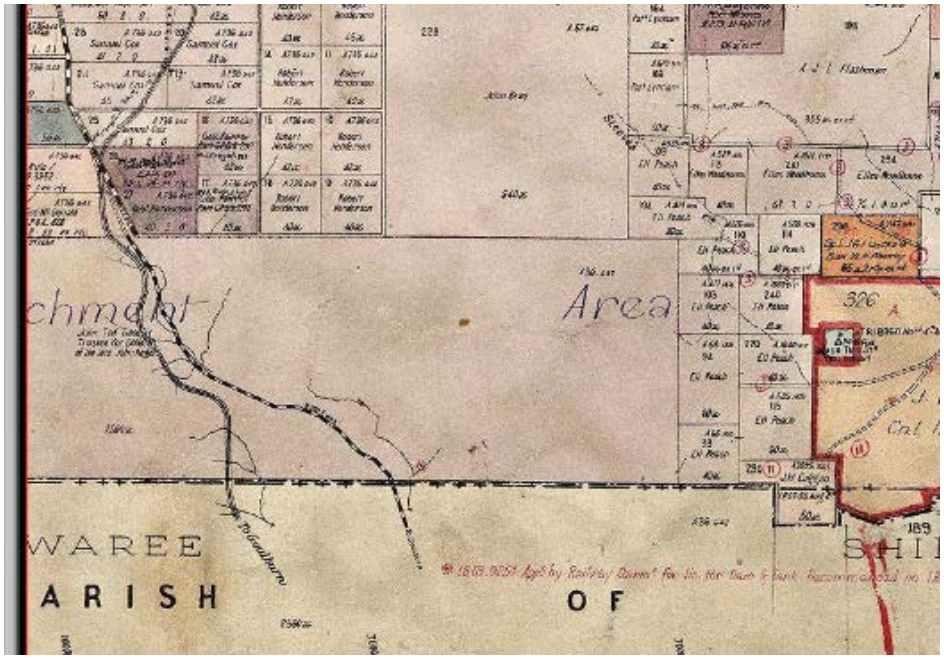


Figure 6.4 *19th century parish map of the west portion of the study area (source: http://www.lpi.nsw.gov.au/mapping_and_imagery/parish_maps)*



6.2 HISTORICAL HERITAGE DATABASE SEARCHES

A search of the following heritage databases was undertaken on the 8 November 2013 to determine whether any historical heritage items have previously been recorded within the study area. The results are outlined below.

Commonwealth Heritage List

There are no heritage items in or in the immediate vicinity of the study area listed on the CHL.

Stage Heritage Register

The heritage item 'Crookwell Railway Station and yard group' (SHR # 01124) is located within the township of Crookwell and will not be impacted by the proposed development.

Local Environmental Plans

There are several heritage items located within the township of Crookwell that are listed as part of the Crookwell LEP. These items are listed in *Table 6.1* below and will not be affected by the proposed development.

Table 6.1 Historical heritage items recorded in the Crookwell LEP

Item name	Address
Bryant's Bakery	41 Goulburn Street
Catherine's Café Bakery Deli	87 Goulburn Street
Coin-Op Laundrette	140 Goulburn Street
Commercial Building	48 Goulburn Street
Commercial Building - Mendl Thompson Associates	93 Goulburn Street
Commercial Hotel	34 Goulburn Street
Commonwealth Bank	79-81 Goulburn Street
Criterion Hotel	76 Goulburn Street
Crookwell Courthouse	Goulburn Street
Crookwell Courthouse Group	9-31 Goulburn Street
Crookwell District Hospital	Kialla Road
Crookwell District Hospital	13-17 Kialla Road
Crookwell Hotel	101 Goulburn Street
Crookwell Official Residence 1	33 Goulburn Street
Crookwell Public School - Buildings B00A (1897),B00B (1886) and residence (1890)	Denison Street
Crookwell Railway Precinct	Colyer Street
Crookwell Railway Station and Yard Group	Colyer Street /Goulburn -Crookwell Railway
Crookwell River Bridge	Binda Road
Crookwell River Bridge	Binda Road
Crookwell Truss Bridge (built 1903)	State Road 54
General Cemetery	Pine Avenue
Goldsworth Theatre (former)	134-138 Goulburn Street
Gundowringa Homestead	2976 Goulburn Road
Lynam's Café	77 Goulburn Street
Masonic Hall	44 Denison Street
Memorial Hall	Denison Street

Item name	Address
'Normanton' Residence	4103 Goulburn Road
Pedley's Buildings	92-98 Goulburn Street
Pejar Creek Underbridge	Goulburn Road (Pejar Dam)
Post Office	83-85 Goulburn Street
Spud Murphy's Inn (former Millhouse Inn)	10 - 12 Goulburn Street
St. Bartholomew's Church of England	15-19 Denison Street
St. Mary's Catholic Church	49-57 Wade Street
St. Mary's Primary School	40-46 Wade Street
Stephenson's Mill (former)	Roberts Street (rear of Commercial Hotel)
Truss Bridge Over Crookwell River	Secondary Road 54
Two Storey Residence 'Montrose'	21 Robertson Street
Westpac Bank (formerly Bank of New South Wales)	106-108 Goulburn Street
Wheat Sheaf Inn ruins	'Kyamma' 4147 Goulburn Road

6.3 HISTORICAL HERITAGE PREDICTIVE MODEL

A search of relevant databases for known non-Indigenous heritage items was undertaken on the 8 November 2013. The historical development of the study area and its surroundings has been such that there may be some evidence of early agricultural activities, timber harvesting, domestic dwelling remains and associated features, gold mining activities, the division of land for the establishment of towns and subsequent transport links, and mines. Examination of aerial imagery and past land disturbances associated with agricultural activities suggest that it is unlikely that previously unknown historical heritage items would be located within the study area. No items of non-Aboriginal heritage were found to be located within the study area, over the course of the site survey..

7 FIELD SURVEY METHODOLOGY AND RESULTS

This section provides an overview of the archaeological field survey of the study area that was undertaken from 2nd December to 6th of December 2013 to determine the presence of Aboriginal cultural heritage sites and values.

7.1 ARCHAEOLOGICAL SURVEY METHODOLOGY

The study area was surveyed by Janene May (ERM Archaeologist), Alister Bowen (Archaeologist) and Justin Boney of Pejar LALC (refer to *Section 2* of this report). The archaeological survey aimed to assess the entire impact footprint of the development, especially targeting all soil exposures and zones with low vegetation such as areas of erosion and any tracks or paths.

Where Aboriginal cultural heritage sites were identified they were mapped and recorded by the survey team for content, GPS location, landscape features and digitally photographed. Notes were made of soil conditions, evidence of ground disturbance and possible spatial extent of sites. The description of survey coverage includes landform units, the total area surveyed within that landform unit and a quantification of the level of ground exposure and visibility.

Visibility refers to the amount of ground upon which artefacts could be seen. The presence of vegetation, leaf litter and other variables can obscure visibility, which is expressed as a percentage. An exposure is defined as an area in which ground surface disturbance (usually in the form of erosion) results in the removal of ground cover and soils and permits the detection of archaeological material that was formerly contained within a surface or subsurface context. The level of exposure is determined as a percentage.

The calculation of effective coverage provides a means with which to describe the proportion of the study area in which it is possible to assess the presence or absence of archaeological material. This measure is expressed as a percentage and can be calculated using a number of different techniques. For this study effective coverage was calculated by multiplying the area surveyed by the percentage of visibility and exposure within the survey unit. The area of effective coverage was then expressed as a percentage of the whole survey unit.

7.1.1 *Archaeological Potential*

The level of archaeological potential relates to the likelihood of discovering an Aboriginal object or site within a location. Further description should then be made as to the potential condition and integrity of the soil matrix and potential site or site itself.

Archaeological site formation is a complex combination of factors, such as bioturbation and environmental conditions like erosion or the burial of sites through soil movement. Once discarded on the ground's surface, artefacts are often readily incorporated into the topsoil horizons through the process of bioturbation. It is common for dense artefact deposits to exist hidden beneath the ground layer (c.f. Wandsnider and Camilli 1992; Fanning and Holdaway 2001). Archaeological assessments that do not employ appropriate methods for prediction cannot reliably define an area's archaeological content. Frequently, only the eroded component of a larger sub-surface deposit is detected and recorded as a site. Where soils are soft, sandy or in boggy conditions, artefacts can occur at greater depths below surface level. Therefore, it is crucial that the nature of an area's soils, sands and geomorphology are defined correctly in an archaeological assessment and the resulting archaeological implications identified. An understanding of these factors, linked further to the notions of site integrity and condition, results in an understanding of an area or site's archaeological potential.

Areas with archaeological potential within the study area were identified according to the definitions in *Table 7.1*.

Table 7.1 Definitions of Archaeological Potential

Rank	Definition	Example
Very Low potential	Artefacts are very unlikely to occur in situ.	Eroded landforms, reconstructed landscapes, hazardous landscape, developed areas.
Low potential	Artefacts are not normally found in comparable contexts but could occur in low densities making detection unlikely.	Landforms with no specific focus for use, i.e. with no water source or undifferentiated slopes.
Moderate potential	Artefacts are known to occur in comparable landforms in detectable densities (~1artefact/m^2) and there is possibility for detection.	Landforms with an environmental focus which may have seen seasonal Aboriginal visitation.
High potential	Artefacts are consistently found in comparable landforms or similar environmental contexts and will very likely be found if soil excavation occurs.	Landforms with known environmental focus areas encouraging repeat visitation to specific locale, i.e. margins of swamp or near high order creeks.

7.2 *ABORIGINAL HERITAGE*

The survey was conducted according to the survey methodology sent to and consulted with registered Aboriginal groups on 19 November 2013.. The field survey methodology was adopted to pursue the discovery of new archaeological sites, ensure the accurate recording such sites and provide sufficient information to provide an assessment of the study areas cultural significance.

As such, each of the different landforms identified in the study area was surveyed, which included gentle slopes, upper flats, crests and open depressions. Creek lines, mature trees, erosion scours and vehicle and animal access tracks were all inspected. In order to ensure the highest likelihood of finding Aboriginal sites, the field survey focussed on areas of highest ground visibility.

7.2.1 *Fieldwork Constraints*

The fieldwork identified that a large portion of the study area was densely vegetated, resulting in low ground visibility across all landforms encountered. Nevertheless, several exposures were located in each of landforms encountered.

The Effective Survey Coverage Table is shown in *Table 7.3*.

7.2.2 *Survey Units/Transects*

The survey entailed walking linear transects approximately 30m in width. These linear transects form the Survey Units for the study area. The survey of the study area included mostly vehicle tracks, animal paths patches of erosion, areas with little or no ground cover, and open paddocks within the study area. Paddocks were generally densely vegetated, however some areas had been recently ploughed which afforded some visibility. The survey areas took in a number of landforms which defined the survey transects inspected. Survey Units are described in *Table 7.2* followed by photographic examples of selected landscapes. Survey Coverage is shown in *Table 7.3,* and Landform Summary in *Table 7.4.* The location of survey units are identified in *Figures 7.1, 7.2* and *7.3.*

Table 7.2 Description of Survey Units/Transects

Survey Unit	Landform	Description
1	Gentle slope	Survey Unit was located along a bitumen vehicle road and subsequent vehicle dirt track leading to farm outbuildings and homestead. Transect had a generally low visibility with some ground exposures along the bitumen road side (especially under trees and in areas of soil erosion). The dirt vehicle track had good visibility. Surrounding area was heavily vegetated with trees and grass. Material for dirt track observed to be imported – and included numerous pieces of crushed quartz. Disturbances observed include the development of tracks, fencing, cattle grids, several drainage lines, and vegetation clearance. Refer to *Photograph 7.1*. Low Archaeological Potential.
2	Simple Slope	Survey Unit located on eroded vehicle dirt track travelling towards a drainage line. Some good visibility along dirt track and several exposures were noted in areas of soil erosion. Material for dirt track observed to be imported – and included numerous pieces of crushed quartz. Disturbances observed include ploughing, the development of tracks and several drainage lines, as well as vegetation clearance. Refer to *Photograph 7.2*. Low Archaeological Potential.
3	Open Drainage Line	Survey Unit dissects open drainage line along an eroded vehicle track and in the vicinity of previously recorded Aboriginal heritage site Wollondilly 9 (a single silcrete flake). Site not re-identified during this field survey, likely due to subsequent soil erosion. There was good visibility within the drainage line due to exposures caused by soil erosion, and also along the eroded vehicle access track. Area of moderate archaeological potential identified on plateau overlooking drainage line (refer to *Figure 7.3*). Area of potential continues on slopes overlooking drainage line. One new Aboriginal heritage site identified along transect (Crookwell WF 1). Refer to *Photograph 7.3*. Low Archaeological Potential (however, area of Moderate Archaeological Potential identified in adjacent landform).
4	Rolling Hills	Survey Unit traverses crests and simple slopes across a landscape of rolling hills. Site identified on crest (Crookwell WF 2) (see *Figure 7.3*), however, site not considered to have sub-surface archaeological potential due to low density of artefacts. Visibility good along exposures of the eroded vehicle track. Some other exposures found in areas of erosion and under trees. The transect traversed an eroded vehicle track which afforded good visibility, however there was very low visibility due to thick grass coverage in the paddock surrounding the wind turbine A33. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and the construction of a dam. Refer to *Photograph 7.4*. Low Archaeological Potential.

Survey Unit	Landform	Description
5	Open Drainage Line	Survey Unit dissects open drainage line and immediately surrounding terrain in the area of newly recorded Aboriginal site Crookwell WF3 and associated PAD area (see *Figure 7.3*). Some areas of ground visibility caused by soil erosion in the vicinity of the drainage line, and also along the vehicle access track. Sub-surface potential identified within the vicinity of Crookwell WF3 and the surrounding flat terrain adjacent to a tributary of the Wollondilly River. Refer to *Photograph 7.5.* Moderate Archaeological Potential.
6	Slopes	Survey Unit incorporates a series of moderately inclining slopes. Some visibility noted in the form of exposures along the eroded vehicle track. Other exposures found in areas of erosion, under trees and within eroded drainage lines nearby. Area comprised paddocks that were heavily vegetated with grass cover. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.
7	Slopes	Survey Unit is represented by moderately inclining slopes. Generally a poor visibility was noted due to thick grass coverage in paddocks. Basalt outcrops were observed on hill tops and some exposures were found along fence lines and in some areas of soil erosion caused by vehicle access. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing, clearance and other agricultural activities. Refer to *Photograph 7.6.* Low Archaeological Potential.
8	Slopes	Survey Unit gently to moderately sloped inclines within the vicinity of an ephemeral drainage line. Visibility was good along eroded vehicle track and within the drainage line caused by soil erosion. There was no water in the drainage line during this survey. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, animal grazing. Low Archaeological Potential.
9	Slopes	Survey Unit traverses a gentle to moderately sloping terrain. The area crosses through a ridgeline associated with a crest landform unit in which the high density Aboriginal site Wollondilly relocated during this field survey. A new site Crookwell WF4 was also located within this survey unit, within the lower slopes of the crest and adjacent to the ridgeline identified as having archaeological potential. There was some visibility on the crest where Wollondilly is positioned and around a dam near the location of wind turbine A26. An exposure along a sheep track also afforded some good ground visibility. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.7.* Moderate Archaeological Potential.

Survey Unit	Landform	Description
10	Slopes	Survey Unit moderately inclining slopes. Visibility along exposures associated with the eroded vehicle track. Further exposures found in areas of erosion and under trees. Area comprised of paddocks that were heavily vegetated with dense grass. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.
11	Rolling Hills	Survey Unit traverses crests and simple slopes across a landscape of rolling hills. Sites identified on crest and slope landforms (Crookwell WF6, 7 and 8), however not considered to have sub-surface archaeological potential and is within a disturbed context along Grey Siding Road. This survey unit is considered to have a low archaeological potential due to the small number of artefacts encountered (as well as likely movement since deposition based on the heavy disturbance caused by the construction and use of the vehicle access track). Visibility along exposures of the eroded vehicle track and surrounding soil erosion. Surrounding area of paddocks was heavily vegetated with trees and grass. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.8*. Low Archaeological Potential.
12	Rolling Hills	Survey Unit traverses crests and simple slopes across a landscape of rolling hills. Previously identified sites include Hillview Park 6, 7 and 8 (Anderson 2010). New sites identified on sloping crest and flat terrain landforms (Crookwell WF9, 10 and 11), however not considered to have sub-surface archaeological potential and is within a disturbed context along Grey Siding Road. These sites have likely been disturbance and moved since original deposition due to the construction and use of the vehicle access track. Visibility along exposures of the eroded vehicle track and surrounding soil erosion as well as eroded ephemeral drainage lines. Surrounding paddocks were heavily vegetated with trees and grass. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing, soil erosion and other agricultural activities. Low Archaeological Potential.
13	Slopes	Survey Unit moderately inclining slopes. Visibility along exposures of the eroded vehicle track. Other exposures found in areas of erosion, under trees and within eroded drainage lines nearby. Area was comprised of paddocks that were heavily vegetated with dense grass. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities.

Survey Unit	Landform	Description
14	Crest	Survey Unit traverses a crest landform unit. Previously identified site Hillview Park 2 located within survey unit, and additional stone artefacts were found within this survey unit during this field survey. Landform considered as having moderate archaeological potential. Visibility along exposures of the eroded vehicle track. Some other exposures found in areas of erosion and under trees. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Moderate Archaeological Potential.
15	Slope	Survey Unit traverses gentle to moderately inclining slopes and flat terrain between the two previously recorded dense artefact scatters Hillview Park 2 and Hillview Park. Continuation of the Hillview Park 2 stone artefact scatter found within this survey unit. This site is located within sandy soil deposits adjacent to a dam and vehicle track. Visibility was high around the dam and in the vicinity of the Hillview Park site. Due to the high density of artefacts recorded here and the soft sandy deposits the area is considered to have a moderate archaeological potential. Disturbances observed include the construction of a dam, the construction and use of a vehicle access track, land clearance and the construction of fences. Refer to *Photograph 7.9.* High Archaeological Potential.
16	Flat Terrain	Survey Unit traverses flat to gently sloping terrain along a vehicle access track. Some visibility was noted along exposures of the eroded vehicle track, however the area immediately surrounding this track was covered with dense grass. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and some trees were observed to have been cut down in the vicinity of the wind turbine A18. Refer to *Photograph 7.10*. Low Archaeological Potential.
17	Slopes	Survey Unit traverses gently and moderately inclining slopes. Visibility along exposures associated with the eroded vehicle track. Other exposures located in areas of erosion and under trees and within eroded drainage lines nearby. Area comprised heavily vegetated paddocks with dense grass cover. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.

Survey Unit	Landform	Description
18	Flat Terrain	Survey Unit traverses flat and gently sloping terrain. The sites Crookwell WF13 and 16 were found within this area. These were both low density sites and are not considered to have potential for additional sub-surface archaeological deposits. There was generally low visibility here due to dense grass coverage. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.
19	Slopes	Survey Unit traverses moderate and steeply inclining slopes. Visibility along exposures of the eroded vehicle track and in paddocks where ploughing has recently occurred. Area was generally comprised of paddocks that were heavily vegetated with dense grass cover. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.
20	Crest	Survey Unit traverses a crest, and upper mid and lower slopes adjacent to a drainage line. A new site was identified, Crookwell WF14, and was located on a crest and gentle slope towards a drainage line. The site represents a dense stone artefact scatter. Area comprised paddocks with thick grass and a wooded area. Good visibility along exposures of the eroded vehicle track. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.1*1. Moderate Archaeological Potential.
21	Slopes	Survey Unit traverses moderate to steeply inclining slopes. Generally there was a low visibility, however some exposures under trees afforded visibility within wooded areas on hill tops and slopes. The area was comprised of hill slopes and crests that were generally wooded, as well as paddocks forming gently to moderately inclining slopes. Paddocks were generally heavily vegetated with grass cover, and rocky outcrops were observed on hill tops. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Low Archaeological Potential.

Survey Unit	Landform	Description
22	Flat terrain	Survey Unit traverses flat and gently sloping terrain within the vicinity of several drainage lines. An area of high archaeological potential was observed within this Survey Unit due to its deep alluvial soils, proximity to several drainage lines and their confluences, and its flat terrain sheltered from the elements. Visibility was generally poor, due to dense grass coverage. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, the construction of a dam, nearby construction of housing and outbuildings, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.12.* High Archaeological Potential.
23	Gentle Slopes	Survey Unit traverses gently sloping terrain adjacent to a drainage line. Visibility was very poor, with some limited exposures around fence lines. An area of moderate archaeological potential was observed within the newly recorded site Crookwell WF15. This area comprised relatively flat terrain sheltered from the elements by surrounding hills and close to a water source. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.13.* Moderate Archaeological Potential.
24	Slopes	Survey Unit traverses moderate and steeply inclining slopes. The area is comprised of paddocks and generally had a poor level of visibility due to dense grass coverage. Disturbances observed include the development of tracks and vehicle use, vegetation clearance, ploughing, fencing and other agricultural activities. Refer to *Photograph 7.14.* Low Archaeological Potential.

Photograph 7.1 View of Survey Unit 1 looking south-east.

Photograph 7.2 View along Survey Unit 2 looking north-east.

Photograph 7.3 View along Survey Unit 3 looking north-east.

Photograph 7.4 View of Survey Unit 4 looking east.

Photograph 7.5 View of Survey Unit 5 looking north-west.

Photograph 7.6 General landscape of Survey Unit 7 looking east.

Photograph 7.7 View of Survey Unit 9 looking west.

Photograph 7.8 View of Survey Unit 11 looking west.

Photograph 7.9 View of Survey Unit 14 and Survey Unit 15 looking south-west.

Photograph 7.10 View of Survey Unit 16 looking south-west.

Photograph 7.11 View of Survey Unit 20 looking north-west.

Photograph 7.12 Survey Unit 22 looking west.

Photograph 7.13 View of Survey Unit 23 looking south.

Photograph 7.14 General landscape of Survey Unit 24 - looking south.

Table 7.3 Archaeological Survey Coverage

Survey Unit	Landform	Survey Unit Area (m²)	Visibility (%)	Exposure (%)	Area Available for Detection (m²)	Effective Coverage (%)
1	Gentle slope	66000	25	30	4950	7.5
2	Simple Slope	15000	25	20	750	5
3	Open Drainage Line	4350	45	40	783	18
4	Rolling Hills	1600	25	20	80	5
5	Open Drainage Line	6600	45	30	891	13.5
6	Slopes	18000	5	5	45	1
7	Slopes	48000	5	5	120	0.25
8	Slopes	12000	10	15	180	1.5
9	Slopes	6000	10	15	90	1.5
10	Slopes	18000	5	5	45	0.25
11	Rolling Hills	2880	20	20	115	4
12	Rolling Hills	2530	45	45	512	20
13	Slopes	2300	75	90	1553	68
14	Crest	280	35	40	39	14
15	Slope	124	30	30	11	9
16	Flat Terrain	340	95	95	307	90
17	Slopes	1080	20	25	54	5

18	Flat Terrain	1520	30	35	160	11
19	Slopes	1620	15	20	49	3
20	Crest	615	60	65	240	39
21	Slopes	1330	5	5	3	0.2
22	Flat terrain	1100	5	5	3	0.3
23	Gentle Slopes	890	20	20	36	4
24	Slopes	3150	5	5	8	0.3
Average	**-**	**8971**	**27.5**	**28.5**	**459**	**13**
Minimum	**-**	**124**	**5**	**5**	**3**	**0.25**
Maximum	**-**	**66000**	**95**	**95**	**4950**	**90**

Table 7.4 ***Landform Summary – Sampled Areas***

Landform	Landform Area (m²)	Area Effectively Surveyed (m²)	Landform Effectively Surveyed (%)	Number of Sites
Gentle Slope	66890	4986	7.5	1
Simple Slope	15000	750	5	0
Open Drainage Line	10950	1674	15	1
Slopes	109984	2158	2	4
Rolling Hills	7010	707	10	7
Crest	895	279	31.2	2
Flat Terrain	2960	470	15.9	3
Total	213689	11024	86.6	18

7.2.3 Landforms Observed

The archaeological survey classified the landforms within the study area according to (Speight 2009). The study area is situated north of the Wollondilly River and is dissected by several minor watercourses (open-drainage depressions), within valleys, which are surrounding by slopes and crest landform units. The study area traverses various landform units within a wider landscape of rolling hills, as described in *Table 7.2* above.

Several landforms within the study area were observed to have moderate or high levels of potential to contain sub-surface archaeological deposits. These PADs are either associated with already recorded surface sites or determined on environmental features, ehthnographic or archaeological information (refer to *Section 5* of this report). The Aboriginal heritage sites Wollondilly 9, Wollondilly, Crookwell WF3, Crookwell WF4, Hillview Park 2, Hillview Park, Crookwell WF14 and Crookwell WF15 are considered to have an associated PAD. PADs recorded entirely due to their landscape context, with no

archaeological surface manifestations, include Crookwell WF PAD1, Crookwell WF PAD 2 and Crookwell WF PAD 3.

The sites Wollondilly 9 and Hillview Park 2 are both located within crest landform units and contain a high number of stone artefacts that encompass various material types and stages of tool manufacturing process. It is considered that these areas were likely used as long-term camp sites by Aboriginal people in the past. The ridgeline adjacent to Wollondilly 9 (Crookwell WF PAD 2) is similarly an elevated landform unit sheltered from the elements, near a creekline, and is considered to have potential sub-surface deposits. The flat landform adjacent to creek lines and the Wollondilly River (Crookwell PAD 1), Crookwell WF3 and Hillview Park are also considered to have potential for additional sub-surface deposits.

The elevated crest and upper slopes underlying the surface stone artefact scatter named Crookwell WF15 are also considered to have sub-surface potential due to their sheltered nature, proximity to water and high number of artefacts recorded (refer to *Photograph 7.13*). Crookwell WF PAD 3 was also recorded as a PAD area due to the flat terrain, proximity to water and sheltered nature.

The landforms described above are shown in *Photograph 7.5, Photograph 7.9, Photograph 7.12, Photograph 7.13*, *Photograph 7.15* to *Photograph 7.23*.

Photograph 7.15 Flat plateau associated with Crookwell WF PAD 1 looking south-east.

Photograph 7.16 View of ridgeline and crest of PAD associated with Wollondilly and Crookwell WF PAD2

Photograph 7.17 View of slopes and flat terrain of PADs associated with Hillview Park and Hillview Park 2, looking north.

Photograph 7.18 View of crest landform PAD associated with Crookwell WF14 looking east.

Photograph 7.19 View of slopes of PAD associated with Crookwell WF14 looking south.

7.2.4 *Soil Conditions (Integrity and Condition)*

Soils across the study area range from alluvial soils adjacent to water courses with thin sandy-silty Aeolian soil in colours of deep orange and red, to a light yellow/brown and dark brown.

Soils associated with higher order watercourses are deep and alluvial in nature. An inspection of the study area's flood plains and lower slope areas show 2-3 m of undifferentiated soils (i.e. no obvious typical duplex soil conditions) overlying clay and bedrock materials. These soils have most likely been deposited by flood events (i.e. alluvial soils could contain Aboriginal sites. The long term effects of flooding and soil deposition have created a stratigraphical sequence in which sub-surface Aboriginal sites may exist (where soil horizons contain archaeological sites of increasing age with depth).

Disturbance to the soil profile has occurred during past episodes of vegetation clearance and ploughing of the upper soil layers (approximately the top 300mm of soil). This has resulted in an interface between the A and B soil horizons and a large amount of angular stones becoming displaced and brought to the surface.

7.2.5 *Observed Aboriginal Sites*

Five previously recorded sites were located and re-inspected (sites Hillview Park 8, Hillview Park 7, Hillview Park 2, Hillview Park and Wollondilly). Several previously recorded sites could not be re-located (sites Hillview Park 6, Hillview Park 5, Hillview Park 4, Hillview Park 3 and Wollondilly 9) due predominantly to dense grass coverage and subsequent movement of sites due to ploughing, vehicle, erosional and agricultural activities. Sixteen new Aboriginal sites were located during the field survey (the sites have been named Crookwell WF1 to Crookwell WF16), and three new areas of PAD were also identified (Crookwell WF PAD 1, 2 and 3). PAD areas were also identified in association with several of the previously recorded surface sites (Wollondilly 9, Wollondilly, Crookwell WF3, Crookwell WF4, Hillview Park 2, Hillview Park, Crookwell WF14 and Crookwell WF15). These sites comprise

isolated stone artefact finds and stone artefact scatters and are described below. The location of these sites is shown in *Figures 7.4* and *7.5* and coordinates are provided in *Table 7.5*.

Previously Identified Sites

Wollondilly

Wollondilly was previously identified by Anderson (2010) as an artefact scatter consisting of 7 quartz fragments. The site is located on an elevated crest landform unit within a wider landscape of rolling hills and in the near vicinity of a drainage line.

Aboriginal stakeholder group Pejar LALC previously determined the site to be of low significance (Anderson 2010) , however on re-examination during this field survey this site was reassessed as having a high significance to local Aboriginal stakeholders. This site was re-located and recorded during this field survey and found to contain a large number of stone artefacts of varied material and type. The site also demonstrated various stages of the stone tool manufacturing process and incorporated large cores, flaked pieces and flaking debitage. The site was found to have an associated area of high archaeological potential, due to the high density of artefacts found. The site and its associated PAD covers an area of approximately 200m by 130m (refer to *Figure 7.4*). Due to the high density of artefacts found at this location and potentially minimal disturbances to deeper stratigraphic levels (where ploughing has not caused disturbance), it is considered that this site has the potential to yield intact archaeological deposits.

Due to its potential to yield sub-surface archaeological deposits, its range of lithic raw material and representations of various stages of the stone tool manufacturing process, Wollondilly is considered be of moderate archaeological significance. Refer to *Figure 7.4* and *Photographs 7.20* and *7.21*. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.20 Sample of artefacts found at Wollondilly.

Photograph 7.21 View of Wollondilly looking south.

Wollondilly 9

Wollondilly 9 was previously identified by Anderson (2010) as a single grey silcrete flake measuring 37 mm x 27 mm x 12 mm. The site was previously considered to be of low archaeological significance and assessed by Pejar LALC as having a low cultural significance (Anderson 2010). The drainage line and surrounding area where the site was recorded was carefully examined as part of this survey and the site could not be re-located – most likely due to vegetation regrowth and subsequent soil erosion. The site is located immediately adjacent to an ephemeral drainage line within an area of heavy soil erosion. There was no water in this drainage line at the time of this survey. The area surrounding this water course consists of cleared paddocks of a flat to gently sloping terrain, and it is possible that the artefact found could have been previously located on adjacent upper slopes or hill tops. A gently sloping plateau of moderate archaeological potential (Crookwell WF PAD1) was identified adjacent this previously recorded site, and Wollondilly 9 may be associated with this PAD (refer to *Figure 7.4*).

Silcrete pieces are not rare in a local or regional archaeological context (refer to Section 5 of this report), and due to the material and artefact type, and the site's low potential to yield further archaeological deposits the site is considered to be of a low archaeological significance. Refer to *Photograph 7.27* and *Figure 7.4*.

Hillview Park 8

Hillview Park 8 was previously recorded by Anderson (2010) and was re-located and recorded during this field survey. Anderson (2010) described the site as an artefact scatter containing 41 fragments of brown silcrete and it was considered to be of moderate archaeological significance. Pejar LALC determined the site to be of moderate cultural significance. On rerecording the site, ERM found it to contain a large variety of lithic materials and stone artefact types including silcrete, quartz and quartzite. The site is a high

artefact density site with artefacts encountered predominantly within an area of erosion formed through an ephemeral drainage line. The site is located adjacent to an ephemeral drainage line (no water was observed during the survey) and is within a flat landform unit within a wider landscape of rolling hills. Soils at the site were noted to be a fine soft light brown loam to yellow sandy deposit, and it is considered that artefacts could have easily been redeposited into sub-surface stratigraphic layers, and this location is considered to have a potential to yield sub-surface archaeological deposits.

Due to its wide range of material and artefact type, its high density of artefacts and sub-surface archaeological potential this site is considered to be of moderate scientific significance. Refer to *Figure 7.5* and *Photographs 7.22* and *7.23*. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.22 Sample of artefacts found at Hillview Park 8.

Photograph 7.23 View of Hillview Park 8 looking south-east.

Hillview Park 7

Hillview Park 7 was previously identified by Anderson (2010) as one brown silcrete flake measuring 30 mm x 25 mm x 14 mm. The site was described as located near a fence line on the existing Greywood Siding Road track. This site was carefully searched for, but could not be re-located during this field survey. However, a grey silcrete core was located and archaeologically recorded at this location measuring 4.2 cm x 4 cm x 1.2 cm. The core contained two negative flake scars. The previously recorded flake may have become displaced through vehicle disturbance or erosion. The site is not considered to be rare in terms of its content within a local and regional context, and due to its low density and disturbed context it is considered to have a low potential to yield further archaeological deposits.

Silcrete pieces are not rare in a local or regional archaeological context (refer to Section 5 of this report), and due to the material and artefact type, and the site's low potential to yield further archaeological deposits the site is considered to be of a low archaeological significance. Refer to *Photograph 7.27* and *Figure 7.5.* Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.24 Artefact found at Hillview Park 7 (left) and view of site looking north.

Hillview Park 6

Hillview Park 6 was previously identified by Anderson (2010) as a single silcrete core located on Greywood Siding Road. The site was considered to be of low archaeological significance by Anderson (2010) and also of low cultural significance by Pejar LALC (Anderson 2010). The location of the previously recorded site was carefully examined as part of this survey. However the site was not relocated – most likely due to artefact movement from vehicle disturbance or erosion. Refer to *Photograph 7.25* and *Figure 7.5* for the location of this site.

Photograph 7.25 View of location of Hillview Park 6 looking north.

Hillview Park 5

Hillview Park 5 was previously identified by Anderson (2010) as a small artefact scatter containing two grey silcrete flakes with a maximum size of 31 mm. The site was considered to be of low archaeological and cultural significance (Anderson 2010). The location of the previously recorded site was examined as part of this survey and the site was not relocated – most likely due to erosion, soil movement and agricultural activities. Refer to *Photograph 7.26* and *Figure 7.5* for the location of this site.

Photograph 7.26 View of location of Hillview Park 5 looking north.

Hillview Park 4

Hillview Park 4 was previously identified by Anderson (2010) as a small artefact scatter containing two grey silcrete flakes with a maximum size of 40 mm. The site was considered to be of low archaeological and cultural significance (Anderson 2010). The location of the previously recorded site was examined as part of this survey and the site was not relocated – most likely due to erosion, soil movement and agricultural activities. Refer to *Photograph 7.27* and *Figure 7.5* for the location of this site.

Photograph 7.27 View of location of Hillview Park 4 looking north-east.

Hillview Park 3

Hillview Park 3 was previously identified by Anderson (2010) as a single brown silcrete flake and was recorded as having low archaeological and cultural significance (Anderson 2010). The location of the previously recorded site was examined as part of this survey and the site was not relocated – most likely due to ploughing activities subsequent to Anderson's survey (2010). Refer to *Photograph 7.28* and *Figure 7.5* for the location of this site.

Photograph 7.28 View of location of Hillview Park 3 looking south.

Hillview Park 2

Hillview Park 2 was previously identified by Anderson (2010) as an artefact scatter containing 8 artefacts of quartz and silcrete positioned along a farm vehicle track. The site was considered to be of low archaeological significance and low to moderate cultural significance (Anderson 2010). The site was relocated during the current field inspection and is positioned within a crest landform unit located above a drainage line). The site contains 10+ artefacts including a grey silcrete proximal flake of 2 x 2.5 x 0.3 cm, a silcrete medial flake 2.5 x 2 x 0.4 cm, a silcrete core 4.3 x 3 x 3.4 cm, a proximal silcrete flake 2 x 1.2 x 0.7 cm. Refer to *Photograph 7.29* and *Figure 7.5* for the location of this site.

Due to the high density of artefacts and proximity to water and the extensive (in terms of size and artefact density) site Hillview Park, this site is considered to have sub-surface archaeological potential and be of moderate archaeological significance. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.29 Sample of artefacts at Hillview Park 2 (left) and view of site looking east (right).

Hillview Park

Hillview Park was previously identified by Anderson (2010) a stone artefact scatter consisting of 17 artefacts adjacent to a dam and a natural drainage line. The soils were described as sandy loam and the drainage line as a tributary of Steeves Creek. Anderson (2010) describes the site as having a moderate archaeological potential. ERM archaeologists relocated this site and identified a large number of artefacts present within the vicinity of the dam and drainage line. The soft sandy soils here are considered to have a high potential to contain sub-surface archaeological deposits. An example of the located artefacts is shown below (*Photographs 7.24 – 7.26*) and includes a range of quartz and silcrete artefacts**.** Refer to *Figure 7.5.* A variety of stone artefact types were found including flakes, cores and a hammerstone with retouch and use wear present on several pieces.

Due to its wide range of material and artefact type, its high density of artefacts and sub-surface archaeological potential this site is considered to be of moderate scientific significance. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.30 Sample of Artefacts found at Hillview Park.

Photograph 7.31 Sample of Artefacts found at Hillview Park.

Photograph 7.32 Sample of Artefacts found at Hillview Park (right).

New Sites Identified

Crookwell WF1

Crookwell WF1 consists of a single isolated quartz piece with a negative flake scar measuring 3 x 4 x 0.5 cm. The site is located on a simple slope/lower slope landform, above a flat terrain landform adjacent to a creek line. This adjacent flat terrain landform is located next to an ephemeral drainage line and has been assessed as having potential to contain archaeological deposits. It is possible that this quartz artefact and pieces within this landform have been relocated from surrounding upper slopes and crests. This artefact is not likely in its original location, and the site is considered to be of low integrity. The site is considered to have a low potential to yield further archaeological deposits due to its disturbed nature (vehicle access track, ploughing, land clearance) and low density of artefacts found.

Quartz pieces are not rare in a local or regional archaeological context (refer to Section 5 of this report), and the site is therefore considered to be of a low archaeological significance. Refer to *Photograph 7.27* and *Figure 7.4*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.33 Quartz artefact found at Crookwell WF1 (left) and view of site looking south-east (right).

Crookwell WF2

Crookwell WF2 consists of four silcrete and quartz artefacts found at a gateway along an eroded vehicle farm track exposure. The site is located in a crest landform within a wider landscape of rolling hills. The site is located approximately 250m north of the nearest water source (an ephemeral drainage line). Water was not observed at this drainage line during the field survey. The site contains three silcrete flakes and one crystal quartz flake. These artefacts measure 2.4 cm x 1.2 cm x 0.3 cm, 1.3 cm x 1.5 cm x 0.4 cm, 1.3 cm x 0.9 cm x 0.3 cm and 0.9 cm x 1.8 cm x 0.2 cm. The artefacts were found within an eroded vehicle access track, allowing for relatively good visibility. It is possible that further artefacts may be located in this area, where grass coverage hindered identification. Heavy disturbances including ploughing, land clearance and the construction of fencing were observed at this site. Due

to vehicle movement and these disturbances it is considered likely that these artefacts are not within their original location.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider area, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.28* and *Figure 7.4*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.34 Artefacts found at Crookwell WF2 (left) and view of site looking south-west (right)

Crookwell WF3

Crookwell WF3 consists of an artefact scatter containing four silcrete stone artefacts including flakes and cores. The artefacts found were all of grey silcrete. The site is located at a gateway on an elevated gentle slope just above a creek line. The artefacts were identified within an exposure along a vehicle access track leading towards the creek line. This exposure afforded good visibility of the ground surface allowing for the identification of artefacts. The surrounding area was comprised of paddocks that were heavily grassed. Additional artefacts may be located within this area, however poor ground surface visibility hindered their identification. Soils at the area consisted of a fine brown to grey loose loam.

Due to its proximity to water and the gently sloping terrain in which this site was found is considered to have the potential to contain further sub-surface and surface artefacts.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. However, the site is considered to have a moderate potential to contain additional sub-surface and surface artefacts, and is therefore considered to have a moderate archaeological significance. Refer to *Photograph 7.35* and *Figure 7.4*. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.35 Artefacts found at Crookwell WF3 (left) and view of site looking south-east (right).

Crookwell WF4

Crookwell WF4 was found along an eroded sheep track below the crest of the previously recorded Wollondilly 9 site (Anderson 2010). The site was found within upper slopes, and may have been washed down from the Wollondilly 9 site. The area in which the site was found has been subjected to disturbances including heavy ploughing, land clearance and animal grazing. Two artefacts were found - two silcrete flakes measuring 2.2 x 1.5 x 0.3 cm and 1.1 x 0.8 x 0.2 cm. Refer to *Photograph 7.30* and *Figure 7.4*. There was some ground surface visibility along the eroded sheep track where the artefacts were identified.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider area, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.36* and *Figure 7.4*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.36 Sample of artefacts found at Crookwell WF4 (left) and view of site looking east (right).

Crookwell WF5

Crookwell WF5 consists of one quartz flake and one silcrete flake within a flat to gently sloping terrain and within a wider landscape of rolling hills. The site was located approximately 80m from an ephemeral drainage line (no water was observed the time of this survey). The artefacts found consisted of quartz and silcrete measuring 1.2 x 0.9 x 0.4 cm and 3.2 x 1.3 x 0.3 cm. Soils at the area had been heavily ploughed, and consisted of a dark brown fine loam. The artefacts were identified in an exposure caused by soil erosion from vehicle use.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local area, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.37* and *Figure 7.4*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.37 Sample of artefacts found at Crookwell WF5.

Photograph 7.38 View of Crookwell WF5 looking north.

Crookwell WF6

Crookwell WF6 consists of four pieces of silcrete measuring 2.5 x 4 x 1.8 cm, 2 x 1 x 0.5 cm, 0.8 x 0.5 x 0.2 cm and 1.2 x 0.8 x 0.3 cm. The site was located on a simple slope/lower slope landform above a flat terrain landform within a wider landscape of rolling hills. The site was found within a disturbed context of a well-used vehicle track. Imported material including crushed quartz was found within this track. Heavy soil erosion was also observed along the side of the track. Due to the disturbance caused by the construction of the vehicle access track and other impacts to the area such as ploughing, land clearance, and the construction of fences, it is not likely that these artefacts are in their original location. The site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.39* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.39 Sample of artefacts found at Crookwell WF6 (left) and view of the site looking east (right).

Crookwell WF7

Crookwell WF7 consists four pieces of quartz measuring 2.5 x 4 x 1.8 cm, 2 x 1 x 0.5 cm, 0.8 x 0.5 x 0.2 cm and 1.2 x 0.8 x 0.3 cm. The artefacts consisted of broken flakes. The site is located on a simple slope/lower slope landform above a flat terrain landform within rolling hills. The artefacts were found on a vehicle access track. The site was found within a disturbed context of a well-used vehicle track. Imported material including crushed quartz was found within this track. Heavy soil erosion was also observed along the side of the track. Due to the disturbance caused by the construction of the vehicle access track and other impacts to the area such as ploughing, land clearance, and the construction of fences, it is not likely that these artefacts are in their original location. The site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.39* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.40 Sample of artefacts found at Crookwell WF7 (left) and view of the site looking east (right).

Crookwell WF8

Crookwell WF8 contains several pieces of quartz and a silcrete core, formerly a flake. These artefacts measure 1.6 x 1.3 x 0.3 cm 2 x 1.8 x 0.3 cm, 0.9 x 1 x 0.2 cm and 5 x 4 x 4.2 cm. The site is located on a gently sloping terrain within a lower slope landform. It is located within a wider context of rolling hills. The artefacts were found on a vehicle access track. Heavy soil erosion was observed along the track. Several disturbances to the area were observed such as vehicle use, ploughing, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.41 – 7.42* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.41 Sample of artefacts found at Crookwell WF8.

Photograph 7.42 Sample of artefacts found at Crookwell WF8 (left) and view of site looking west (right).

Crookwell WF9

Crookwell WF9 is an artefact scatter containing five silcrete artefacts including a core 4 x 3 x 1.5 cm, and flakes measuring 4 x 2.5 x 0.3 cm, 1 x 1 x 0.2 cm, 4 x 2 x 1.5 cm and 2 x 1.5 x 1 cm. The site was found at a gateway within an elevated hill top landform in a wider landscape of rolling hills. The artefacts were found on a vehicle access track at a gateway. Heavy soil erosion was observed along the track. Several disturbances to the area were observed such as vehicle use, ploughing, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance.

Refer to *Photograph 7.43* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.43 Sample of artefacts found at Crookwell WF9 (left) and view of site looking south-west (right).

Crookwell WF10

Crookwell WF10 is a single silcrete core measuring 3.2 x 4 x 2.5 cm. The artefact was found within an elevated hill top landform in a wider landscape of rolling hills. The site was found at a gateway within an elevated hill top landform in a wider landscape of rolling hills. The artefacts were found on a vehicle access track at a gateway. Heavy soil erosion was observed along the track. Several disturbances to the area were observed such as vehicle use, ploughing, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.43* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.44 Artefact found at Crookwell WF10 (left) and view of site looking north (right).

Crookwell WF11

Crookwell WF11 is a single silcrete flake found along an eroded vehicle track within a flat terrain landform across a wider landscape of rolling hills. The flake measures 4.2 x 3 x 0.6 cm. Heavy soil erosion was observed along the track. Several disturbances to the area were observed such as vehicle use, ploughing, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.45* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.45 Artefact found at Crookwell WF11 (left) and view of site looking south (right).

Crookwell WF12

Crookwell WF12 consists of an artefact scatter found on an eroded sheep track. This site contained a grey silcrete proximal flake of 2 x 2.5 x 0.3 cm, a silcrete medial flake 2.5 x 2 x 0.4 cm, a silcrete core 4.3 x 3 x 3.4 cm and a proximal silcrete flake 2 x 1.2 x 0.7 cm. The site was found within a gently sloping terrain within a winder landscape context of rolling hills. The site is located approximately 300m south of an ephemeral drainage line. The site was located in a paddock which was observed to have been recently ploughed, with the upper soil horizon being heavily disturbed. Due to this, it is considered likely that these artefacts are no longer in their original deposition location. Several other disturbances to the area were observed such as vehicle use, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.46* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.46 Sample of artefacts found at Crookwell WF12 (left) and view of site looking west.

Crookwell WF13

Crookwell WF13 is comprised of a silcrete grey silcrete flake. The flake is located within a gently sloping landform near an ephemeral drainage line (no water was observed here during the field survey). It measures 2.8 x 1.2 x 0.5 cm. Several disturbances to the area were observed such as vehicle use, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.47* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.47 Artefact found at Crookwell WF13 (left) and view of site looking west.

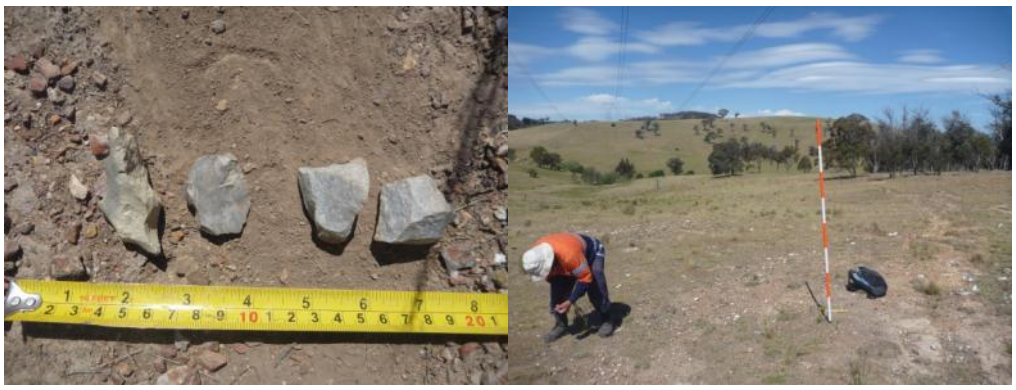
Crookwell WF14

Crookwell WF14 is a large stone artefact scatter found within a crest and upper/mid slop landform unit adjacent to a drainage line. The site is extensive in terms of size and artefact density. The site area measures approximately 200 m by 450 m and traverses two landform types including a crest and an upper slope. The site contained 50+ stone artefacts including quartz and silcrete material. Artefacts found include a silcrete flake measuring 4.3 x 2.1 x 0.6 cm, silcrete flake measuring 2.2 x 1.4 x 0.4 cm, silcrete flake measuring 4 x 2.3 x 0.7 cm, a quartzite flake measuring 4.5 x 3.5 x 0.9 cm, a silcrete flake measuring 2.2 x 0.7 x 0.2 cm, a quartz flake measuring 3.8 x 1.2 x 0.3 cm (*Photograph 7.48)*.

Due to the high density of artefacts and proximity to water this site is considered to have sub-surface archaeological potential and be of moderate archaeological significance. Refer to *Photographs 7.48 – 7.49* and *Figure 7*.5. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.48 Sample of artefacts found at Crookwell WF14.

Photograph 7.49 Sample of artefacts found at Crookwell WF14 (left) and view of sight looking east.



Crookwell WF15

Crookwell WF15 was located on a flat plateau above a drainage line. Five silcrete artefacts were found including a flake measuring 2 x 1 x 0.3 cm, a flaked piece measuring 2.7 x 1 x 0.4 cm, a flake measuring 0.6 x 0.4 x 0.1 cm, a flaked piece measuring 2.4 x 1.3 x 0.4 cm and a flake measuring 1.5 x 0.9 x 0.2 cm. The site was found to be approximately 250 m by 70 m, and a surrounding area of moderate archaeological potential measures approximately 500 m by 200 m, running north-south parallel to the drainage line. The soils at the area were observed to be soft, dark brown and alluvial in nature. It is likely that further artefacts have been deposited or relocated to lower stratigraphic layers, and so it is considered that this area has a moderate archaeological potential.

Due to the areas landform context, the soft alluvial soils and proximity to water this site is considered to have sub-surface archaeological potential and be of moderate archaeological significance. Refer to *Photographs 7.50* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that sub-surface testing occur prior to any impact at this site.

Photograph 7.50 Sample of artefacts found at Crookwell WF15 (left) and view of sight looking south.

Crookwell WF16

Crookwell WF16 is an artefact scatter consisting of three grey silcrete flakes identified on a gentle slope adjacent to an ephemeral drainage line. The site is located within a wider context of rolling hills. Three artefacts were found all consisting of grey silcrete flakes measuring 2.2 x 1.2 x 0.5 cm, 1.1 x 0.9 x 0.2 cm and 5.2 x 3.5 x 0.6 cm. Several disturbances to the area were observed such as vehicle use, land clearance, and the construction of fences and the low number of artefacts found. Due to these disturbances, the landform context and the low number of artefacts found, this site is considered to have a low potential to contain sub-surface archaeological deposits.

Due to the low number of artefacts found, and the regular occurrence of the material and artefact type identified in the local and wider region, it is considered that this site has a low archaeological significance. Refer to *Photograph 7.47* and *Figure 7.5*. Recommendations provided in *Section 8* of this report propose that this site be collected prior to any disturbances.

Photograph 7.51 Artefacts found at Crookwell WF16 (left) and view of sight looking north-west.

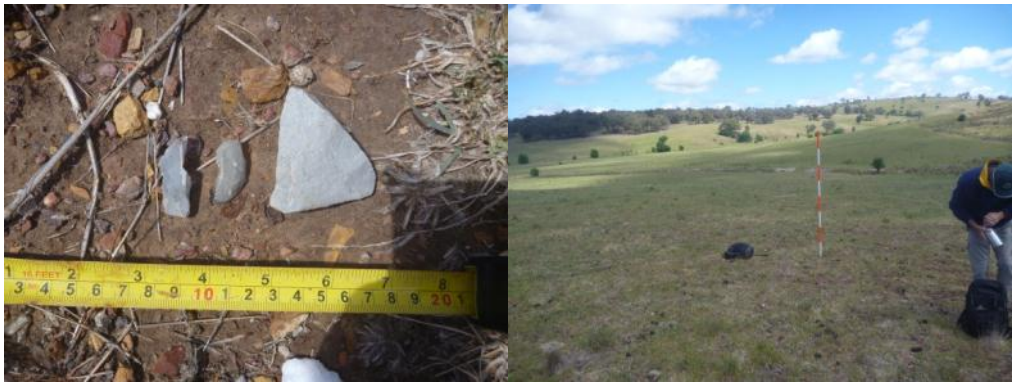
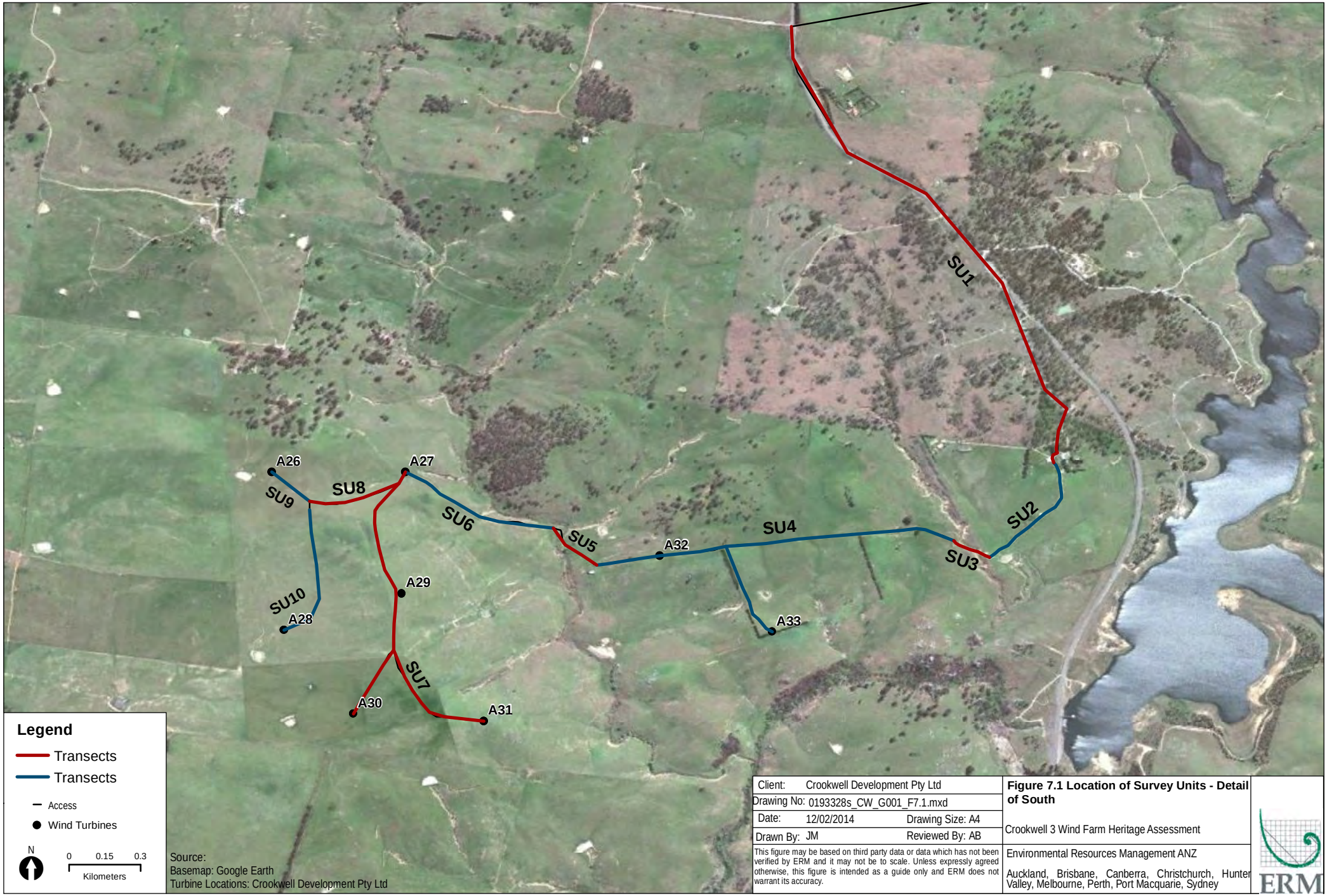


Table 7.5 Coordinates for newly recorded sites

Site Name	X	Y	Site Name	X	Y
CWF1	735612	6170934	CWF11	743656	6170143
CWF2	735926	6170332	CWF12	743873	6172689
CWF3	735046	6170814	CWF13	743445	6173283
CWF4	733944	6171168	CWF14	742992	6173868
CWF5	734242	6171014	CWF15	742464	6174698
CWF6	743260	6169715	CWF16	742972	6173864
CWF7	742295	6169869	CWF PAD 1	735944	6170710
CWF8	741279	6170042	CWF PAD 2	734107	6171261
CWF9	743625	6170002	CWF PAD 3	741300	6173792
CWF10	743716	6170441			

7.3 HISTORICAL HERITAGE

No historical heritage items or sites were found during the field survey, and there are no known non-Aboriginal heritage items located within the project's impact area. Several items have been previously identified in the wider region of the impact area, including the Leeston homestead and the Hillview Park Property homestead and its surrounding buildings (Anderson 2010). These items will not be affected by the proposed development.



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Date:	12/02/2014
Drawing Size:	A4
Drawn By:	JM
Reviewed By:	AB

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 7.1 Location of Survey Units - Detail of South

Crookwell 3 Wind Farm Heritage Assessment

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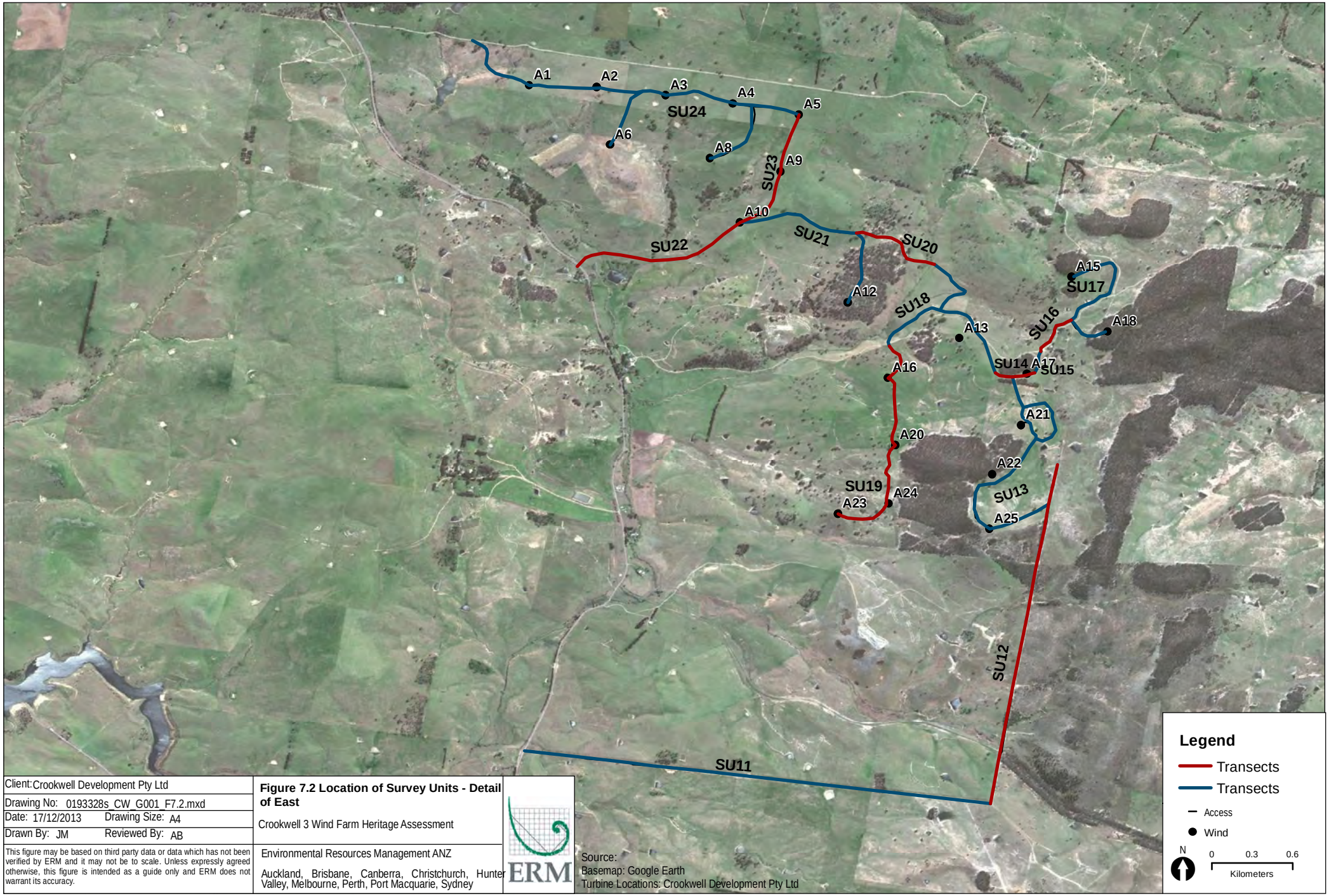

Client: Crookwell Development Pty Ltd	**Figure 7.2 Location of Survey Units - Detail of East**
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Date: 17/12/2013 Drawing Size: A4	
Drawn By: JM Reviewed By: AB	Environmental Resources Management ANZ
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.	Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

Source:
Basemap: Google Earth
Turbine Locations: Crookwell Development Pty Ltd

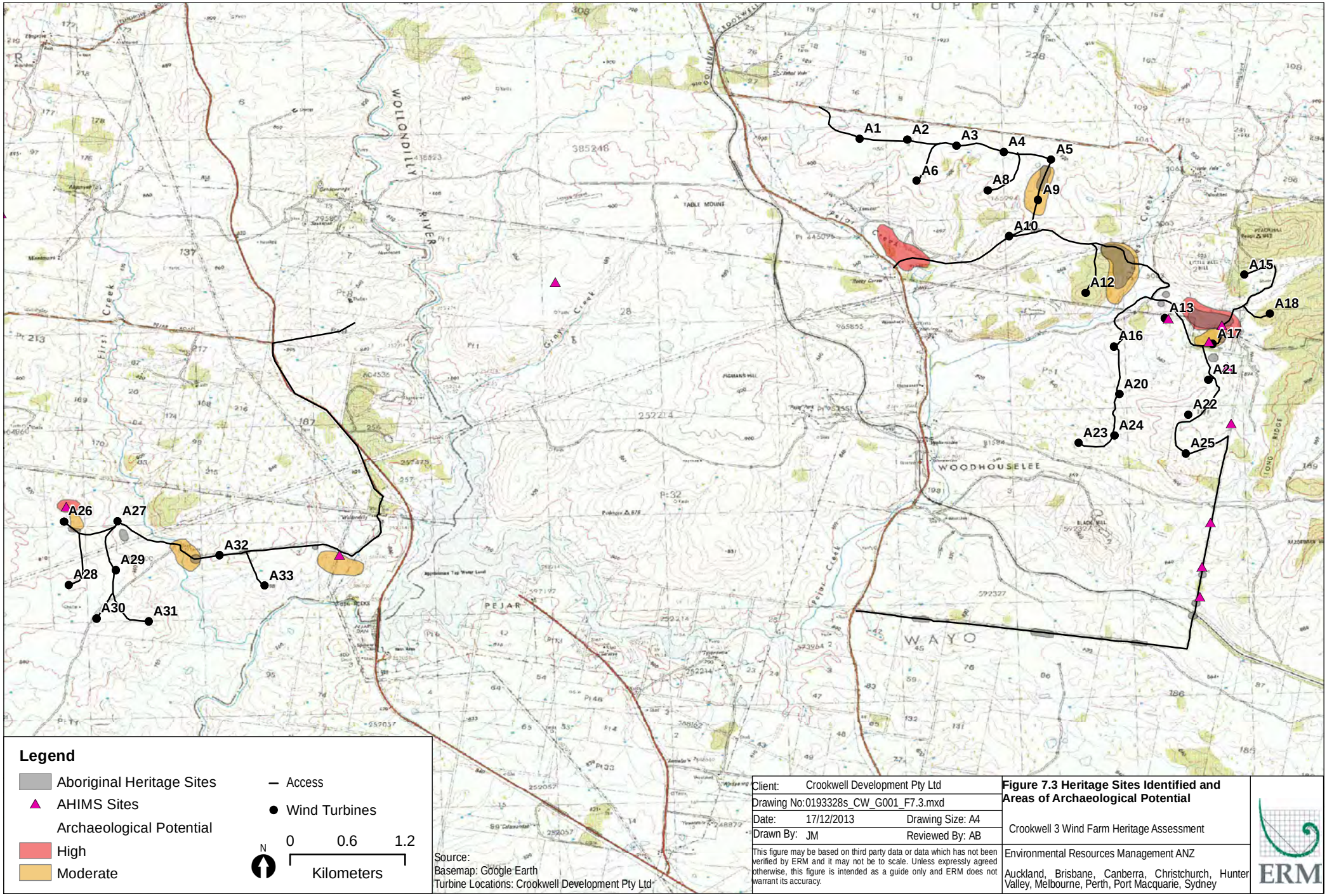

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Figure 7.3 Heritage Sites Identified and Areas of Archaeological Potential

Crookwell 3 Wind Farm Heritage Assessment

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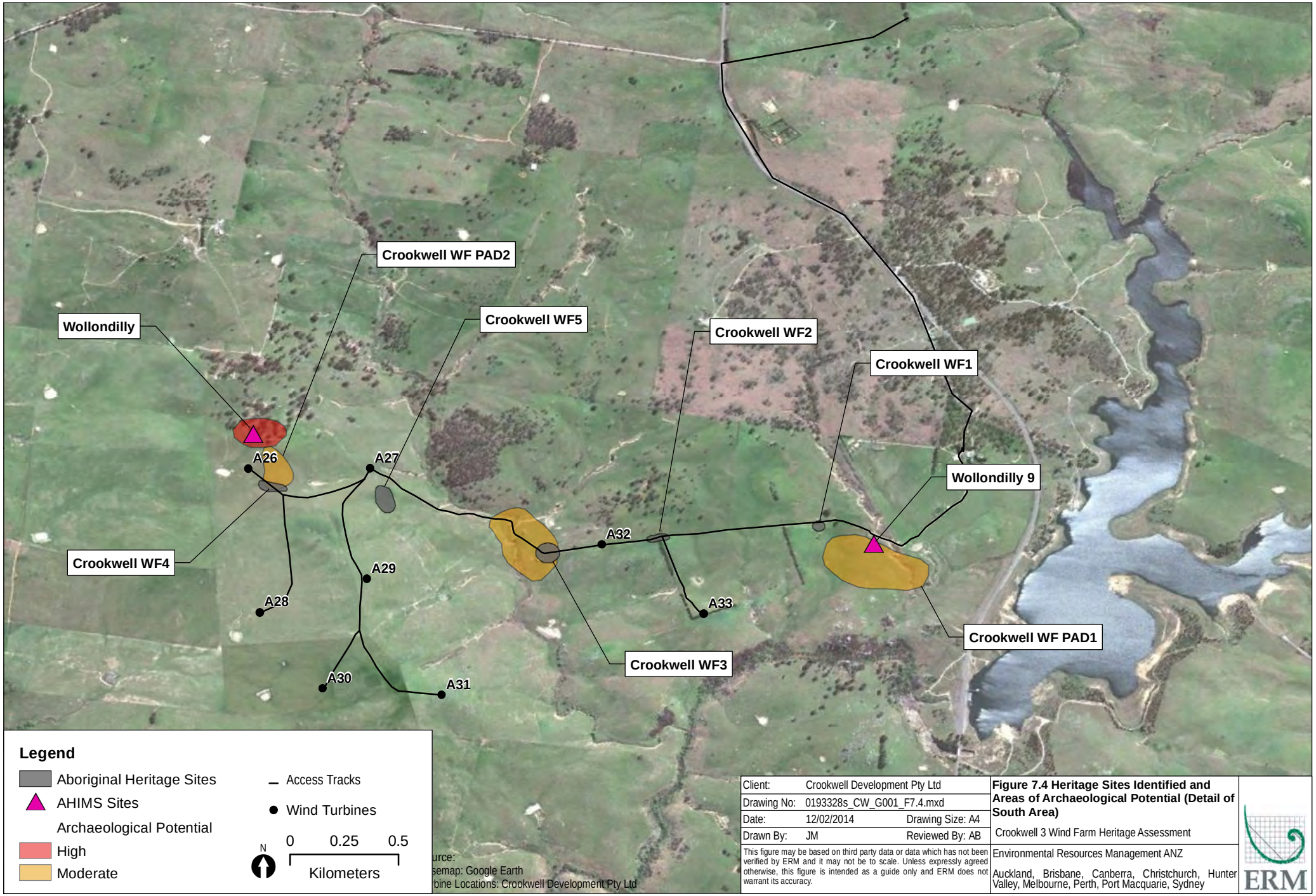

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Figure 7.4 Heritage Sites Identified and Areas of Archaeological Potential (Detail of South Area)

Crookwell 3 Wind Farm Heritage Assessment

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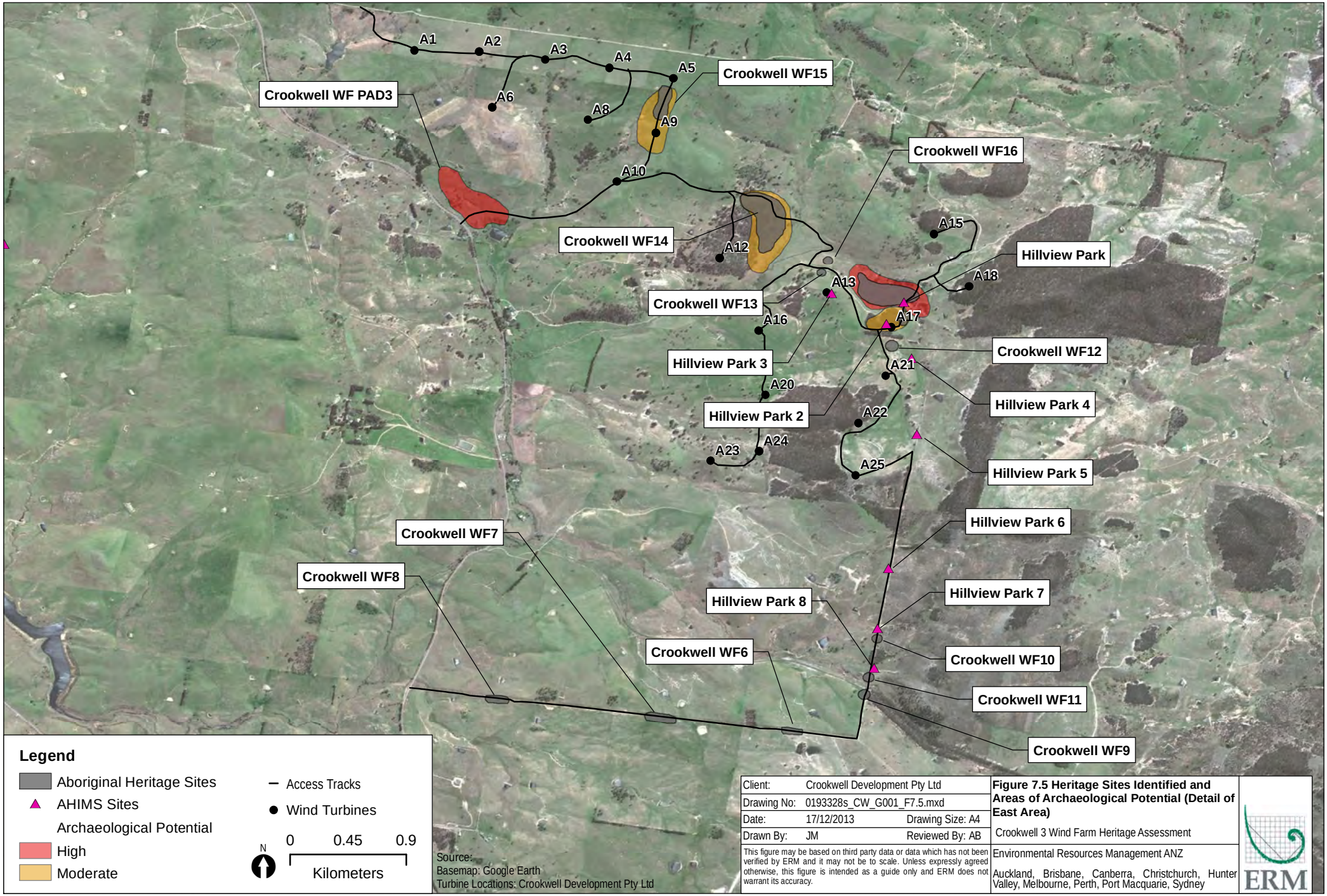
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Crookwell WF PAD3
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Crookwell WF16
Crookwell WF14
Crookwell WF13
Hillview Park
Hillview Park 3
Hillview Park 2
Crookwell WF12
Hillview Park 4
Hillview Park 5
Hillview Park 6
Hillview Park 7
Hillview Park 8
Crookwell WF7
Crookwell WF8
Crookwell WF6
Crookwell WF10
Crookwell WF11
Crookwell WF9
Legend
Aboriginal Heritage Sites
AHIMS Sites
Archaeological Potential
High
Moderate
Access Tracks
Wind Turbines
N
0
0.45
0.9
Kilometers
Source:
Basemap: Google Earth
Turbine Locations: Crookwell Development Pty Ltd
Client: Crookwell Development Pty Ltd
Drawing No: 0193328s_CW_G001_F7.5.mxd
Date: 17/12/2013
Drawing Size: A4
Drawn By: JM
Reviewed By: AB
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Figure 7.5 Heritage Sites Identified and Areas of Archaeological Potential (Detail of East Area)
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Environmental Resources Management ANZ
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8 SIGNIFICANCE ASSESSMENT

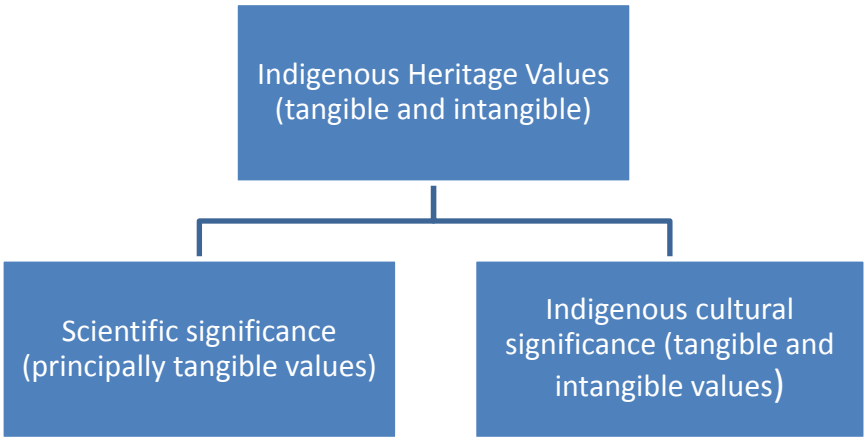
The heritage values significance assessment for the study area has been assessed in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and encompasses the four values outlined in the *Burra Charter* (social, historical, scientific and aesthetic) (Australian ICOMOS 1999).

8.1 ABORIGINAL HERITAGE

8.1.1 Preamble

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

ERM's approach to this Aboriginal heritage assessment is based upon identifying the key Aboriginal heritage values; values that are likely to be both tangible and intangible. In accordance with Australian best practice documents, this approach needs to consider the values assessment from the scientific and Aboriginal community perspectives.



The NPWS Aboriginal Cultural Heritage Standards and Guidelines Kit (1997) states:

> While Aboriginal sites and places may have educational, tourism, and other values to groups in society, their two principal values are their cultural/social significance to Aboriginal people and their scientific significance to archaeologists. It is thus possible to identify two main streams in the overall significance assessment process: the assessment of cultural/social significance to Aboriginal people and the assessment of scientific significance to archaeologists… (1997: PDF page 92)

This assessment focuses upon the scientific significance assessment of the sites recorded during the survey. The cultural significance assessment assessed in *Section 8.1.4* of this report. The Aboriginal community has provided input into the survey and assessment and has been afforded the opportunity to comment on this report for a cultural and social significance assessment of the sites recorded.

8.1.2 Background: Scientific Significance Assessment

The primary guide to the management of heritage places is the Australia ICOMOS Burra Charter 1999.

This assessment has sought to identify Aboriginal heritage objects and sites within the study area and obtain sufficient information to allow the scientific values of those objects and sites to be determined. NPWS (1997:93) have stated that *'while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential'*. As such, seven key criteria may be used to examine the scientific value/significance of a site. These are:

- Rarity: whether any or all aspects of a site (type, location, integrity, content and archaeological potential) can be considered common or rare within a local, regional or national context;

- Representativeness: the comparative rarity of the site when considered and contrasted against other similar sites conserved at the local and/or regional level;

- Archaeological landscapes: the study of the cultural sites relating to Aboriginal peoples within the context of their interactions in the wider social and natural environment they inhabited. Landscapes can be large or small depending upon specific contexts (i.e. local or regional conditions); they may also may be influenced by Aboriginal social and demographic factors (which may no longer be apparent);

- Connectedness: whether the site can be connected to other sites at the local or regional level through aspects such as type, chronology, content (i.e. materials present, manufacturing processes), spatial patterning or ethno-historical information;

- Integrity & condition: integrity refers to the level of modification a site has been subject to (the cultural and natural formation process) and whether the site could yield intact archaeological deposits, which could be spatially meaningful. Condition takes into account the state of the material, which is especially relevant for organic materials;

- Complexity: the demonstrated or potential ability of a site to yield a complex assemblage (stone, bone and/or shell) and/or features (hearths, fire pits, activity areas); and

- Archaeological potential: the potential to yield information (from sub-surface materials which retain integrity, stratigraphical or not) that will contribute to an understanding of contemporary archaeological interest, or which could be saved for future research potential.

The Aboriginal heritage sites identified during this assessment are assessed against these criteria in *Section 8.1.3* of this report.

8.1.3 Scientific Significance Assessment

All of the areas of archaeological interest occurring in the study area are common site types within the region. Stone artefact sites including open camp sites (or artefact scatters) and isolated finds are the most common regional sites types, and that is reflected in the results of the field survey undertaken for this project.

The majority of Aboriginal archaeological sites recorded are small surface assemblages that are low density and contain artefacts common to the area. The isolated stone artefact sites within the study area (Wollondilly 9, Hillview Park 3, 6, 7 and Crookwell WF1, 10, 11 and 13) may be considered as representative of the types of sites (along with stone artefact scatters), behaviours and patterning that are expected locally and regionally. The description of the isolated artefacts does not place them as an exceptionally high value example in terms of condition or content. They are therefore assessed as having a low archaeological significance.

The stone artefact scatters Wollondilly, Hillview Park 2, Hillview Park and Crookwell WF14 were found to be of a high density, demonstrating various stages of stone tool manufacturing and containing relatively rare stone artefact types (e.g. points) and are considered to have the potential to yield information about Aboriginal stone tool making industries across the region. These sites are therefore assessed as having a moderate archaeological significance.

Several crests and flat or gently sloping landforms, slightly elevated and adjacent to drainage lines within the study area would have been attractive camping locations. Such landscape zones (or PADs) within the study area were identified during the fieldwork stage for this project as areas of either moderate or high archaeological potential (refer to *Figure* 7.4 and *Figure 7.5*) and are considered to be archaeologically, scientifically and culturally significant. These areas have been identified as having moderate or high potential for containing intact archaeological deposits. Several of these archaeologically sensitive areas within the surrounding region to the study area have previously been found to be associated with stone artefact sites. The areas identified as PADs within the study area are also likely to contain stone artefacts. However, no significance assessment of the content of these PADs can be made until after sub-surface investigations have been conducted.

Due mainly to their commonness within the regional landscape and the currently unknown contents of the areas deemed to have archaeological potential, the archaeologically sensitive areas within the study area have been assessed as having moderate archaeological/scientific significance.

8.1.4 Statement of Heritage Significance

The study area contains 26 recorded Aboriginal sites (10 recorded in 2010 by Anderson [all sites are either open campsites or isolated finds] and nineteen recorded during this current study). The sites recorded during this study have been assigned scientific significance in terms of rarity, representativeness, archaeological landscape, connectedness, integrity and condition, complexity, and archaeological sensitivity.

The significance rating of the identified stone artefact sites is higher or lower based on the presence of particular stone artefact types, formal tool types, diverse or unusual raw stone materials or the potential for stratified sub-surface deposits to exist. All sites identified within the study area are common site types at a local and regional level. Stone artefact sites are the main site type represented in the region and those located within the study area have not demonstrated a significantly greater diversity or complexity in comparison to other known sites within the region. It is for this reason that four of the artefact scatters within the study area (Sites Wollondilly 9, Hillview Park 3, Hillview Park 4, Hillview Park 5, Hillview Park 6, Hillview Park 7, Crookwell WF1, Crookwell WF2, Crookwell WF4 – 13 and Crookwell WF16) have been assessed as having low archaeological significance. The remaining four sites (Wollondilly, Hillview Park, Hillview Park 2, Hillview Park 8, Crookwell WF3, Crookwell WF14, Crookwell WF15) have been given a moderate archaeological significance rating based on the larger number of artefacts present and the sites potential to reveal *in situ* sub-surface deposits.

Portions of the study area are within close proximity to watercourses and located within flat terrain with shelter from the elements (areas of known Aboriginal occupation) and therefore have cultural significance to local Aboriginal groups (Crookwell WF PADs 1, 2 and 3). These areas incorporate prominent landscape types within the study area (i.e., flat terrain, and slightly sloping areas near a water source) similar to those where Aboriginal cultural heritage sites have already been recorded (refer to *Section 5.3* of this report). Such areas are likely to contain as yet unrecorded Aboriginal sites. Until further archaeological examinations are conducted to assess the size and nature of any potential surface or sub-surface archaeological deposits, these areas represent a moderate level of archaeological significance.

8.1.5 Aboriginal Cultural Significance Assessment

Cultural/social significance concerns the values of a place, feature or site to a particular community groups, in this case the local Aboriginal communities. The primary guide to management of heritage places is the Australia ICOMOS Burra Charter 1999. The Burra Charter defines cultural significance as:

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

Aspects of cultural or social significance are relevant to sites, objects and landscapes that are important or have become important to local Aboriginal communities. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for sites generally and their continued protection. Aboriginal communities have provided input into the archaeological survey methodology and the archaeological and cultural significance assessment of the study area. They have also been provided the opportunity to comment on the cultural and social significance assessment of the study area.

Landscapes or locations within a landscape may hold special significance to Aboriginal communities as places where traditional lifestyles have occurred and where sacred or symbolic significance places exist. As such, Aboriginal cultural significance can only be determined by the Aboriginal community. Consultation with Aboriginal people (who can provide information about the local and regional significance of Aboriginal cultural heritage) is therefore required for any archaeological, social or cultural values assessment of Aboriginal heritage (especially where there is the potential for impact or harm to an Aboriginal heritage site or item). The consultation guidelines used for this assessment (as identified above) set out a process for identifying and registering Aboriginal parties who wish to be consulted on the proposed development. These processes have been followed and consultation with the registered Aboriginal stakeholder groups has been maintained throughout the project.

During the fieldwork component of this study and in accordance with the relevant Aboriginal consultation guidelines, Aboriginal representative Justin Boney of Pejar LALC was queried about the cultural significance (to individuals and the community more broadly) of the study area generally, specific locations within the study area and the study areas identified sites. Justin Boney indicated that the study area holds a high level of cultural significance to Aboriginal people as it is situated within areas that were used for hunting, gathering and camping by past Aboriginal groups and therefore represent Aboriginal occupation of the region, a past way of life and a direct link to their ancestors.

He also indicated that the wider landscape, particularly the flora, fauna and water courses associated with the study area are significant to them and other past and present Aboriginal people as they formed part of an economic resource environment.

The identification of archaeological and Aboriginal cultural heritage items associated with the study area was achieved during the heritage assessment through desktop research, field reconnaissance and consultation with Aboriginal stakeholders. In accordance with the DGRs for this project, all assessments have been developed in consultation with Aboriginal people who hold cultural knowledge or responsibility for the country in which the study area is part of.

8.2 HISTORICAL HERITAGE

No historical heritage items were found during the field survey, and there are no known non-Aboriginal heritage items located within the study area.

9 PROJECT INFORMATION AND IMPACT ASSESSMENT

This chapter outlines the project development and the potential impacts that may result to Aboriginal cultural heritage. The proposed activity has been outlined in *Section 1.1* of this report.

9.1 POTENTIAL HARM TO ABORIGINAL OBJECTS

The proposed works involve the following actions that have the potential to impact on Aboriginal heritage sites and values:

- the construction of roads and access tracks;
- the transportation and construction of 29 wind turbines and associated infrastructure (such as underground cabling); and
- the construction of a lay down area and a substation area.

Several stone artefact sites and PAD areas will be impacted upon through the works outlined above. Avoidance of these sites and PAD areas is considered the most appropriate heritage outcome. Sites Crookwell WF 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, Wollondilly 9, Hillview Park 6, 7, 2 and Hillview Park and several areas of PAD (refer to *Figures 7.4* and *7.5*) will be impacted by the proposed works. The remaining sites are also in close proximity to the project developments and warrant mitigation measures to protect them during the wind farm construction phase. Impact reduction and mitigation measures for each site and PAD areas have been developed to ensure a sound heritage outcome for the study area. These are outlined in *Section 11* of this report.

9.2 POTENTIAL HARM TO HISTORICAL OBJECTS

No historical heritage items were found during the field survey, and there are no known non-Aboriginal heritage items located within the impact area. Several items have been previously identified in the vicinity of the impact area including the Leeston homestead and the Hillview Park Property homestead and its surrounding building (Anderson 2010). These items will not be affected by the proposed development.

10 RECOMMENDATIONS

This section provides recommendations for protecting archaeological sites identified during the historical and Aboriginal Cultural Heritage Assessment undertaken as part of the proposed Crookwell 3wind farm. Avoidance of archaeological sites represents the best heritage outcome as it means no impact on the identified heritage features.

The management recommendation statements are made in light of:

- the results of background desktop investigation and archeological field inspection as outlined in this report;
- predictive modelling;
- a heritage significance assessment;
- legislative requirements as outlined in this report;
- results of the field survey;
- consultation with the relevant Aboriginal organisations; and
- the premise that elements of the proposed development of the study area may unavoidably impact on the study area's archaeology.

Several areas of Aboriginal cultural heritage exist that require measures to manage impacts to Aboriginal places:

- Previously recorded sites Wollondilly, Wollondilly 9, Hillview Park, Hillview Park 2, 3, 4, 5, 6, 7 and 8, and any associated PADs;
- Newly recorded sites Crookwell WF1 to 16 and any associated PADs; and
- Newly recorded PAD areas Crookwell WF1, 2 and 3.

The three PAD areas are proposed for test excavations if impact cannot be avoided. These areas are flat crest and flat to gently sloping landforms or crest areas. A sub-surface testing and salvage program will add to the understanding of Aboriginal occupation in the region and is necessary to adequately assess the Aboriginal cultural heritage of the study area. It will also allow for the recording and retrieval of sub-surface archaeological deposits before developments begin.

Artefactual material recovered through the test excavation procedure should be collected, interpreted, catalogued and then reburied within a portion of the study area (or nearby region) that is to be conserved and not impacted during the proposed or future development. Artefacts for reburial will be placed in a closed container and the reburial location recorded with all information forwarded to the OEH.

The previously recorded sites Hillview Park 3, 4, 5, 6 and 7 and Wollondilly 9 should again be searched for and if located, their position be recorded, the artefacts collected if disturbance is imminent, and redeposited in a suitable and recorded safe location. The stone artefact scatters identified during this survey – Crookwell WF1, 2, 4, 5, 6, 7, 8, 9, 10 ,11 ,12 ,13 and 16 – should be collected if disturbance is imminent and redeposited in a suitable and recorded safe location.

Crookwell WF PAD areas 1, 2, and 3 and those PADs identified in association with sites Wollondilly, Crookwell WF3, Crookwell WF4, Hillview Park 2, Hillview Park, Crookwell WF14 and Crookwell WF15 should undergo sub-surface archaeological investigations before the construction phase of the wind farm development occurs in that area of the site (refer to *Figures 7.3, 7.4* and *7.5*).

Before construction begins, each of the sites and PADs identified above should undergo protection mediation measurers (through the use of silt traps and hemp bunding to prevent the sites being impacted by increased erosion and soil run off generated by earth works) and their location should be clearly marked on all relevant construction plans. Aboriginal site disturbance through an increase in human visitation to the area should also be limited at the Aboriginal sites and PAD locations.

Table 10.1 Management Recommendations for each Aboriginal heritage site identified

Site ID	Archaeological Significance	Recommendation
Wollondilly	Moderate	Outside of impact area – provide location on all relevant construction maps to avoid disturbance.
Wollondilly 9	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Hillview Park	Moderate	If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Hillview Park 2	Moderate	If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Hillview Park 3	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Hillview Park 4	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.

Site ID	Archaeological Significance	Recommendation
Hillview Park 5	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Hillview Park 6	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Hillview Park 7	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Hillview Park 8	Moderate	Avoid disturbance to site and associated area of archaeological potential. If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Crookwell WF1	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF2	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF3	Moderate	Avoid disturbance to site and associated area of archaeological potential. If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Crookwell WF4	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF5	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF6	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF7	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF8	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF9	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF10	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF11	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.

Site ID	Archaeological Significance	Recommendation
Crookwell WF12	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF13	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.
Crookwell WF14	Moderate	Avoid disturbance to site and associated area of archaeological potential. If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Crookwell WF15	Moderate	Avoid disturbance to site and associated area of archaeological potential. If avoidance is not possible, sub-surface testing should occur in this location to determine the extent and nature of this site. A cultural heritage management plan should be prepared and implemented to manage this process and provide for measures for the care and control of any artefactual material recovered.
Crookwell WF16	Low	If avoidance is not possible, it is recommended that the site is collected and stored with the Pejar LALC or relocated to an area outside of the impact zone.

The study area holds Aboriginal heritage significance as it contains landforms that have the potential to display evidence of a distinctive way of life, tradition, land use, custom, and process or function no longer practised. The results of past and present archaeological studies relevant to the study area show Aboriginal sites exist within the study area and within the surrounding region.

Due to vegetation ground cover (in the form of dense grass) over the majority of the study area, a complete assessment of its Aboriginal heritage values could not be adequately conducted, particularly in regard identified areas of PAD. Therefore, from knowledge obtained during the field survey and through consultation with the local Aboriginal community, the following recommendations have been developed:

- the three PAD areas of relatively undisturbed ground within the study area that have been identified as having moderate or high potential to reveal Aboriginal cultural heritage (Crookwell WF PADs 1, 2 and 3), should undergo a sub-surface testing program where disturbance to these areas cannot be avoided (refer to *Figures 7.4* and *7.5*). This should occur prior to ground disturbing elements of the proposed wind farm development commencing in the immediate area;

- an Aboriginal Cultural Heritage Management Plan (ACHMP) should be prepared and implemented to manage sub-surface testing activities and the Aboriginal heritage values within the study area;

- where disturbance of Aboriginal heritage sites or areas of PADs cannot be avoided, these areas should be salvaged or archaeologically tested as outlined in *Table 10.1*;

- during works, the location of all recorded sites should be clearly marked on all construction plans for the study area and site foremen informed of their presence and the need to avoid disturbance;

- no archaeological constraints exist for areas that have been surveyed and identified as having no heritage sites or PADs shown in *Figure 7.4* and *Figure 7.5*);

- no ground disturbing components in the location of Aboriginal heritage sites or areas of PAD should take place until the sub-surface archaeological investigations outlined in this report have been undertaken and reported on;

- where possible, and in consultation with Aboriginal stakeholders, conservation areas should be established where disturbed artefacts may be relocated. An interpretive strategy should also be established that describes what the area is and the past use of the landscape by Aboriginal people;

- a copy of this report should be provided to each of the Aboriginal organisations who expressed an interest in the project; and

- a copy of this report should be provided to OEH.

10.1.1 Cultural Awareness Training

In order to comply with best practice principles, it is recommended that personnel involved with ground breaking activities in the study area undertake a cultural awareness training programme. This programme should:

- include information on the Aboriginal archaeological and cultural heritage values of the study area;

- outline the location and type of archaeological sites within the study area and give instructions not to disturb these sites ;

- provide training on how to identify stone artefacts and other Aboriginal heritage sites; and

- be prepared and delivered in consultation with Aboriginal stakeholder groups.

10.1.2 Chance Find Procedure

If any heritage objects and/or relics, as protected under NSW legislation, are uncovered during the construction, then the following steps should be followed:

- all activity in the immediate area should cease;
- and an appropriately qualified heritage professional should be consulted;
- the Office of Environment and Heritage should be immediately contacted;
- local Aboriginal stakeholder groups should be notified; and
- an appropriately qualified heritage professional should record the location and attributes of the site and determine the significance of the find.

In the event of the discovery of human skeletal material (or suspected human skeletal material) during project activities in the study area the following steps should be followed:

- all activities and/or works in the immediate area must cease;
- the State Police or State Coroner must be contacted along with the Office of Environment and Heritage ; and
- any sand/soils removed from the near vicinity of the find must be identified and set aside for assessment by the investigating authorities.

10.1.3 Aboriginal Community Comment and Recommendations

During the archaeological field survey the recommendations outlined in this report were discussed and agreed upon with Justin Boney of Pejar LALC. This report should be sent out to all registered interested Aboriginal groups for review and their comments incorporated into the final version of this report.

10.1.4 Sub-surface sampling strategy

Where Aboriginal heritage sites or areas of PAD cannot be avoided, it is proposed that 100 metre long transect lines be set out across the areas defined as holding moderate or high archaeological potential. PADs 1, 2 and 3 should be tested through the use of three transects lines at each site. Test pits 1 metre by 1 metre in size should be excavated at twenty metre intervals along each transect line. Therefore, starting at 0 metres and ending at 100 metres, six test pits would be excavated along each transect line. Several smaller 0.5 metre by 0.5 metre test pits may be excavated to define an identified archaeological site boundary. It is also proposed that up to ten 0.5 metre by 0.5 metre test pits may be excavated randomly at the discretion of the excavation team –

undertaken to capture archaeological samples of specific landforms within the study area.

This technique will ensure that the landforms identified as potentially holding archaeological deposits are adequately tested as part of the sub-surface investigation program. To obtain an appropriate sample of the identified PAD areas, the proposed testing strategy should excavate a minimum of 48, 1 metre by 1 metre test pits along 8 transect lines, not including the random pits

10.2 HISTORICAL HERITAGE

No historical heritage items were found during the field survey, and there are no known non-Aboriginal heritage items located within the impact area. Several items have been previously identified in the vicinity of the impact area including the Leeston homestead and the Hillview Park Property homestead and its surrounding building (Anderson 2010). These items will not be affected by the proposed development.

11 REFERENCES

Anderson Environmental Consultants Pty Ltd 2010 **Indigenous and Non-Indigenous Archaeological Heritage for Proposed Crookwell 3 Wind Farm.** A report to Union Fenosa.

Attenbrow V, 2002 **Sydney's Aboriginal Past: investigating the archaeological and historical records**. University of NSW Press, Sydney.

Austral Archaeology Pty Ltd. 2009a. **Capital Wind Farm Tarago Region, NSW. Aboriginal Archaeological Excavation Report.** Report to Renewable Power Ventures.

Austral Archaeology Pty Ltd. 2009b. **Gunning Wind Farm, Aboriginal Archaeological and Cultural Heritage Assessment: Additional Assessment Report.** Report to Acciona Energy.

Austral Archaeology Pty Ltd 2010 **Capital Wind Farm II, Tarago Region, NSW, Aboriginal Archaeological & Cultural Heritage Assessment** A report to Infigen Energy.

Barwick, D. E. 1984. '**Mapping the Past: An Atlas of Victorian Clans 1835 – 1904**', *Aboriginal History* 8 pp. 100-132.

Bayley, W. 1975 **Uplands Pastures: History of Crookwell Shire, New South Wales**. Crookwell: Crookwell Shire Council.

Bennett, G. 1834, **Wanderings in New South Wales, Batavia, Pedir Coast, Singapore and China: being the journal of a naturalist in those countries, during 1832, 1833 and 1834**. Two volumes, Bently, London.

Bowdler S, 1983 "**Beyond the Hydro-Majestic: a Commissioned Report on Aboriginal Sites for a Landscape Study of the Megalong, Kanimbla and Hartley Valleys, NSW**", *Archaeology at ANZAAS*, Western Australian Museum, Perth. pp 329-349.

Biosis 2004 **Indigenous and Non-Indigenous Archaeological Assessment of the Proposed Crookwell II Wind Farm, Crookwell, NSW.**

Biosis. 2005. **Archaeological sub-surface testing at the proposed Crookwell II wind farm, New South Wales**. A report to Gamesa Energy Australia.

Clark, I. D. 1990. **Aboriginal Languages and Clans: An Historical Atlas of Western and Central Victoria,** *1800-1900*. Monash Publications in Geography, Number 37, Department of Geography and Environmental Science, Monash University, Melbourne.

Coffey Geotechnics 2010 **Proposed Wind Farm Crookwell 3 NSW Preliminary Geotechnical Assessment Crookwell Developments Pty Ltd.**

Dallas, M. 1985. **A preliminary archaeological study of the Cullerin Range Deviation of State Highway No. 2 between Breadalbane and Gunning NSW**.

DECCW. 2004. **Interim Community Consultation Requirements for Applicants.**

DECCW. 2005. **Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation**.

DECCW. 2005. **Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation**.

Dearling, C. 2007. **Proposed Upgrade, Crookwell-Booroowa Road (MR248 West), Narrawa, NSW).** Report to Connell Wagner.

Dibdin, J. 2007. **Proposed Gullen Range Wind Farm Archaeological Assessment.** A report to NGH Environmental on behalf of Epuron Pty Ltd.

Environmental Resources Management (ERM), 2012, **Fyshwick Section 47 & Jerrabomberra Land – Cultural Heritage Assessment.** A report to the Land Development Agency.

Flood, J., 1980, **The Moth Hunters: Aboriginal Prehistory of the Australian Alps**. Australian Institute of Aboriginal Studies, Canberra.

Flood, J. 1995. **Archaeology of the Dreamtime**. Angus and Robertson, Sydney.

Fuller, N. 1989 Goulburn City – **An Archaeological Investigation of Aboriginal Site Location**. Report to Goulburn City Council.

Govett, W. 1836. **Sketches of New South Wales** in The Saturday Magazine, November 5 1836.

Jo McDonald Cultural Heritage Management 1998 **Salvage Excavation at the Proposed Crookwell Wind Farm**, Crookwell, NSW.

Jo McDonald Cultural Heritage Management Pty Ltd. 2003. **Archaeological Survey for an Aboriginal Heritage Assessment Gunning Wind Farm, Gunning, NSW.** Report prepared for Connell Wagner PPI.

Johnson D, 2007 Sacred Waters: **The Story of the Blue Mountains Gully Traditional Owners**, Halstead Press, Broadway, NSW.

Koettig, M. 1983 **Survey for Aboriginal and Historic Archaeological Sites along the Proposed Goulburn By- Pass Route** .Report to the Department of Main Roads, NSW.

Lance, A. 1984 **An Archaeological Assessment of the Proposed Water Supply Pipeline between Sooley Dam and Rossi Weir, Goulburn, NSW**. Report to Public Works Department of NSW.

Lampert, R.J., 1971b. **Burrill Lake and Currarong: coastal sites in southern New South Wales**. Terra Australis 1. Department of Prehistory, Australian National University, Canberra.

Lance, A. and Koettig. M. 1986 **An Aboriginal resources planning study for the city of Goulburn, NSW**. Report to Goulburn City Council.

Mathews, R. H. 1905. **Ethnological Notes on the Aboriginal Tribes of New South Wales and Victoria.** Journal of the Royal Society of New South Wales for 1904, Vol 38 203-381

McDonald, J. and Garling S. 1997. **The Proposed Crookwell Wind Farm: Test Excavation Report.** A report to Pacific Power.

Navin Officer Heritage Consultants 2000 **Aboriginal Archaeological Survey Sooley Dam Raising Project, Goulburn, NSW**. Report to Connell Wagner Pty Ltd.

Navin Officer. 2003. **Pictura Tourist Complex Goulburn, NSW – Cultural Heritage Assessment.** A report to URS Australia Pty Ltd.

New South Wales Department of Environment and Conservation 2004 Interim Guidelines for Aboriginal Community Consultation - Requirements for Applicants.

New South Wales Department of Environment and Conservation 2005 Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation.

NSW NPWS. 2003. **The Bioregions of New South Wales: their biodiversity, conservation and history**. NSW National Parks and Wildlife Service, Hurstville.

Ossa, P. 1995 **New Guinea II Cave: a Pleistocene site on the Snowy River, Victoria**, Papers by Paul co-authored with Brendan Marshal & Cathie Webb, *Archaeology in Oceania* (1995) Volume: 30, Issue: 1, Pages: 22-35

Paton, R. 1990 **Archaeological Excavation at Site G17, Goulburn, NSW**. Report to Roads and Traffic Authority, Goulburn.

Reeves, J. & M. Thomson 2004 **An archaeological survey of the proposed Woodlawn Wind Farm, Tarago, New South Wales**. Report for EHN (Oceania Australia & URS Australia Pty Ltd.

Silcox, R. 1988 **Chatsbury Slate Quarry: Archaeological Survey of Proposed Mining Lease at Middle Arm, near Goulburn, NSW**. Report to R.W. Corkery and Co, Pty Ltd.

Silcox, R. 1989 **Chatsbury Slate Quarry: Test Excavations on a Proposed Mining Lease at Middle Arm, NSW**. Report to R.W. Corkery and Co, Pty Ltd.

Silcox, R. 1991. **Survey and Test Excavation of the Site of a Proposed Stormflow Detention Pond, Ross Street, Goulburn, New South Wales.** A report to Kinhill Engineers, Sydney.

Smith, J. 1992 **Aborigines of the Goulburn District**. Goulburn Historical Society.

Speight, JG. 2009. **Landform**. In Australian Soil and land survey field handbook (3rd edition). The National Committee on Soil and Terrain (CSIRO Publishing Melbourne).

Thomas O.D., Johnston, A.J., Scott M.M., Pogson, D.J, Sherwin L., Simpson C.J., MacRae G.P. & Vassallo, J.J. 2013. *Goulburn 1:100 000 Geological Sheet 8828*. Geological Survey of New South Wales.

Tindale, N. 1974 **Aboriginal Tribes of Australia**. ANU Press, Canberra.

Wandsnider, L. and Camilliy, E. 1992. **The Character of Surface Archaeological Deposits and its influence on survey accuracy.** Journal of Field Archaeology Vol 19: 169-188.

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