Flyers Creek Wind Farm Pty Ltd

Flyers Creek WIND FARM

Environmental Assessment

APPENDIX F
Heritage

Flyers Creek Wind Farm Project

Aboriginal Archaeological & Cultural Heritage Assessment

Combined Desktop And Field Assessment Report

THIS VERSION SUITABLE FOR PUBLIC ACCESS AND EXHIBITION

Prepared by

Austral Archaeology Pty Ltd

Archaeological & Cultural Heritage Consultants

For

Aurecon Pty Ltd

On behalf of

Flyers Creek Wind Farm Pty Ltd

13th May 2011

Project No: 1018

Blayney Shire Council LGA

NOTE: SOME INFORMATION OF CULTURAL SENSITIVITY TO THE ABORIGINAL COMMUNITY HAS BEEN REMOVED FROM THIS VERSION OF THE REPORT

AUSTRAL ARCHAEOLOGY PTY. LTD.

SHOP 1, 92-96 PERCIVAL ROAD, STANMORE NEW SOUTH WALES 2048

TELEPHONE 02 9568 6701 FAX 02 9568 6702

ABN 25 008 174 829

EXECUTIVE SUMMARY

This report details the Aboriginal archaeological and cultural heritage assessment for the proposed Flyers Creek Wind Farm (FCWF) development located approximately 15 km south of Orange, within the Blayney Shire Council Local Government Area (LGA), New South Wales (see Figure 1.1). Austral Archaeology Pty Ltd was commissioned by Aurecon, on behalf of Flyers Creek Wind Farm Pty Ltd, to prepare the assessment which will form part of an Environmental Assessment (EA) and Development Application (DA) to be prepared by Aurecon under the NSW *Environmental Planning and Assessment Act 1979 – amended 2009* (EP&A Act). The Flyers Creek Wind Farm (FCWF) development is being undertaken in accordance with Part 3A of the *Environmental Planning and Assessment Act 1979 - amended 2009* (EP&A Act*)*.

Flyers Creek Wind Farm Pty Ltd is proposing to construct a wind farm within the study area (see Figure 1.2) located at Flyers Creek which will include the installation of 46 wind turbines with ancillary access tracks, electrical cabling and transmission lines. In addition to the 33 kV transmission line connecting the turbines to a substation, there is also proposed to be the installation of a 10 km 132 kV transmission line that will connect the wind farm to the National Electricity Transmission Grid located at the Newcrest Mining Limited Cadia Gold Mine to the west of the wind farm.

Consultation was undertaken with the two identified Aboriginal stakeholder groups, Orange Local Aboriginal Land Council (OLALC) and Wiradjuri Traditional Owners Central West Corporation (WTOCWC) as well as the twelve individual stakeholders. In alphabetical order the individual stakeholders were Enid Clarke, Stuart Cutmore, Keith Freeman, Norma Freeman, Jirrah Freeman, Coedie Freeman, Krystal Ingram, Dallas Ingram, Neville Williams, Sharon Williams, Wayne Williams and Shawn Williams. The Aboriginal stakeholder groups were given the opportunity to participate in the field survey and comment on the potential impacts of the proposed development on the archaeological and cultural values of the local area. Subsequently they were provided with copies of the final draft report for comment before this final version of the report was finalised. Consultation with stakeholders was undertaken according to the Office of Environment and Heritage *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment & Community Consultation* 2005 (the Part 3A Guidelines). A search of the National Native Title Tribunal (NNTT) data base identified no Native Title Holders or Claimants within the study area.

Summary of Results

A search was undertaken of the Aboriginal Heritage Information Management Systems (AHIMS) database maintained by the Office of Environment and Heritage which revealed that there is a single recorded site within the study area, although it is outside the development footprint and not in danger of being impacted upon.

A pedestrian and vehicular survey of the study area was undertaken on 25 – 29 October and 1 – 5 November 2010 by Austral Archaeology Pty Ltd archaeologists, a representative from OLALC and four of the individual stakeholders (see Figures 7.1 through to 7.10). In total, seven Aboriginal archaeological sites were located, comprising four artefact scatters and three isolated artefacts. In addition two Potential Archaeological Deposits (PADs) were identified. The sites and PADs were recorded and will be registered with the Office of Environment and Heritage under the field names

FCWF-S-01 to 04, FCWF-IF-01 to 03 and FCWF PAD-01 and FCWF-PAD-02 as illustrated in Figures 8.1, 8.2 and 8.3. A less than optimum level of ground surface visibility was observed across the majority of the study area. Visibility was generally limited to vehicle and access tracks and small erosional scars. Consequently, the sites which were identified during the investigations were generally located in these limited areas of ground surface visibility. These sites are considered to represent a sample of the existing archaeological resource currently present within the study area.

Sites FCWF-S-02 to 03 and FCWF-IF-01 to 03 are considered to be of low significance due to the low frequency and generally dispersed nature of the recorded artefacts. FCWF-S-01 and FCWF-S-04 are considered to be of low to medium significance due to the higher frequency of artefacts, assortment of raw materials and formal tool types at these sites. The PAD's are considered to be of high significance due to their rarity and possible research potential to provide new information. It should be noted however, that the archaeological potential of the two PADs is currently unknown and can only be determined by a broad archaeological excavation program which is beyond the scope of the current investigation.

These identified Aboriginal archaeological sites could have constituted a constraint on the proposed development. However, the recommendations that have been formulated will allow for appropriate management and mitigation measures to be put in place prior to the future development within the study area. It is therefore considered that there are no Aboriginal archaeological constraints against the undertaking of the FCWF development.

Based on the proposed development footprint areas, all seven Aboriginal archaeological sites and two PADs located within the study area will be impacted (Site Names: FCWF-S-01 to 04, FCWF-IF-01 to 03 and FCWF PAD-01 and FCWF-PAD-02). It is considered that the identified impacts can be adequately managed through the recommended mitigative actions. The impact of the proposed FCWF development on the known Aboriginal archaeological sites and PADs is illustrated in Figures 8.1, 8.2 and 8.3.

Annette Steele, the Chairperson of OLALC, submitted a response to the draft report indicating that OLALC approved of the report and agreed with the recommendations (See Appendix B). No submissions from any of the other stakeholders were received in response to the draft report. At the conclusion of the fieldwork programme and prior to receiving the draft version of this report to review, Enid Clarke, Jirrah Freeman, Wayne Williams and Shawn Williams submitted an Aboriginal Cultural and Heritage report to Jonathon Upson of Flyers Creek Wind Farm Pty Ltd on the 10th November 2010 (see Appendix F). They recommended that owing to a low level of ground surface visibility during the survey, all locations of wind turbines and transmission lines should be monitored by Aboriginal stakeholders during the construction process. In addition they recommended that where artefacts has been recorded during the field survey, that there should be a programme of test excavation and subsurface investigation.

Summary of Recommendations

The following management recommendations are derived from the results of the Aboriginal archaeological and cultural heritage assessment. The recommendations have been developed after considering the archaeological context, environmental information, consultation with the local Aboriginal community during the fieldwork, the findings of the survey results, the predicted impact of the proposed development on archaeological resources and responses from the stakeholders to

the draft report. Annette Steele of the OLALC was the only one to formally respond to the draft report and she concurred with its conclusions and recommendations. The wide spread monitoring and subsurface investigation requested by Enid Clarke, Jirrah Freeman, Wayne Williams and Shawn Williams is not considered to be necessary. Recommendations 2 and 3 below already address the situation where testing and salvage may be required if impacts are to occur.

- **Recommendation 1** – *Avoidance of sites*

If possible the proponent should try and redesign the layout of elements of the proposed wind farm infrastructure which will impact on the identified archaeological sites and PADs. If this can be achieved then no further archaeological works will be required. Some temporary fencing of PADs and sites may however be required during the construction process.

- **Recommendation 2** - *Aboriginal archaeological test excavation / salvage excavation*

The development and implementation of a programme of test excavation and reporting is required to clarify the archaeological potential of archaeological PADs located within the study area (FCWF-PAD-01 and FCWF-PAD-02) if they are to be impacted by development for the wind farm project. Furthermore, development and implementation of a programme of salvage excavation and reporting is recommended if warranted by the results of the test excavations.

Under the NP&W Act 1974, the Office of Environment and Heritage must be notified in advance of any such proposed excavations. Approvals for such work are not required.

- **Recommendation 3** – *Aboriginal archaeological salvage excavation*

Salvage through collection and relocation of surface artefacts is recommended for FCWF-S-01 to 04 and FCWF-IF-01 to 03 if they are to be impacted by development for the wind farm project.

- **Recommendation 4** – *Implementation of a care and control of artefacts strategy*

The development and implementation of a care and control of artefacts strategy, devised through consultation with Aboriginal stakeholders, is recommended for all collected and excavated archaeological material retrieved during the abovementioned surface collection, testing and/or salvage excavation works. Such a strategy should be agreed and finalised with the Aboriginal stakeholders prior to any archaeological site works commencing.

- **Recommendation 5** – *Legal protection of Aboriginal archaeological sites*

If additional unrecorded Aboriginal archaeological material is encountered during development, works must cease immediately to allow an archaeologist to make an assessment of the finds, as all Aboriginal artefacts (known and unknown) are protected under the *NP&W Act 1974*. the Office of Environment and Heritage must be notified immediately of any such finds as per these Acts.

- **Recommendation 6** – *Historical Archaeological Sites*

As required by the *NSW Heritage Act 1977* (amended), in the event that historic relics are encountered, works must cease immediately to allow an archaeologist to make an assessment of the finds. The archaeologist may need to consult with the Heritage Branch Office of the Office of Environment and Heritage concerning the significance of any historic cultural material encountered.

- **Recommendation 7** – *Restriction of access to Aboriginal archaeological information*

Restriction of access to some Aboriginal archaeological information is recommended in the event that this report is to go on public exhibition. Consultation with Austral Archaeology Pty Ltd and the

registered Aboriginal stakeholders will be necessary to determine the appropriate level of public release.

- **Recommendation 8** – *Distribution of copies of final report*

Copies of the finalised report must be provided by the client to the following Aboriginal stakeholder groups: OLALC and WTOCWC as well as the twelve individual stakeholders. In alphabetical order the individual stakeholders include Enid Clarke, Stuart Cutmore, Keith Freeman, Norma Freeman, Jirrah Freeman, Coedie Freeman, Krystal Ingram, Dallas Ingram, Neville Williams, Sharon Williams, Wayne Williams and Shawn Williams. Austral Archaeology Pty Ltd will provide a copy of the finalised report to the Office of Environment and Heritage. Completed site cards are to be provided to the Office of Environment and Heritage AHIMS Registrar as per the *NP&W Act 1974*.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This report details the Aboriginal archaeological and cultural heritage assessment for the proposed Flyers Creek Wind Farm (FCWF) development located approximately 15 km south of Orange, within the Blayney Shire Council Local Government Area (LGA), New South Wales (see Figure 1.1).

Austral Archaeology Pty Ltd was commissioned by Aurecon, on behalf of Flyers Creek Wind Farm Pty Ltd to prepare an Aboriginal archaeological and cultural heritage assessment which will form part of an Environmental Assessment (EA) and Development Application (DA) to be prepared by Aurecon under the NSW *Environmental Planning and Assessment Act 1979 – amended 2009* (EP&A Act). The Flyers Creek Wind Farm development is occurring under Part 3A of the *Environmental Planning and Assessment Act 1979 - amended 2009* (EP&A Act*)*.

Flyers Creek Wind Farm Pty Ltd are proposing to construct a wind farm within the study area (see Figure 1.2) located at Flyers Creek which will include the installation of 46 wind turbines with ancillary access tracks, electrical cabling and transmission lines. In addition to the 33 kVtransmission line connecting the turbines to a substation there is also proposed to be the installation of a 10 km 132 kV transmission line that will connect the wind farm to the National Electricity Transmission Grid located at the Newcrest Mining Limited Cadia Gold Mine to the west of the wind farm.

Subsequent to the on site survey work, the proponent decided to delete two wind turbines from the proposed wind turbine layout (turbines #1 and #2). It is understood the current proposal is for 44 wind turbine generators.

This assessment takes into consideration the archaeological context, environmental information, consultation with the local Aboriginal community and the findings of the survey results in the identification of any impacts due to the proposed development (wind turbine and transmission line placement and associated works), on the Aboriginal cultural and/or archaeological resources.

The study area includes approximately 35 km of existing and to be developed access tracks, 46 proposed wind turbine locations, underground cabling, an 8 km 33 kV transmission line and a 10 km 132kV transmission line corridor.

As one of the proposed transmission line routes is located along the western and south western borders of the Newcrest Mining Limited Cadia Gold Mine site, all survey participants had to complete a site induction prior to entering the site.

1.2 SITE DESCRIPTION

The Flyers Creek Wind Farm (FCWF) development is located approximately 15 km south of Orange, within the Blayney Shire Council Local Government Area (LGA), New South Wales.

The study area is bounded by Errowanbang Road to the west, Beneree Carcoar Road to the east, the Mandurama Burnt Yards Road and Ewins Lane to the south and Beneree Flyers Creek Road to the north. The landscape within the immediate area is dominated by the

undulating low hills to rolling hills located to the south of Orange. Local relief is usually between 100-120 m, although it can be as low as 60 m for undulating slopes around Panuara. The drainage lines run to the west and are spaced approximately 500-800 m apart. The study area is located between the Macquarie and Lachlan River system catchment.

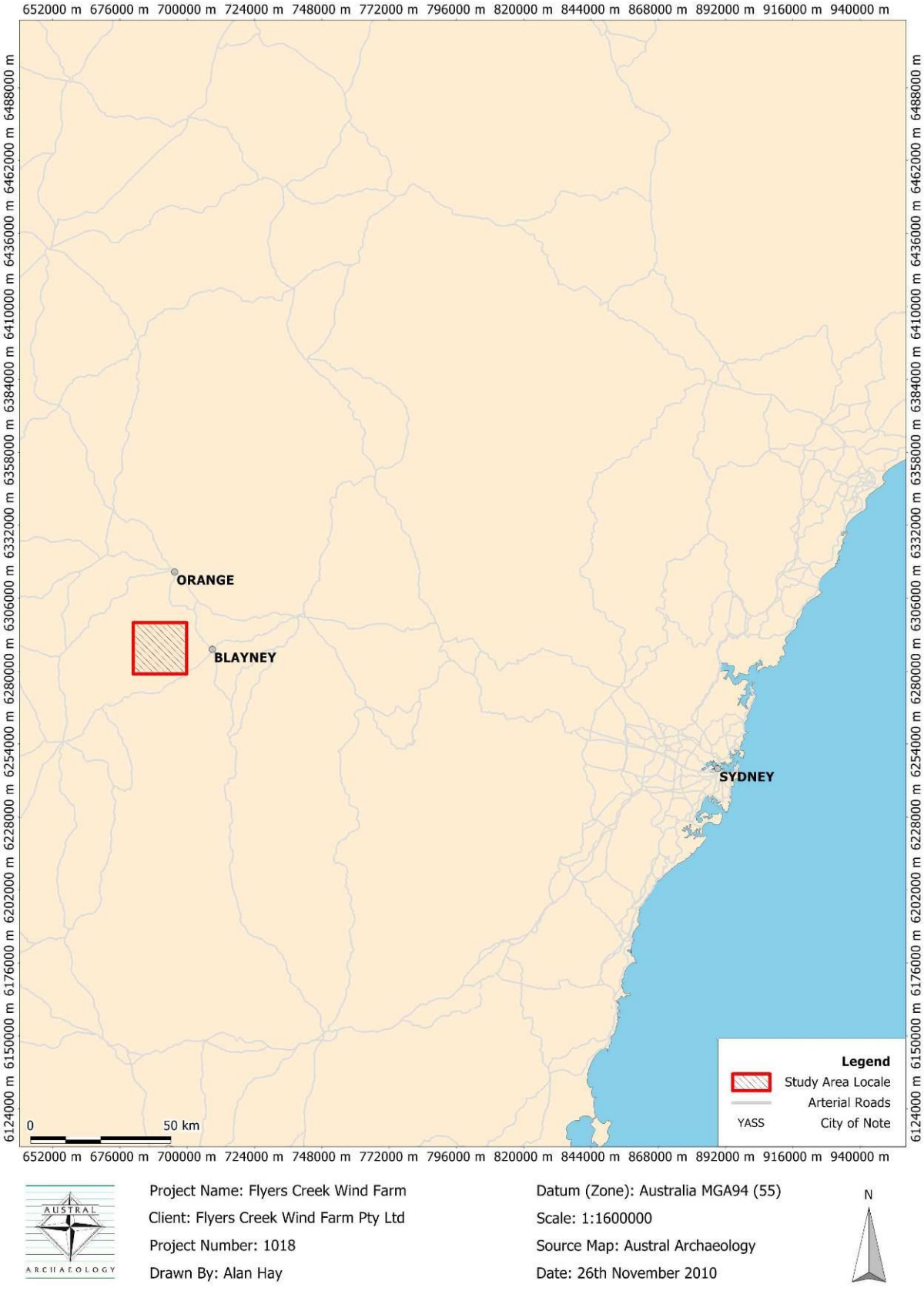


Figure 1.1 *Location of the study area in NSW in relation to Sydney and/or surrounding towns.*

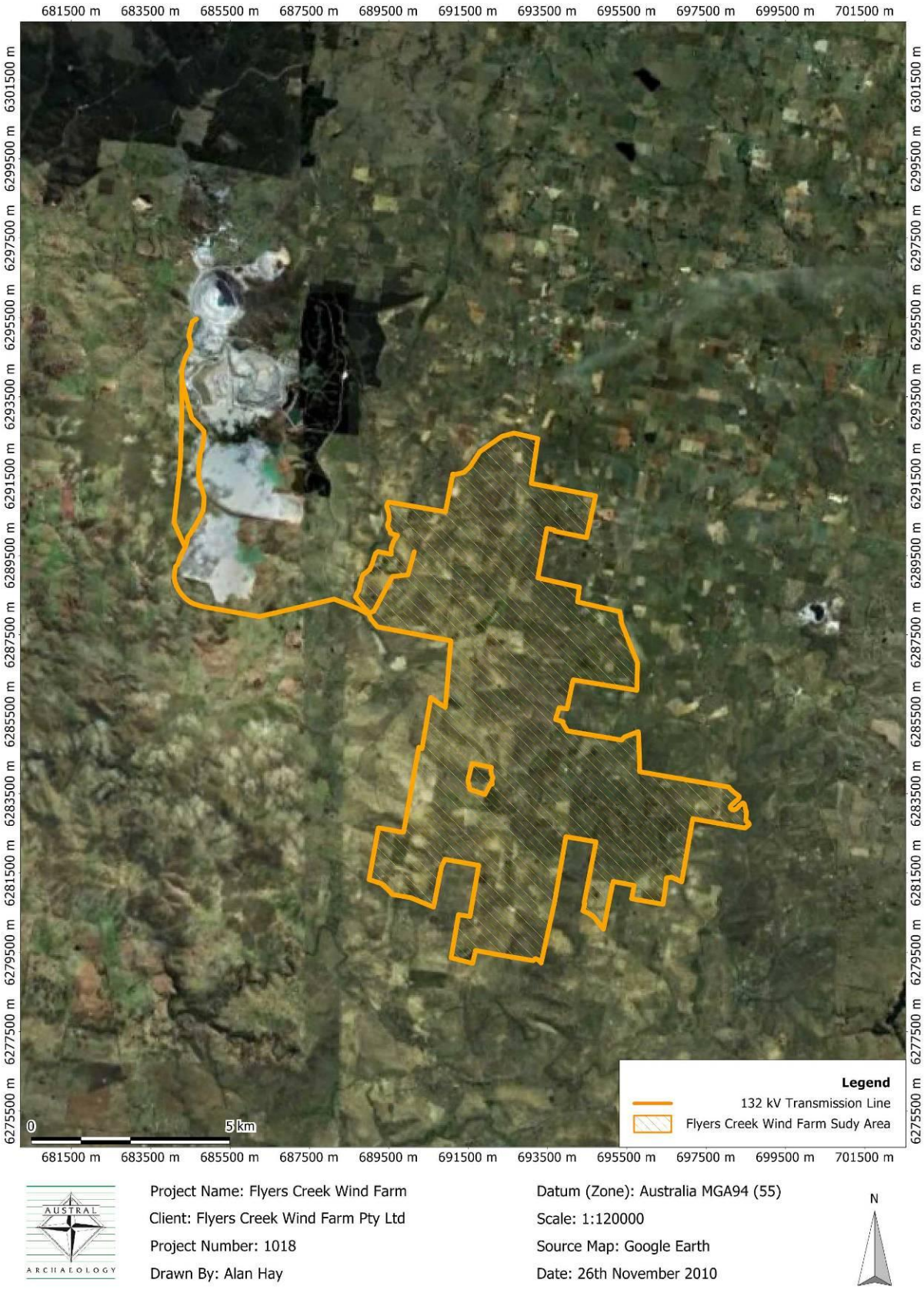


Figure 1.2 *Close up view of study area.*

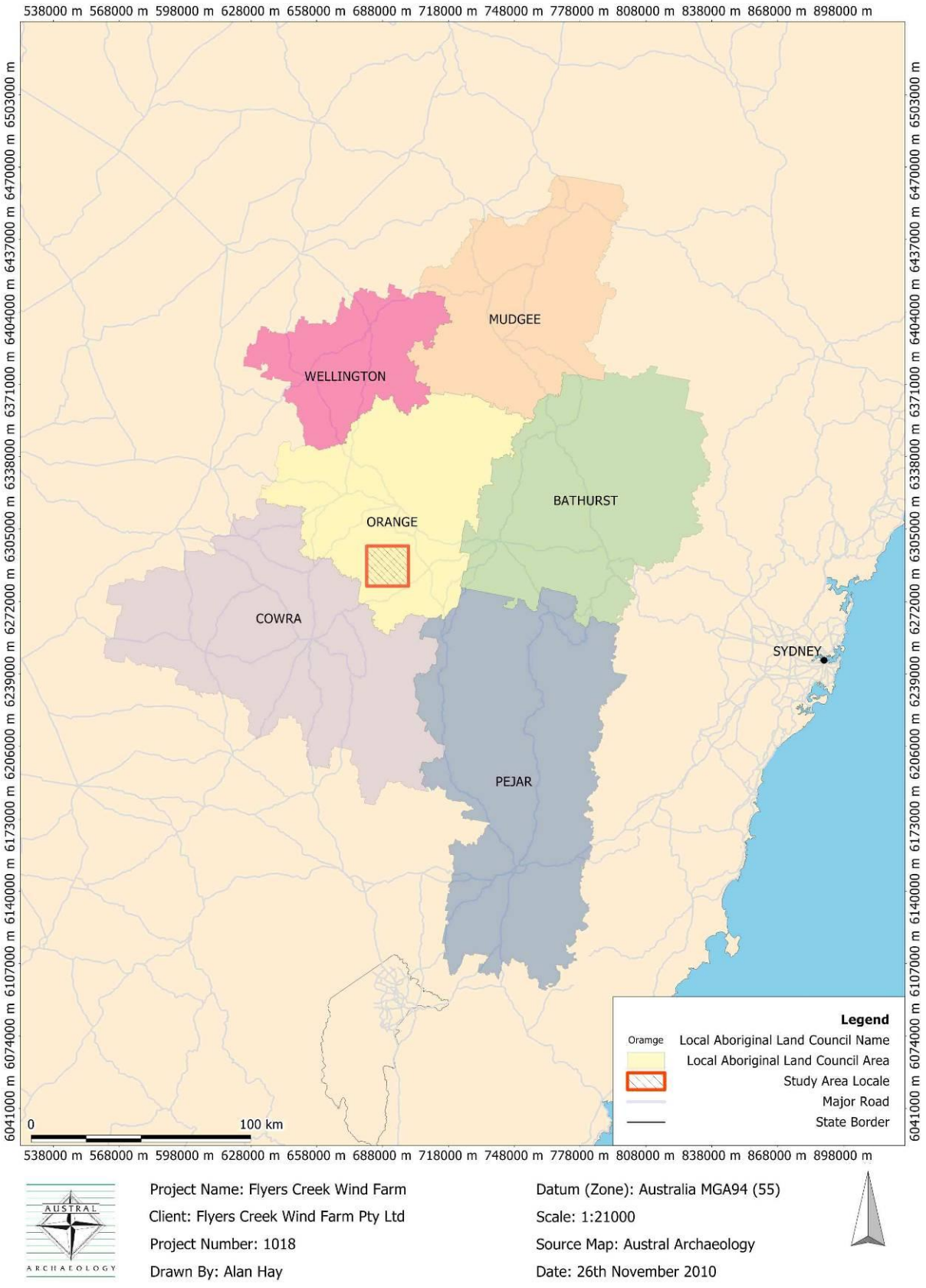


Figure 1.3 *Study area in relationship to Local Aboriginal Land Councils (LALCs)*

1.3 REPORT OBJECTIVES

The scope of the assessment was based on the brief supplied by Aurecon and the legal requirements, guidelines and policies of the Office of Environment and Heritage (OEH).

The scope of works includes the following:

- Undertake a literary review of available data, including previous studies/investigations undertaken and searches of relevant heritage registers and/or data bases.
- Undertake necessary consultation with relevant Government Agencies and key Local Stakeholders (i.e., Local Aboriginal Land Council).
- Carry out a field assessment of the study area in order to locate and identify the presence, extent and nature of any Aboriginal archaeological sites in the study area and to identify areas of PAD and archaeological sensitive landform units within the study area in order to explore the archaeological constraints and opportunities that may effect the FCWF development.
- Prepare a report on the assessment of the Aboriginal archaeology and cultural heritage of the FCWF site. Please note, in consideration of the sensitivity of site location information to the Aboriginal community, it is recommended that site location information and maps be removed from the report if it is to be put on public display. This is detailed in section 1.7.
- The construction of a consultation log detailing all consultation so that a record will exist to show that Austral Archaeology have maintained, in good faith, appropriate levels of community involvement.
- Recommendations for mitigation measures to be put in place prior to the wind farm development within the study area as well as further management recommendations based on the results of the Aboriginal archaeological and cultural heritage assessment.

1.4 STAKEHOLDER CONSULTATION

The stakeholder consultation process for this project was conducted in accordance with the DECCW (NSW) *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005* (the Part 3A Guidelines). At the time of project initiation, new consultation guidelines for Part 6 projects came into force (DECCW *Aboriginal cultural heritage consultation requirements for proponents 2010*). However to-date there are no updated guidelines for projects undertaken as a Part 3A assessment. Consultation was undertaken with the two identified Aboriginal stakeholder groups as well as the twelve individual stakeholders. A search of the National Native Title Tribunal (NNTT) data base identified no Native Title Holders or Claimants that were registered within the study area.

Stakeholders were invited to register their interest by placing advertisements in the *Koori Mail* and *Central Western Daily*. In addition, contact was made with OLALC, DECCW (now OEH) and the Register of Aboriginal Owners in the form of letters of notification prior to the newspaper advertisements.

As a result of the written correspondence and advertisements, Austral Archaeology received registrations on behalf of the WTOCWC, the OLALC and 12 individual registrations of interest from Aboriginal stakeholders. In alphabetical order the individual stakeholders were Enid Clarke, Stuart Cutmore, Keith Freeman, Norma Freeman, Jirrah Freeman, Coedie Freeman, Krystal Ingram, Dallas Ingram, Neville Williams, Sharon Williams, Wayne Williams and Shawn Williams. All registered stakeholders were provided with a copy of the survey methodology and asked to provide their comments.

After negotiations with the registrants by the proponent, the following participated in the fieldwork: Chad Boney (representing OLALC), Enid Clarke, Jirrah Freeman, and Wayne and Shawn Williams. WTOCWC were not able to provide a representative.

Views of the local Aboriginal community groups regarding cultural constraints were sought throughout the fieldwork component of the project.

A copy of this draft report will be provided to the Aboriginal stakeholders for comment and review. Each will be requested to provide a written submission which will be attached to the final version of this report. Received submissions will be attached in Appendix B.

1.5 PROJECT TEAM AND ACKNOWLEDGEMENTS

This project was undertaken by staff of Austral Archaeology Pty Ltd. The site survey was conducted by Sandra Wallace and Alan Hay (Archaeologists). This report was prepared by Karyn McLeod (Senior Archaeologist, Austral Archaeology) and written by Alan Hay and Monique Jacobs (Archaeologists, Austral Archaeology). Justin McCarthy (Managing Director, Austral Archaeology Pty Ltd) supervised the overall project and reviewed the draft report.

Austral Archaeology would like to acknowledge the participation of the following people who have contributed to the preparation of this report:

Chad Morgan	*Orange Local Aboriginal Land Council*
Enid Clarke	*Individual Stakeholder*
Stuart Cutmore	*Individual Stakeholder*
Keith Freeman	*Individual Stakeholder*
Norma Freeman	*Individual Stakeholder*
Jirrah Freeman	*Individual Stakeholder*
Coedie Freeman	*Individual Stakeholder*
Krystal Ingram	*Individual Stakeholder*
Dallas Ingram	*Individual Stakeholder*
Annette Steele	*Orange Local Aboriginal Land Council*
Neville Williams	*Individual Stakeholder*
Sharon Williams	*Individual Stakeholder*
Wayne Williams	*Individual Stakeholder*
Shawn Williams	*Individual Stakeholder*
Jeff Bembrick	*Aurecon*
Jonathan Upson	*Flyers Creek Wind Farm Pty Ltd*

1.6 LIMITATIONS OF THE REPORT

Site location information received from the AHIMS database is subject to some limitations. First, due to the transition from using AMG84 coordinates to MGA94 coordinates during recording site location (either by hand-held non-differential GPS or through the use of 1:25,000 scale topographic maps), incorrectly projected data may be received. Second, as per DECCW (now OEH) policy the search data was only provided to Austral after being filtered through an algorithm which altered the recorded site locations by 5-10 m, in order to conceal the true locations of the sites. This difference is not visible in the scale of the maps provided throughout this report. Finally, the inherent error range (of generally 4 – 8 m) in recordings made by non-differential GPS must be taken into consideration. Best efforts have been made to confirm the projection of coordinates by reference to the original site cards and report; however Austral cannot confirm these locations without ground-truthing through relocating the sites.

These limitations are considered acceptable and they should not detract from the results of this report.

1.7 DATA RESTRICTION

Data restrictions have been put on some aspects of this version of the report in order to make it suitable for public exhibition. The sections that have been omitted contain advisory text highlighted in yellow. See Recommendation 7 for more details.

1.8 ABBREVIATIONS

AD	Artefact Deposit
AFT	Artefact (Stone, Bone, Shell, Glass, Ceramic, and Metal)
ART	Art (pigment or Engraved)
AHD	Australian Height Datum
AHIP	Aboriginal Heritage Impact Permit
AHPI	Australian Heritage Places Inventory
ATSICC	The Aboriginal and Torres Strait Islander Consultative Committee
Burra Charter, the	ICOMOS Australia Burra Charter 1999
DEC	Department of Environment and Conservation (now OEH)
DECC Guidelines	DECC Interim Community Consultation Guidelines 2005
DoP	Department of Planning
EA	Environmental Assessment
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act 1979	Environmental Planning and Biodiversity Conservation Act
FCWF	Flyers Creek Wind Farm
GDA94	Geocentric Datum of Australia 1994
LGA	Local Government Area
LEP	Local Environmental Plan
MNF	Minimum Number of Flakes
NNTT	National Native Title Tribunal
NP&W Act	National Parks and Wildlife Act 1974, amended 2001

NSW DECCW	New South Wales Department of Environment, Climate Change and Water (now OEH)
OEH	Office of Environment and Heritage
OLALC	Orange Local Aboriginal Land Council
PEI	Preliminary Environmental Investigation
PAD	Potential Archaeological Deposit
RNE	Register of the National Estate
SHI	New South Wales Heritage Office State Heritage Inventory
SHL	Shell
STA	Stone Arrangement
SHR	New South Wales Heritage Office State Heritage Register
TRE	Modified Tree (Carved or Scarred)
WTOCWC	Wiradjuri Traditional Owners Central West Corporation

2.0 LEGISLATIVE FRAMEWORK

2.1 ABORIGINAL HERITAGE LEGISLATIVE FRAMEWORK

Aboriginal archaeological and cultural heritage assessments in NSW are governed by a range of State and Federal Acts and Guidelines. The Acts allow for the management and protection of Aboriginal places and objects, and the Guidelines set out best practice for community consultation in accordance with the requirements of the Acts.

Table 2.1 details the Australian Acts and Guidelines which have been identified as being applicable or with the potential to be triggered with regards to the FCWF development.

Table 2.1 A summary of the relevant Aboriginal heritage legislation relevant to the FCWF development.

Federal Acts:	**Applicability and implications**
Environment Protection and Biodiversity Conservation Act 1999	This Act has not been triggered and so does not apply. • No sites listed on the National Heritage List (NHL) are present or in close proximity to the study area. • No sites listed on the Commonwealth Heritage List (CHL) are present or in close proximity to the study area.
Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987	Applies. • This Act provides blanket protection for Aboriginal heritage in circumstances where such protection is not available at the state level. This Act may also override state and territory provisions.
State Acts:	Applicability and implications
National Parks and Wildlife Act 1974 (NP&W Act 1974)	Applies in limited form. Consents not required. • Section 89A (formerly Section 91) – requires that the NSW OEH must be notified of any Aboriginal objects discovered
The Environmental Planning and Assessment Act 1979 (EP&A Act 1979)	Applies. • This project is being assessed under Part 3A of the EP&A Act 1979. The DECCW's *Draft Guidelines for Aboriginal Cultural Heritage Impact Statement & Community Consultation Guidelines 2005* (Part 3A) are to be followed.
NSW Heritage Act 1977	This Act has not been triggered and so does not apply. • No Aboriginal sites listed on the State Heritage Register are present or in close proximity to the study area.
Planning Instruments	Applicability and implications

Local Environmental Plans	The following LEP is applicable • Blayney LEP (BLEP) 1998
Guidelines	**Applicability and implications**
DECCW Aboriginal cultural heritage consultation requirements for proponents 2010.	• These Guidelines do not apply to Part 3A projects.
DECCW Interim Community Consultation Guidelines 2005 (Part 3A)	• The Part 3A Guidelines will apply.

2.2 SECTION SUMMARY

Aboriginal Places and Objects, both known and unknown, are protected in New South Wales by State and Federal legislation. The present assessment is being undertaken under the DECCW *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation Guidelines 2005* (Part 3A).

3.0 LANDSCAPE CONTEXT

Investigations of the distribution of archaeological objects and places include an analysis of information on the natural resources available in a region to gain an understanding of the range of cultural remains that can be expected. Resources are linked to the hydrology, geology and soil types in a region.

Water availability is a major influence on the intensity of Aboriginal occupation and evidence. This usually comes in the form of flaked stone artefacts and is often associated with permanent water sources.

Information on the geology, soil landscapes and topography in the region is presented below. This data was utilised in the development of the fieldwork methodology and discussion of the results of the field inspection.

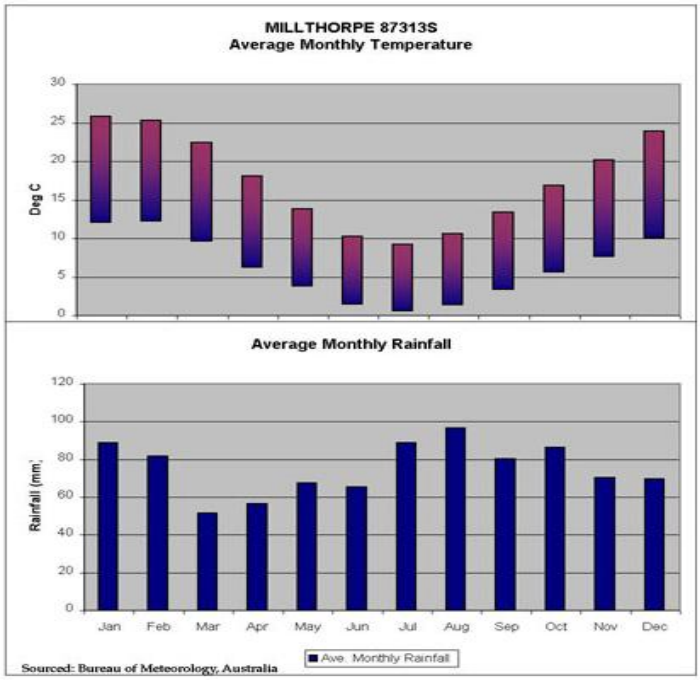
Soil types are influential as accumulating sediments can cover cultural remains while areas of sediment removal through erosion can either uncover buried archaeological material or transport small items away from the original depositional context. Soil analysis has important ramifications for archaeological research through the potential impact of different soils on human activity (such as agricultural exploitation) and the impact of the soils on archaeological evidence such as post depositional movement). The soils known to occur throughout the study area are identified here in order to delineate their nature and impact on the survival and location of archaeological material.

A detailed description of archaeological evidence is also presented to further analyse and interpret the spatial distribution and likelihood of archaeological material occurring within the study area.

3.1 PHYSICAL GEOGRAPHY

3.1.1 Climate

The Blayney region has a temperate climate, with an average annual rainfall over 800mm, generally increasing with altitude and distributed fairly evenly throughout the year. The climate of the study area has been determined through analysis of results from the Bureau of Meteorology's weather station at Orange Airport. From temperature data collected over 40 years, the annual average temperature in summer ranges from 12.7°C to 27°C and the annual average



temperature in winter ranges from 0.4°C to 9.7°C. January is the hottest month of the year and July is the coldest. Compared with most population centres in Australia, Blayney has colder winters due to the altitude of the location. The general elevation of the area (above 800m) also provides occasional snow falls with regular frosts occurring within the Blayney Shire during the winter months (Bureau of Meteorology 2009).

The climate of the last 1,000 years is considered to be similar to that of the present time (Attenbrow 2002: 39).

3.1.2 Topography and Hydrology

The main topographic features of the region are Mount Canobolas and Mount Towac, which are of volcanic origin and stand at elevations of 1,396 m Australian Height Datum (AHD) and 1,136 m AHD, respectively. The summits of these mountains are often snow-capped in winter. The surrounding tablelands vary in elevation from 650m to1200m. Mount Canobolas and Mount Towac are located 10-15 km north of the study area.

The region is characterised by undulating hills, cleared open grassland, scattered native vegetation remnants and State Forest plantations of Monterey Pine (*Pinus radiata*).The district is extensively folded and faulted due to past volcanic action. Consequently, due to erosion the current topography consists of a series of well-rounded ridges separated by wide and mature valleys.

The Blayney LGA is the catchment boundary between the Macquarie and Lachlan River systems. The Belubula River is the dominant water course of the immediate Flyers Creek Study area. It starts in the high country between Bathurst and Orange, passes by the eastern side of Blayney then flows into Carcoar Dam. The dam was constructed in 1970 to regulate the Belubula River and is popular with sailors, windsurfers, water skiers and fishermen. The Belubula River then meanders in a westerly direction to the Lachlan River.

Flyers Creek is an upland headwater catchment of the Lachlan River. Flyers Creek originates on slopes below Mount Canobolas and generally flows in a north to south direction through a narrow steep-sided valley before joining the Belubula River. The height of the mountain produces a strong rainfall effect with water flowing in all directions from the summit. Numerous gullies and ephemeral streams feed into Flyers Creek which is rarely without water. Eroding tributary channels are generally situated in the lower part of sub-catchments of Flyers Creek and are linked directly to the main channel (http://www.csu.edu.au/research/ilws/news/events/5asm/docs/proceedings/Smith_Hugh_366.pdf). Channel incision and gullying are relatively widespread in Flyers Creek. Flyers Creek could be considered a second order stream when it enters the Belubula River.

The Belubula River and its tributaries are suffering from the effects of overloading with nutrients, organic matter and sediment. Levels of all pollutants are outside the recommended ranges for healthy river systems (http://www.blayney.nsw.gov.au/files/10009/File/22AStormwaterManagementPlan.pdf).

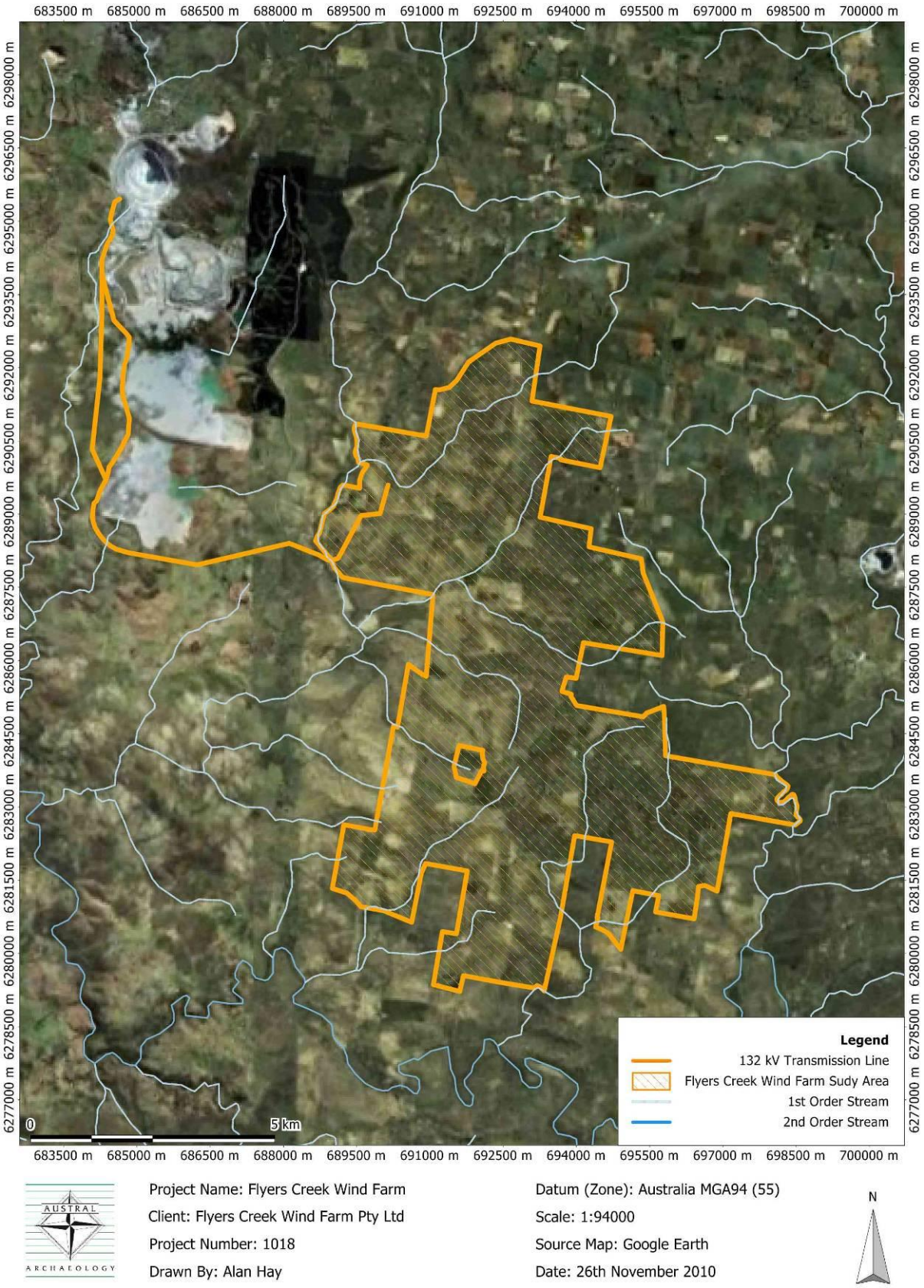


Figure 3.1 *Hydrological aspect of the study area.*

3.1.3 Geomorphology and Soil Landscapes

The study area lies within the Central and Southern Highlands fold belt and significantly influenced by tertiary volcanics of Mount Canobolas. There are three main soil landscapes in the study area (Figure 3.2).

The Vittoria Blayney soil landscape is the dominant soil landscape in the study area. The Blayney landscape consists of undulating to rolling hills with 800 m-1050 m elevation, and local relief from 30 m-80 m but mostly to 50 m-60 m. The drainage channels are located 800 m-1000 m apart. The upper part of the study area is dominated by Tertiary basalts, with Silurian shales, sandstones and limestones in the west and Ordovician volcanics in the south. Soils predominantly consist of red silty clays on the upper slopes and yellow sandy loams on the lower slopes. Alluvial-colluvial material derived from the parent rock is less than 1 m deep on the crests but may be up to 40 m deep on the lower slopes and drainage depressions (Kovac and Lawrie 1990: 273).

The Panuara soil landscape consists of undulating low to rolling hills 500 m-965 m above sea level with red podzolic soils (sandy loam) on the upper slopes and yellow solodic soils present within the drainage lines. The drainage lines run west and are spaced from 500 m-800 m apart. The geology consists of andesite, tuff, limestone, siltstone and shale (Kovac and Lawrie 1990: 221).

The Quarry soil landscape is only represented in a very small section of the study area. This landscape is characterised by rolling low hills 860 m-980 m in elevation consisting of pale siliceous sands on mid slopes and yellow earths on lower slopes. The sands are not particularly susceptible to erosion (Kovac and Lawrie 1990: 232).

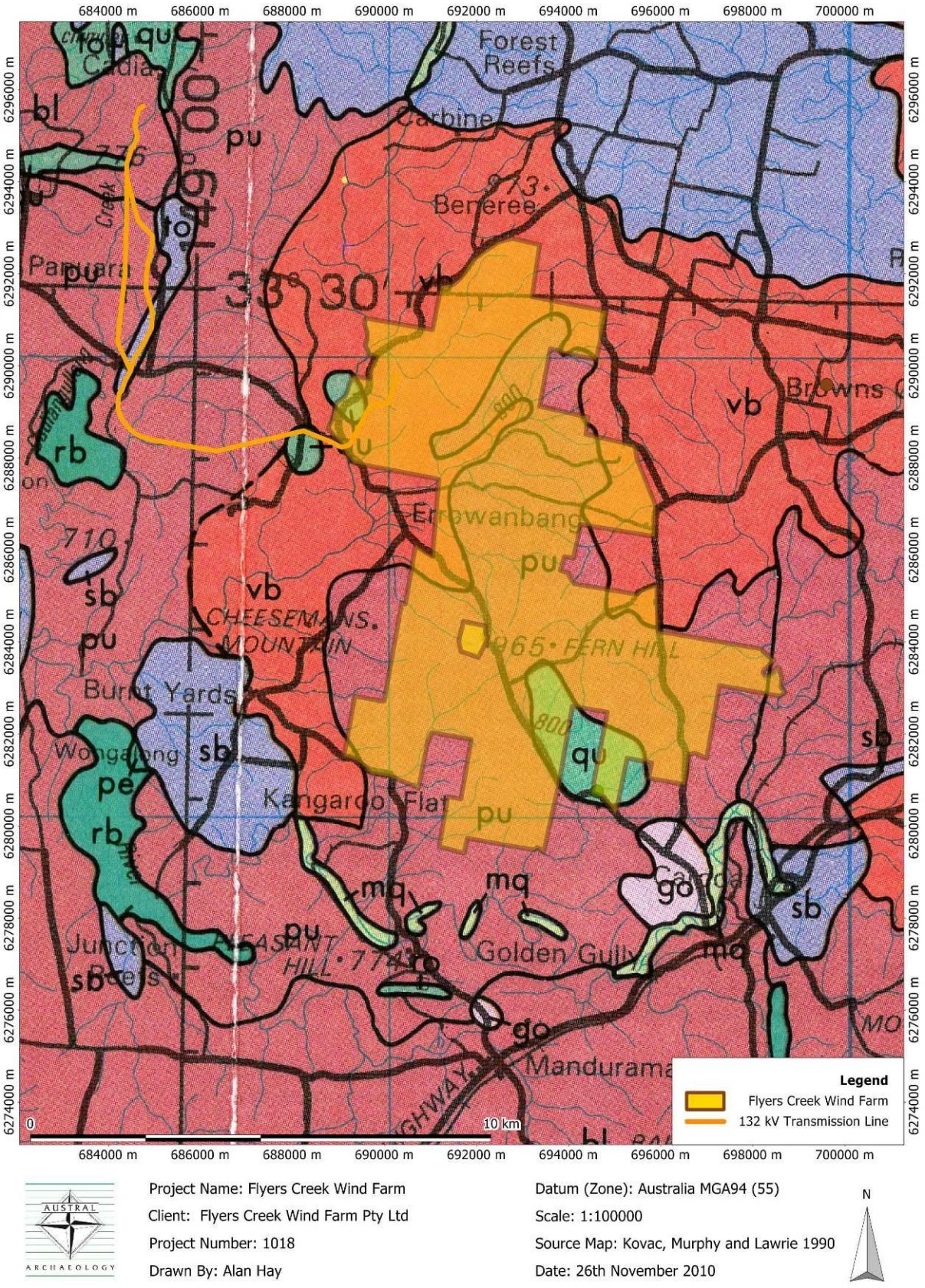


Figure 3.2 Soil landscapes within the study area. Within the development easement are the Vittoria Blayney (vb), Quarry (qu), and the Panuara (pu) soil landscapes.

3.1.4 Flora

The native vegetation of the study area has been largely cleared as a result of long-term agricultural activities. The previous land use in the study catchment was predominantly pasture (74%), with some cultivation (19%) and a limited area of non native forest cover (6%). The native woodland communities have been reduced to 0.01% of their original distribution (Prober & Thiele 1993 http://www.environment.gov.au/biodiversity/threatened/communities/grassy-white -box.html).

Prior to European settlement native vegetation in the Central Tablelands area was typically temperate and the savanah woodlands were dominated by *Eucalyptus melliodora* (Yellow Box), *E. blakelyi* (Blakely's Red gum) and *E. albens* (White Box) with *E. camaldulensis* (River Red Gum) and *Casuarina cunninghamiana* (River She-Oak) dominant along the rivers and creeks (Moore 1970).

The understory was dominated by native grasses such as *Themeda australis* (Kangaroo Grass), *Poa sieberiana* (Tussocky Poa) and *Stipa aristiglumis* (Plains Grass). Shrubs did not form a major part of the mature woodland (Moore 1970). Grass species characteristic of heavy grazing such as *Bromus molliformis* (Soft Brome), *Lolium perenne* (Perennial Rye-grass), V*ulpia spp*. (Rat's Tail Fescue) and *Bothriochloa macra* (Red Grass) now dominate the understory. The change in species composition has been attributed to livestock grazing and applications of fertiliser.

At present, salinity, acidification, water logging and soil erosion are major forms of land degradation in the region (Howling 1996). Little or no eucalypt regeneration of the scattered trees is observed in these agricultural areas (http://www.blayney.nsw.gov.au/files/10009/File/ 22AStormwaterManagementPlan.pdf).

3.1.5 Fauna

The Atlas of NSW Wildlife lists 191 faunal species located within the Blayney LGA. Species recorded include 11 species of amphibians, 134 species of birds, 30 species of mammal and 16 species of reptile, although 5 species of bird and 10 species of mammal were introduced and were not an available food resource for the Aboriginal occupants prior to European colonisation.

Common species include the Pacific black duck (*Anas supercilosa*), Australian wood duck (*Chenonetta jubata*), Platypus (*Ornithorhynchus anatinus*), Koala (*Phascolarctos cinereus*), Short-beaked echidna (*Tachyglossus aculeatus*) and the Common wombat (*Vombatus ursinus*).

The exposed and large open areas located within the region in combination with the lack of intact native woodland corridors or large native remnants, substantially lowers the quality and diversity of a habitat for the population of native bird and animal species. Diverse populations of smaller woodland birds are unlikely to find suitable habitat on the site as the Bioregion has been intensively cleared and cultivated. What remains is mostly fragmented vegetation, a landscape conducive to decline of bird populations.

3.2 HISTORIC LAND USE

Surveyor George Evans passed through the region in 1815. The temporary settlement throughout the area between 1821 and 1828 was predominantly pastoral. The village of Carcoar in the Central Tablelands of NSW was gazetted in 1839 and was the first settlement beyond Bathurst. Blayney was established in 1843 followed by Orange in 1846.

Initially, the main income base of the region was agricultural, predominantly wheat and barley, but minerals including iron ore, cobalt and copper soon began to add to the wealth of the district. The gold rush of the 1850s and 60s sparked the development of a number of settlements throughout the region.

The coming of the railway to Blayney in 1876 resulted in further development of the region with small towns flourishing and the construction of many of the significant buildings in these towns, which still stand today. The district is predominantly made up of cleared land dedicated to pasture and cultivation, however industry and mining play a much greater role in the economics of the Shire (http://www.blayney.local-e.nsw.gov.au/about/1005.html).

The cool climate and rich volcanic soils has seen a resurgence of agricultural and pastoral activities generating a wide range of products. These include sheep's cheeses, beef, lamb, fungi, stone fruits, olives, grapes, berries and almost half the NSW crop of apples. There is also a rapidly expanding wine production industry (http://www.visitnsw.com/town/Orange.aspx?utm_source=google&utm).

3.3 SECTION SUMMARY

Climatic conditions within the study area are generally mild to cool and have been fairly similar for the last 1000 years. The area experiences good rainfall throughout the year which maintains soil moisture and in turn creates good conditions for ground cover growth and lowers the risk of erosion from climatic causes.

The current flora and fauna inhabiting the study area is not indicative of the range and quality present prior to European settlement. Although the remnants today still show that there were sufficient resources to support a moderate-sized population of hunter-gatherers.

As a result of over 170 years of farming and mining only a very small portion of the study area remains relatively undisturbed.

4.0 REGIONAL ABORIGINAL HISTORY

The linguistic and social links between pre-contact populations and present Aboriginal groups are obscured by gaps in written and oral histories. The biases of European chroniclers must also be taken into account, alongside the devastating effects of newly introduced European diseases such as influenza and smallpox, social dislocation and the disruption of traditional land use and travel practices by the European settlers.

4.1 ABORIGINAL GROUPS

The Wiradjuri are the largest Aboriginal group in New South Wales occupying a large area in central New South Wales that includes from the Blue Mountains in the east, to Hay in the west, north to Nyngan and Gunnedah and south to Albury. The Wiradjuri tribal area has been described as 'the land of the three rivers', the Wambool later known as the Macquarie, the Kalare later known as the Lachlan and the Murrumbidgee. The Murray River forms the Wiradjuri's southern boundary (Tindale 2000).

The Wiradjuri were a hunter-gatherer society, made up of small clans or family groups whose movements followed seasonal food gathering and ritual patterns. Cultural identity was maintained through kinship association, language and cultural practices such as dance, art, knowledge about plants and animals and spirituality. The social organisation of the Wiradjuri was determined by kinship systems which governed marriage, family associations and obligations.

Despite the presence of differences within the Wiradjuri such as dialects, totem names and associations and stylistic variations (Tindale 2000), the Wiradjuri are identified as a coherent group as they maintained a cycle of ceremonies that moved in a ring around the whole tribal area. This cycle led to tribal unity despite the large occupied area.

An established Indigenous trading route over the Blue Mountains was in place for thousands of years before Blaxland, Wentworth and Lawson crossed the mountains in 1813. The lands of the western plains were soon taken up by graziers and by 1824, 1267 settlers had taken up land in Wiradjuri country around Bathurst with 91,636 acres cleared and fenced and 113,973 sheep and cattle. Clashes between the new European settlers and the local Aboriginal people were common. The Wiradjuri suffered the destruction of sacred areas, the removal of the possum and kangaroo habitat and displacement from fishing grounds which formed a staple of their diets. The Wiradjuri were forced to kill settler livestock for food and attacked stock men and farming huts in response to the killing of their people and loss of their territory. Violent clashes during the period between 1823 and the mid 1840s were known as the 'Wiradjuri wars'. Disease and mass European influx during gold rush periods further impacted on the native population and within 50 years of European settlement, the traditional patterns of existence could not be followed and intertribal meetings, corroborees and the important bogong moth ceremonies ceased (http://www.environment.nsw.gov.au/bioregions/SouthWesternSlopes-RegionalHistory htm).

Past occupation of the land by the Wiradjuri can be seen in the landscape today by the survival of scarred and carved trees, art sites, shell middens along river banks and the shores

of lakes, camp sites, ceremonial sites, fire places, grinding stones for grinding seeds and grinding grooves for sharpening tools as well as stone arrangements and quarries.

4.2 PAST RESOURCE USE AND MATERIAL CULTURE

The material culture of the Aboriginal people of the Blayney district at the time of European contact was diverse. Early European observations suggest that Aboriginal people used toolkits largely of organic materials such as wood, bark, leaves, shell and bone. Spear shafts spear-throwers were made from wattle or thin, straight hard wood branches. Stone, bone, shell or wood was sometimes used as a barb (Turbet 2001: 40). Various kinds of boomerangs and clubs were made from hardwoods, as were such items as digging sticks (Turbet 2001: 37-39, 45; Attenbrow 2002: 112). Men used sand, charcoal and ashes to finish wooden tool manufacture.

Bark of various types was used for making a diverse range of items (Attenbrow 2002: Table 10.1) and women were proficient at weaving baskets out of bark fibres from kurrajong and stringybark trees. Resin was used as an adhesive for tool and weapon making (Attenbrow 2002: 116).The Wiradjuri were also known for their possum fur cloaks stitched together with bark fibers. Various other skins and sinew were used for apparel and binding, while bone, teeth and feathers were utilised for tools and ornaments. A barter or trade system for particular resources such as good quality stone and rare items was likely to have been in place well before the arrival of the Europeans.

Modified or scarred trees are the result of removal of the bark to make items as small as bowls or as large as canoes. Carved trees were also grave markers, an important part of Wiradjuri culture.

Stone was commonly used for tools and, apart from shell, is the most common material found in archaeological sites of the central west region. Stone was modified to form axe heads, spear barbs and woodworking tools, amongst other things. Two main methods were used to make stone tools: percussion flaking (knapping) and grinding. Each technique requires the appropriate raw material. The knapping of stone creates a large amount of stone debris in very little time. Large knapping events tend to occur in proximity to sources of permanent water. This is probably because the availability and resources made these good places to camp for short periods of time. Small scale knapping events can occur anywhere in the landscape and are associated with the manufacture or maintenance of stone tools as a direct result of a specific need. Siliceous stones such as chert, silcrete and quartz were favoured for their relatively easy working properties.

Edge-ground axes mounted on wooden handles were used as all-purpose tools for woodworking (http://www.environment.nsw.gov.au/nswcultureheritage/StoneTools.htm). The hard volcanic stones which can hold an edge such as dolerite or basalt were the preferred material for grinding. The selected piece of stone was usually shaped by flaking before it was ground on surfaces such as sandstone outcrops. Occasionally large stones were placed in a fire, which would cause them to shatter providing smaller workable pieces of stone.

4.3 SECTION SUMMARY

The pre-European context of the Flyers Creek area is one of Aboriginal people living a mobile hunting and gathering lifestyle. The pre-European environment provided an extensive resource base associated with the multitude of water sources, woodland flora and fauna as well as alpine regions. Fire was used as a hunting aid and modified trees are a common cultural marker.

Material culture, such as tools, was made of a variety of materials such as bark, resin, shell, bone and reeds. Hard stone raw material that was made into stone tools is the main element of this tool kit to remain in the archaeological record.

5.0 ARCHAEOLOGICAL BACKGROUND

5.1 HERITAGE DATABASE SEARCH RESULTS

5.1.1 Aboriginal Heritage Information Management System Search Results

A search of the NSW DECCW's (now OEH) Aboriginal Heritage Information Management System (AHIMS) was conducted covering an area of approximately 17 km² surrounding the proposed FCWF study area. A total of 2 Aboriginal objects and places have been recorded within this area (Table 5.1 and Figure 5.1).

Table 5.1 Summary of sites recorded within 17km² of the study area

Feature Type	Total	%
Modified Tree (Carved or Scarred)	1	50%
Open Camp Site	1	50%
TOTAL		**100%**

Please note, definitions of the site types are provided in Appendix C.

The Longview (AHIMS# 44-5-0070) scarred tree occurs within the study area but at such a distance from the impact of construction that it is not considered at risk of harm. Combined with the Dirty Creek open campsite (AHIMS# 44-5-0008) appearing to the east of the study area, the two AHIMS sites serve to underscore the paucity of archaeological research within the study area and confirm the modelling of the findings of the few studies that have been conducted nearby. These sites will be referred to in Section 6.2.

5.1.2 Other Heritage Register Search Results

Searches of the Australian Heritage Places Inventory (AHPI), the Register of the National Estate (RNE), the National Heritage List (NHL) and the NSW Heritage Council State Heritage Register (SHR) databases did not identify any recorded Aboriginal object or place within the Blayney Shire LGA.

This information has been omitted from the current document due to its potentially culturally sensitive nature. Such data is presented in the restricted version only.

Figure 5.2 *Results of AHIMS search showing previously recorded sites in the vicinity of the study area.*

5.2 THE FLYERS CREEK WIND FARM ARCHAEOLOGICAL CONTEXT

Both the sparsity of the data reflected in the AHIMS search and the comparatively few studies focusing on the Flyers Creek area or its immediate surrounds means that in order to draw sound inference about past land uses by the Aboriginal population a wider context of archaeological research needs to be established. To this end archaeological studies focusing on the wider Orange Plateau area, particularly in the hilly terrain to the south of Orange, have been explored as means of constructing an archaeological background.

5.3 PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS IN THE ORANGE PLATEAU AREA

Recently Colin Pardoe (2009) extensively reviewed previous archaeological investigations in the Orange area (that encompasses the Flyers Creek study area) and his findings shall be used as a framework here. He notes that there is some rarity in Aboriginal sites within the Orange area despite a number of surveys having been conducted in recent decades.

The first archaeological survey conducted within this broader area was by Pearson (1979) who was able to identify over 40 sites in the Brown's Creek/Lewis Ponds area, to the south east of Orange (Ross 1981). This was followed by Ross (1981), who was working within a context established by Pearson's earlier research (Ross 1981). From Pearson's work Ross developed a predictive model that focused on "large stone outcrops and river flats" (1981). This survey established the evidence of only three artefacts, two isolated lithic finds and a scarred tree (Ross 1981); the argument for the cultural origins of the scarring on the tree were later rendered dubious by Roland Williams, Aboriginal Sites Officer for the Wiradjuri Regional Land Council, who asserted the scarring was natural (Pardoe 2009: K-7). Ross further concluded that surface visibility of artefacts situated on river flats would be almost nonexistent as a "vast amount" of historical artefactual material was seen to be *in situ* in the river deposits, indicating that recent alluvial events would have hidden traces of pre-European occupation (Ross 1981).

A few years later Haglund was able to identify several artefact scatters and a potential archaeological deposit in her investigations to the north-west of Orange (Pardoe 2009). This early work in the 1980's led onto the more intensive investigation of the region that was to occur during the 1990's and 2000's.

Throughout the 1990's Kohen conducted several investigations in the adjacent areas that identified a number of open artefact sites and included subsurface testing on the Rodd's Creek (Cadia 2) site (Pardoe 2009: K-7). This excavation revealed no artefacts indicating that the extent of disturbance would severely impact upon the possibility of finding Aboriginal sites of significance within this region (Pardoe 2009: K-7). It was eventually argued by Kohen that the archaeological potential of the area was low, especially where it had been manipulated by European agricultural and mineralogical regimes (Pardoe 2009: K-7).

Around the same time as the work carried out by Kohen, Navin (1996) and Kelton (1996) also undertook archaeological surveys within the area. Navin located two artefact scatters and a single isolated find (1996:1) whereas Kelton noted what he terms an "open campsite" (1996:34). The paucity of finds is consistent with the observations made by Kohen regarding the low potential of the area; it is important to bear in mind however that this was also

possible due to the lack of intensive investigation. Furthermore the rarity of sites in this area means that any new sites found are going to be of considerable scientific value because of the proportionately large amount of data that can be gleaned from them irrespective of their condition (Kelton 1996:34).

In the last decade work by Pardoe (2009) and Kayandel (Pardoe 2009) have identified a few more small sites within the Orange area reinforcing the idea of heavy impact of European land use and a small amount of discernible existing sites. Kayandel noted a single site as a potential archaeological deposit (Pardoe 2009:K-7) while Pardoe identified an isolated find and a scarred tree (Pardoe 2009:12-13). These results of wider archaeological research are given corroboration by the type and frequency of registered Aboriginal heritage sites within the study area. The low number of sites located around the development area and their designation as scarred tree and open site indicate that the research within the area will highly likely produce a similar range of artefacts as the above studies.

5.4 Archaeological Models within the Orange Plateau Area

The first archaeological model constructed for the region was by Pearson and his work is summarised by Ross (1981):

- Surface campsites, recognisable by some lithic scatter on level ground, or hill slopes and ridges away from direct juxtaposition to river flats and creeks.
- Stone arrangements, in the form of cairns probably near to stream banks or on flattened hilltops.
- Scarred and carved trees, either in the form of trees scarred for tool making or carved for ceremonial purposes.
- Quarries and other stone sources, in the form of rocky outcrops surrounded by quarrying debris like, waste flakes, used cores and quarried blocks.

Ross uses the results of her investigation to further refine this model and add that colluvial and alluvial erosion will most likely obscure any sites remaining on the river flats. The stone outcrops atop ridges were also considered to be less indicative of cultural activity in this area than was assumed under Pearson's model above (Ross 1981).

Another interesting model is proposed by Kelton (1996: 13-14) who places a possible date of Aboriginal occupation of the area as far back as 12,000 – 14,000 B.P. and sees the area as a transitional zone between the Wiradjuri people who occupied the higher plateau and those whose focus was around the Lachlan River. He further argues that during the Holocene, the time when he anticipates the area to have been most likely occupied, the weather would have been conducive to human habitation (Kelton 1996: 14). Engaging with Pearson's above model he agrees that sites of lithic scatter were likely to be within 90 metres of water sources and yet located on ridge tops, spurs hills and slopes (Kelton 1996: 15). Furthermore he agrees that accessibility to water, well drained level ground, elevation above frost and flooding, sheltered in winter and breezy in summer and having adequate food supplies (Kelton 1996: 15).

Kelton goes on to construct a model of possible sites that may be included in the region supported by hypotheses as to the likely nature and location of the sites within it. As this model will be used as the basis for the predictive model for this investigation due to its comprehensive nature, geographical similarity and recent construction, a full consideration of it is given under Section 6.2 below.

Navin (1996) classed the possible site types occurring within the study area in terms of likeliness with open artefact scatters, isolated finds and scarred trees being the most likely and potential archaeological deposits, quarry and procurement sites, burials and contact sites being less likely. Pardoe (2009) also places emphasis on the probability of artefact scatters, isolated finds and scarred trees occurring within the broader Orange area.

5.5 SECTION SUMMARY

The longevity of Pearson's model lends it credence within this context and it, along with the highly detailed argument of Kelton, will form the basis of the predictive model for this investigation. The assessment of likelihood from Pardoe and Navin will contribute to the construction of the predictive model here by highlighting sites that are most likely to be present and therefore providing a basis, when combined with the work of Kelton and Pearson, for a statement concerning the landforms that will most likely yield a higher number of sites.

6.0 PREDICTIVE MODEL

6.1 POTENTIAL IMPACTS ON THE ARCHAEOLOGICAL RESOURCE

The understanding of the difference between cultural and natural transformation processes is critical to identifying what constitutes the archaeological record, as it allows a distinction to be made between what has created and altered by humans and what has resulted from naturally occurring environmental factors (Renfrew and Bahn 2000:53-54). This difference is fundamental in understanding the degree of disturbance present within the study area for several reasons; it allows the identification of cultural disturbances to archaeological data that are themselves of archaeological significance, enhances the understanding of the interplay between natural and cultural processes, forms the basis for a more nuanced predictive statement and explains variations in levels of disturbance in different areas.

6.1.1 Degree of Disturbance due to Natural Transformation Processes

The historic land use activities as described in Section 3.2 can have impacts upon the surface and subsurface archaeological potential for the area. In general, lower levels of disturbance correlate to higher potential for Aboriginal archaeological resources. This process is described in Table 6.1 below.

Of specific relevance to the study area are impacts consequent upon cultural transformation processes such as vegetation clearance, ploughing, stock grazing, subsurface services installation, fence construction, dwellings and unsealed access roads, and modification of natural streams/drainage lines into dams.

6.1.2 Degree of Disturbance due to Cultural Transformation Processes

The natural transformation processes is the aggrading of soil around level low lying areas, which serve to conceal deposits, and the erosion of deposits at greater heights that remove artefacts from context. Sites may also be exposed through the process of erosion. Also culturally modified trees may cease to continue living removing any scarring they bore from the archaeological record.

Table 6.1 Categories of Ground Disturbance

Degree of Disturbance	Impact Description	Impact on the Archaeological Record
Undisturbed	No apparent disturbance to original land surface.	*In situ* archaeological deposits may be present.
Low	Non-mechanical vegetation clearance and stock grazing.	Archaeological material will retain some spatial integrity although localised displacement is expected. Removal of tree stumps has subsurface impact.
Moderate	Mechanical vegetation clearance and cultivation (ploughing) sheet/gully erosion, fluvial disturbance.	Archaeological materials may be present, although localised spatial displacement and artefact damage is likely; *in situ* deposits may remain beyond plough zone (usually between 100 – 150 mm).

Severe	Removal of topsoil via excavation for residential development, road and infrastructure construction, landscaped gardens, sheer erosion through natural causes and development, earthworks for dam construction (when topsoil has been moved to create earthworks).	While archaeological sites may be destroyed, remnant dispersed archaeological material may survive. The context of such material may be unknown.

6.2 PREDICTIVE MODEL

Drawing on the landscape context and wealth of archaeological investigation within the Orange area, the infrequency of finds notwithstanding, it is possible to construct a flexible predictive model that will best anticipate the location and type of Aboriginal site remaining in the landscape. Lacking the quantity of archaeological sites in this context to produce a mathematical prediction, the model will nevertheless be a statement that is both testable and a sound basis for the development of predictive strategies. The most recent and exhaustive predictive model developed for the Orange area is that of Kelton (1996), discussed in Section 5.3 above, and it will here be adopted as basis for predictive modelling with some small variation. This predictive model will be summarised in Table 6.2.

6.2.1 Artefact Scatters

Scatters of Aboriginal stone tools may indicate the location of number of activities, such as knapping sites, hunting blinds and campsites. It has been strongly argued that in this area such artefact scatters are likely to be representative of campsites (Kelton 1996:15). Following Kelton's (1996:15) adaptation of Pearson's model it can be predicted that sites of lithic scatter are likely to be within 90 metres of water sources and yet located on ridge tops, spurs hills and slopes. The ground is likely to be level and either sheltered from the cold winter winds or open to cool summer breezes. These sites are also likely to be found in areas where adequate supplies of wood would have existed in the past.

6.2.2 Isolated Finds

Isolated finds represent a broader range of human activity than artefact scatters, either being a surface indicator of a larger subsurface deposit or the outcome of a vast variety of human movement across the landscape (Kelton 1996: 16). Single artefacts are much more susceptible to being obscured by cultural and natural transformation processes that occur throughout the area, such as natural aggradations and European ploughing. Obversely, transformation processes such as erosion that expose older depositional contexts may increase the likelihood of occurrence of isolated finds.

6.2.3 Culturally Modified Trees

Due to the impact of regimes of European land use, especially land clearance and logging, the likelihood of culturally modified trees being present within the study area has been significantly reduced (Kelton 1996: 17). *E. melliodora* (Yellow Box Gum tree), *E. Albens* (White Box Gum tree) and *E. Macrorhyncha* (Red Gum) are trees normally found to be scarred by past Aboriginal tool creation and subsistence strategies (Kelton 1996:18). Carved trees, a characteristic feature of Wiradjuri Aboriginal culture, initiation areas or burial sites are also a possible occurrence within the area (Kelton 1996: 18). The possibility of any of these trees existing within the study area is based on the presence of old growth forest or

remnant vegetation left in the area, where such areas of vegetation remain then it is also possible that culturally modified trees will be present (Kelton 1996: 18).

6.2.4 Quarry or Stone Procurement Site

Dependent on suitable outcrops of geological raw materials, such as quartz and silcrete, quarry sites may be possible within the region. However, Ross (1981) noted that the outcrops observed were not likely to contain materials suitable for the production of stone artefacts and her survey which focused particularly on outcrop sites was unable to detect the presence of any areas of stone procurement.

6.2.5 Hearth Sites

Hearth sites may occur within this study area and particularly in association with artefact scatters indicating open campsites above (Kelton 1996:20) and therefore are likely to be subject to the same locational constraints as that of the artefact scatters in subsection 6.2.1. In this case owing to the considerable disturbance afforded by European land use practices, there is little possibility of any hearth sites remaining intact (Kelton 1996:20).

6.2.6 Stone Arrangements

There is a possibility for stone arrangements, associated with ceremonial activity, to be present within the study area. The location favoured for these stone arrangements appears to be on flat, elevated ground with suitable access to the stone that formed the constituent materials (Kelton 1996: 19). The geographical indicators of this activity can only be taken as determinative in a general way as cultural factors were of overriding importance in the location of these sites. These sites are particularly liable to being disturbed by grazing, collection, cultivation and land clearance activities (Kelton 1996: 20).

6.2.7 Axe grinding Grooves

Due to the lack of suitable geological formations within the study area there is little possibility of the axe grinding grooves being present (Kelton 1996: 21).

6.2.8 Burials

Burials within Wiradjuri Country were often simple interments in river and creek banks or hillsides located some distance from campsites (Kelton 1996: 18). Burials that involved the carving of trees were often associated with the death of a person of some standing in the community (Kelton 1996: 18). Other forms of burial included open interment where bodies were placed above ground, usually at the base of trees in various positions and also mound burials where highly significant individuals were covered by an earthen mound (Kelton 1996: 18). If the circumstances of an individual's death were unusual or unpleasant then they were often interred within hollow logs or within standing trees (Kelton 1996: 19). This site type is also sensitive to taphonomic processes that occur within the study area such as land use impacts, erosion and destruction of culturally modified trees (that may indicate the location of a burial), all lead to the possibility of burials remaining undisclosed within the survey area.

6.2.9 Potential Archaeological Deposits

Although a potential archaeological deposit was identified recently by Kayandel and five artefacts were recovered incidentally by a historical archaeological excavation within the

area, the failure of Kohen's subsurface investigation to uncover any artefacts from below a promising surface site is cautionary (Pardoe 2009: k-7). The uncertainty of archaeological deposits being present in any specific location within this area must be guarded against by ensuring that criteria for such sites are strenuously adhered to both as regards relevant landscape features and associated surface archaeological finds.

Table 6.2 Predictive Model Summary Table

Site Type	Site Location	Relative Probability of Occurrence within the Study Area
Artefact Scatter	Within 90 metres of water sources and on elevated ground. Not likely to be visible on river terraces.	Moderate
Isolated Find	Throughout the landscape especially in locations of erosion, rarely in locations of aggradation.	Moderate
Culturally Modified Tree	Within remnant vegetation and old growth forests.	Low to moderate
Hearth Site	Within 90 metres of water sources and on elevated ground. Not likely to be visible at all but especially on river terraces.	Low
Stone Arrangement	On elevated flat ground nearby to suitable sources of raw material.	Low
Axe Grinding Groove	On sandstone outcrops, or other hard rock exposures next to creek beds etc.	Low
Burial	Some distance from artefact scatters and in the banks of watercourses and hillsides. Within trees, or near them and possibly in association with culturally modified trees.	Low
Potential Archaeological Deposit	Within 90 metres of water sources and on elevated ground.	Low to moderate

.

6.2.10 Site Preservation

A range of natural and human-induced taphonomic factors affect site preservation. Factors likely to affect site preservation and the potential for subsurface deposit in the study area are considered below:

The construction of roads and access tracks, and other surface services (such as transmission line poles, safety barricades, rural property and house fencing) and subsurface services (such as buried telecommunications cables) within its easement;

- Vegetation clearance, ploughing and cattle/horse tread within agricultural properties;