Cleveland Road North Precinct Archaeological Report

DRAFT REPORT

Prepared for Newquest Property

14 February 2020

Biosis offices

NEW SOUTH WALES

Newcastle
Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney
Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong
Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

Albury
Phone: (02) 6069 9200
Email: albury@biosis.com.au

VICTORIA

Melbourne
Phone: (03) 8686 4800
Email: melbourne@biosis.com.au

Ballarat
Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Wangaratta
Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

Document information

Report to:	Newquest Proprty
Prepared by:	Mathew Smith Matthew Tetlaw
Biosis project no.:	30982
File name:	30982.Cleveland.Rd.AR.DFT00.20200212.R-EJW

Citation: Biosis (2020). Cleveland Road North: Archaeological Report. Report for Newquest Property. Authors: M Smith and M Tetlaw, Biosis Pty Ltd, Wollongong. Project no 30982.

LGA:	Wollongong

Document control

Version	Internal reviewer	Date issued
Draft 01	Elizabeth Wyatt	13/02/2020
Final 01	To be confirmed	TBC

Contents

Tables

Figures

Plates

Glossary

ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
Consultation requirements	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010a)
DA	Development Application
DECCW	Department of Environment, Climate Change and Water (now EES)
DP	Deposited Plan
EES	Environment, Energy and Science Group
EP&A Act	*Environmental Planning and Assessment Act 1979*
GPS	Global Positioning System
GSV	Ground Surface Visibility
ICOMOS	International Council on Monuments and Sites
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
MGA	Map Grid of Australia
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PAD	Potential Archaeological Deposit
RAP	Registered Aboriginal Party
SEPP	State Environmental Planning Policy
Study area	Lot 1 and 2 DP 730326, Lot 200 DP 803810, Lot 59 DP 1125379, Lot 1 DP 156208, Lot 1 DP 532391, Lot 312 DP 1188000, Lot 202 and 203 DP 1175709, and Lot 210 DP 1057565
the Code	*Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010)

Summary

Biosis Pty Ltd was commissioned by Newquest Property to undertake an Aboriginal Cultural Heritage Assessment (ACHA) of a proposed development along Cleveland Road (the study area). This Archaeological Report (AR) documents the findings of the archaeological investigations conducted as part of the ACHA. As required under Section 2.3 of The *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a) (the Code), the AR provides evidence about the material traces of Aboriginal land use to support the conclusions and management recommendations in the ACHA.

The study area is located within the Wollongong Local Government Area (LGA), Parish of Kembla, County of Camden. The study area incorporates Lot 1 and 2 DP 730326, Lot 200 DP 803810, Lot 59 DP 1125379, Lot 1 DP 156208, Lot 1 DP 532391, Lot 312 DP 1188000, Lot 202 and 203 DP 1175709, and Lot 210 DP 1057565.

A review of the Aboriginal Heritage Information Management System (AHIMS) register identified 114 Aboriginal cultural heritage sites registered within 6 kilometres of the study area. A total of 13 of these registered sites were located within the study area, however, two of these sites are not valid sites (AHIMS 52-5-0585/Cleveland Road PAD 3 and AHIMS 52-5-3765/Cleveland Road PAD 5) and one has been destroyed under a previous AHIP AHIMS 52-5-0586/Cleveland Road PAD 4), indicating that there are 10 valid AHIMS sites in the study area that may be impacted.

The Aboriginal community was consulted regarding the heritage management of the project throughout its lifespan. Consultation has been undertaken as per the process outlined in the Department of Environment Climate Change and Water document (DECCW) document, *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010b) (consultation requirements).

The survey was conducted on 9 and 12 December 2018 by Biosis archaeologist Samantha Keats. The overall effectiveness of the survey for examining the ground for Aboriginal sites was deemed low due to vegetation cover restricting ground surface visibility (GSV) combined with a low amount of exposures. Two previously unrecorded Aboriginal cultural heritage sites were able to be identified during the field investigation, each consisting of an isolated stone artefact. These two artefacts were identified in exposures on the alluvial flat landforms. The field investigation also identified four areas of potential archaeological deposit (PAD) in the study area. These areas of PAD were located on alluvial flats in close proximity to a creek line following predictive modelling undertaken in the study area by AMBS (2006) and GML (2015).

Following the field investigation, test excavations of two areas of PAD, CR PAD 1 and CR PAD 2 were undertaken. These test excavations identified two low density artefact deposits, one at each PAD, that were consistent with the results of previous assessments undertaken in the area. Analysis of artefacts recovered from these excavations indicated that the study area had likely been used as a resource gathering area.

The archaeological assessment has identified 19 sites within the study area. Two of these sites have undergone test excavations in the past and were determined not to be valid sites (AHIMS 52-5-0585/Cleveland Road PAD 3 and AHIMS 52-5-3765/Cleveland Road PAD 5) and one site (AHIMS 52-5-0586/Cleveland Road PAD 4) has been previously destroyed under an AHIP application. A total of seven sites will be impacted by the proposed works and harm to 10 sites will be avoided.

Strategies have been developed based on the archaeological significance of cultural heritage relevant to the study area. The strategies also take into consideration:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.

- Current best conservation practice, widely considered to include:
  - The ethos of the Australia International Council on Monuments and Sites (ICOMOS) Burra Charter.
  - (the Code).

The recommendations that resulted from the consultation process are provided below.

Management recommendations

Prior to any development impacts occurring within the study area, the following is recommended:

Recommendation 1: Application for an Aboriginal Heritage Impact Permit for sites AHIMS 52-5-0497/WDRA_AX_24, AHIMS 52-5-0498/WDRA_AX_25, CR PAD 1, CR PAD2, CR IF1, CR IF2, CR PAD4.

It is recommended that an AHIP application is made to impact on sites AHIMS 52-5-0497/WDRA_AX_24, AHIMS52-5-0498/WDRA_AX_25 and AHIMS 52-2-3285 CR PAD 1, CR PAD2, CR PAD4, CR IF1, and CR IF2 which cannot be avoided by the proposed development works. It is recommended that this AHIP be for a timeframe of 15 years.

For information about AHIPs and their preparation, see below.

Advice preparing AHIPs

An AHIP is required for any activities likely to have an impact on Aboriginal objects or Places or cause land to be disturbed for the purposes of discovering an Aboriginal object. Environment, Energy and Science (EES) issues AHIPs under Part 6 of the NPW Act.

AHIPs should be prepared by a qualified archaeologist and lodged with the EES. Once the application is lodged processing time can take between 8-12 weeks. It should be noted that there will be an application fee levied by the EES for the processing of AHIPs, which is dependent on the estimated total cost of the development project.

Where there are multiple sites within one study area an application for an AHIP to cover the entire study area is recommended.

Recommendation 2: Surface collection of CR IF1 and CR IF2

It is recommended that surface artefacts at sites CR IF1 and CR IF2 are collected as part of a surface salvage program in accordance with the proposed AHIP application prior to the commencement of works

Recommendation 3: Further investigation of AHIMS pending/CR PAD 4 is required

Access to AHIMS pending/CR PAD 4 was not available at the time of this assessment and test excavations could not be undertaken in this area. It is recommended that test excavations of this site are undertaken by an experienced archaeologist prior to submission of an AHIP to ascertain if this site needs to be included before impacts can occur.

Recommendation 4: Avoidance of sites AHIMS 52-5-0496/WDRA_AX_23, AHIMS 52-2-3815/Riverpark Way AFT-1, AHISM 52-2-1688/WD1, 52-2-3831/Cleveland Road FT 2, AHIMS 52-2-3832/Cleveland Road FT 2, AHIMS 52-2-3285/WDRA_AX_22, AHIMS 52-5-0619/Cleveland Road AFT-6, 52-0584/Cleveland Road PAD 2, CR PAD 3

AHIMS sites 52-5-0496/WDRA_AX_23, AHIMS 52-2-3815/Riverpark Way AFT-1, AHIMS 52-2-1688/ WD1, AHIMS 52-2-3831/Cleveland Road FT 1, AHIMS 52-2-3832/Cleveland Road FT 2, AHIMS 52-0584/Cleveland Road PAD

2, AHIMS 52-5-0619/Cleveland Road AFT-6, and CR PAD 3 are located outside of the propose development footprint and it is recommended that impacts to these sites are avoided.

Recommendation 5: Development of a Cultural Heritage Management Plan (CHMP)

It is recommended that a CHMP be developed in consultation with the RAP's, DPE and EES prior to the commencement of works. The CHMP will outline Aboriginal site management requirements including the management of identified sites, unexpected finds, and further works required prior to development.

Management options – previously identified sites

The CHMP should provide provisions to ensure that the identified sites located outside of the development area are not unintentionally impacted during works. This should include provision for exclusion fencing and development of suitable no go buffers if required.

Stop works provision – previously unidentified sites or objects

The CHMP should include a stop work provision for any potential heritage sites identified during construction, not identified as part of this assessment or the CHMP.

All Aboriginal places and objects are protected under the NPW Act. This protection extends to Aboriginal objects and places that have not been identified but might be unearthed during construction. If construction proceeds, work must cease if Aboriginal objects or places are identified which have not previously been identified as part of this assessment or have not been approved for harm under a CHMP. EES and the archaeologist must be notified to make an assessment of the find and advise on subsequent management.

Historical archaeological sites are protected under the relics provisions (s139 – 146) of the NSW *Heritage Act 1977*. Should any historical archaeological sites be identified during any phase of the proposed development, all works must cease in the vicinity of the find and the project archaeologist and EES notified. Should the archaeological nature of the find be confirmed the Heritage Branch of the NSW Department of Planning, will require notification.

Stop works provision – Discovery of Aboriginal Ancestral Remains

The CHMP should also include a provision for the discovery of Aboriginal Ancestral Remains

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity the Diocese must:

- Immediately cease all work at that location and not further move or disturb the remains
- Notify the NSW Police and EES's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location
- Not recommence work at that location unless authorised in writing by EES.

Heritage training and induction

The CHMP should develop a training and heritage induction for all employees, contractors and associated subcontractors working on site. The induction training should address elements related to:

- Relevant legislation.
- CHMP conditions.
- Location of identified heritage sites.

- Basic identification skills for Aboriginal and non-Aboriginal artefacts and human remains.
- Procedure to follow in the event of an unexpected heritage item find during construction works.
- Procedure to follow in the event of discovery of human remains during construction works.
- Penalties and non-compliance.

Long term care and control agreement

As part of the CHMP, a long term care agreement of artefacts should be developed for all Aboriginal artefacts identified during the test excavations and salvage works. This should be undertaken in consultation with the RAPs.

Recommendation 6: Discovery of Unanticipated Historical Relics

Relics are historical archaeological resources of local or State significance and are protected in NSW under the *Heritage Act*. Relics cannot be disturbed except with a permit or exception/exemption notification. Should unanticipated relics be discovered during the course of the project, work in the vicinity must cease and an archaeologist contacted to make a preliminary assessment of the find. The Heritage Council will require notification if the find is assessed as a relic.

Recommendation 7: Continued consultation with the Registered Aboriginal Parties (RAPs)

As per the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010b), it is recommended that the proponent provides a copy of this draft report to the project and considers all comments received. The proponent should continue to inform these groups about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project.

.

1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Newquest Property to undertake an ACHA of the proposed Cleveland Road North residential development (the study area) (Figure 1). This AR documents the findings of the archaeological investigations conducted as part of the ACHA. The AR provides evidence about the material traces of Aboriginal land use to support the conclusions and management recommendations in the ACHA.

This investigation has been carried out under Part 6 of the *National Parks and Wildlife Act 1974* (NPW Act). It has been undertaken in accordance with the Code. The Code has been developed to support the process of investigating and assessing Aboriginal cultural heritage by specifying the minimum standards for archaeological investigation undertaken in NSW under the NPW Act. The archaeological investigation must be undertaken in accordance with the requirements of the Code.

It is stated in section 1.2 of the Code that where the ACHA report concludes that the proposed activity will result in harm to Aboriginal objects or declared Aboriginal Places, an application for an AHIP will be required. This application must be supported by an ACHA report.

The *Environmental Planning and Assessment Act 1979* (EP&A Act) includes provisions for local government authorities to consider environmental impacts in land-use planning and decision making. Each Local Government Area (LGA) is required to create and maintain a Local Environmental Plan (LEP) that includes Aboriginal and historical heritage items. Local Councils identify items that are of significance within their LGA, and these items are listed on heritage schedules in the local LEP and are protected under the EP&A Act and *Heritage Act 1977.*

1.2 Study area

The study area is located within the Wollongong LGA, Parish of Kembla, County of Camden. The study area incorporates Lot 1 and 2 DP 730326, Lot 200 DP 803810, Lot 59 DP 1125379, Lot 1 DP 156208, Lot 1 DP 532391, Lot 312 DP 1188000, Lot 202 and 203 DP 1175709, and Lot 210 DP 1057565. It is bounded by the village of Horsley to the north, Cleveland Road to the south and Mullet Creek to the east (Figure 2).

1.3 Planning approvals

The proposed development will be assessed against Part 4 of the EP&A Act. Other relevant legislation and planning instruments that will inform the assessment include:

- NPW Act
- *National Parks and Wildlife Amendment Act 2010* (NSW)
- *Wollongong Local Environmental Plan 2009* (LEP).

1.4 Objectives of the investigation

The objectives of the investigation can be summarised as follows:

- To identify and consult with any registered Aboriginal stakeholders and the Illawarra Local Aboriginal Land Council (LALC).

- To conduct additional background research in order to recognise any identifiable trends in site distribution and location.
- To search statutory and non-statutory registers and planning instruments to identify listed Aboriginal cultural heritage sites within the study area.
- To highlight environmental information considered relevant to past Aboriginal occupation of the locality and associated land use and the identification and integrity/preservation of Aboriginal sites.
- To summarise past Aboriginal occupation in the locality of the study area using ethnohistory and the archaeological record.
- To formulate a model to broadly predict the type and character of Aboriginal sites likely to exist throughout the study area, their location, frequency and integrity.
- To conduct a field survey of the study area to locate unrecorded or previously recorded Aboriginal sites and to further assess the archaeological potential of the study area.
- To assess the significance of any known Aboriginal sites in consultation with the Aboriginal community.
- To identify the impacts of the proposed development on any known or potential Aboriginal sites within the study area.
- To recommend strategies for the management of Aboriginal cultural heritage within the context of the proposed development.

1.5 Investigators and contributors

The roles, previous experience and qualifications of the Biosis project team involved in the preparation of this archaeological report are described below in Table 1.

Table 1 Investigators and contributors

Name and qualifications	Experience summary	Project role
Elizabeth Wyatt BSc. Grad.Dip Arts (Hons) Archaeology	Elizabeth is a senior archaeologist based in Newcastle, NSW. Elizabeth has over 12 years' experience in consulting archaeology in NSW. Elizabeth has prepared numerous ACHAs for SSDs and as part of AHIP applications for local councils, land developers and the extractive resources industries in the Newcastle, Hunter Valley and Central Coast regions.	• Quality assurance
Mathew Smith BA, BSc (Hons)	Mathew is a project archaeologist who has four years of experience in the consulting industry. Mathew has worked on a number of Aboriginal cultural heritage projects across New South Wales as an archaeologist and project manager and specialises in the identification and analysis of lithic assemblages.	• Test excavations • Project management • Report preparation • Artefact analysis
Matthew Tetlaw BA (Hons)	Matthew completed his Bachelor of Arts with honours in 2018 and joined Biosis in their Wollongong office in 2019. During his undergraduate years he participated in historical and Indigenous archaeological assessments in his home state of	• Test excavations • Aboriginal consultation • Background research

	Western Australia and abroad. Primarily, these have included historical surveys of convict sites, an international excavation in Bulgaria and a desktop rock-art assessment.	

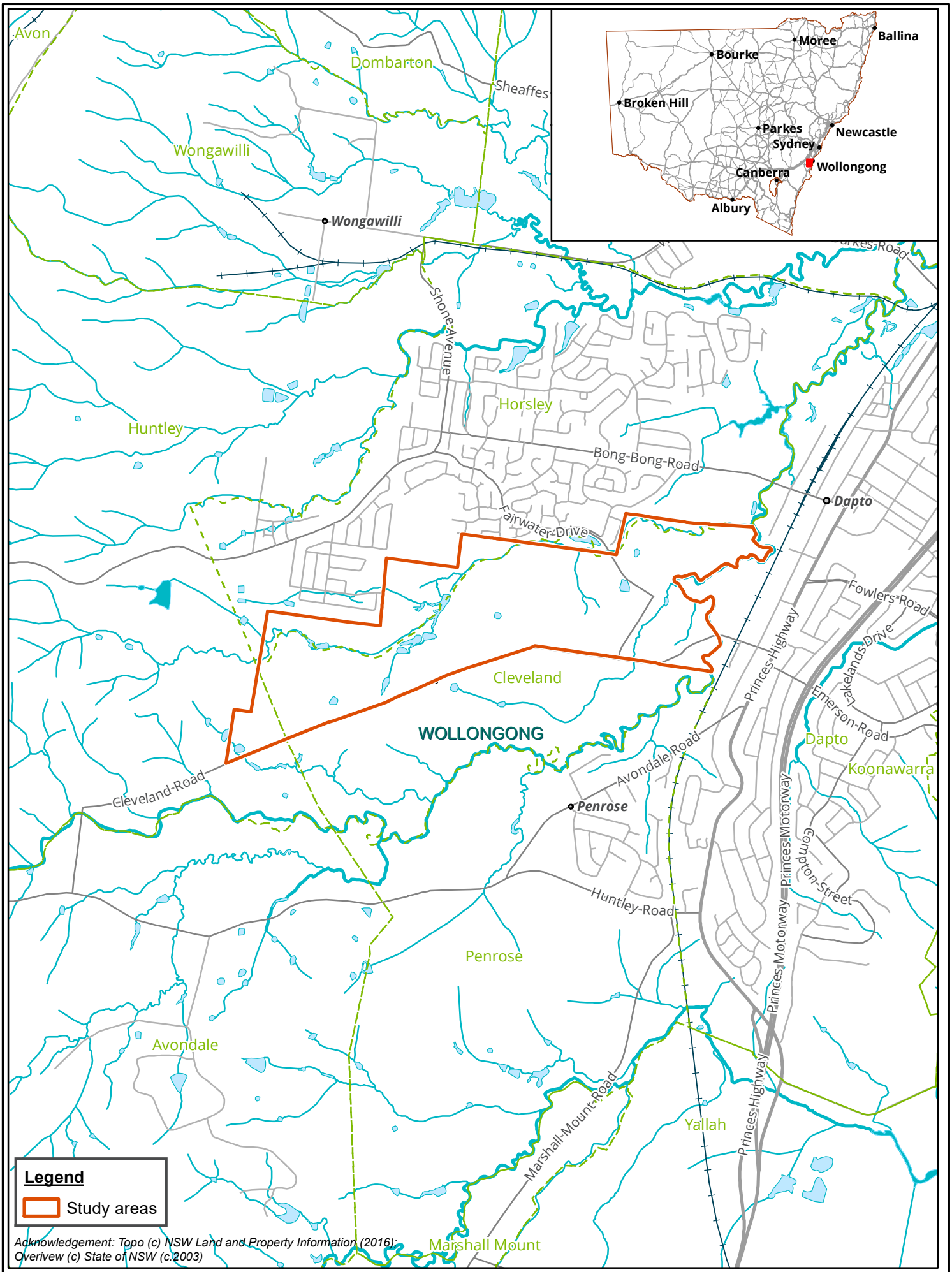


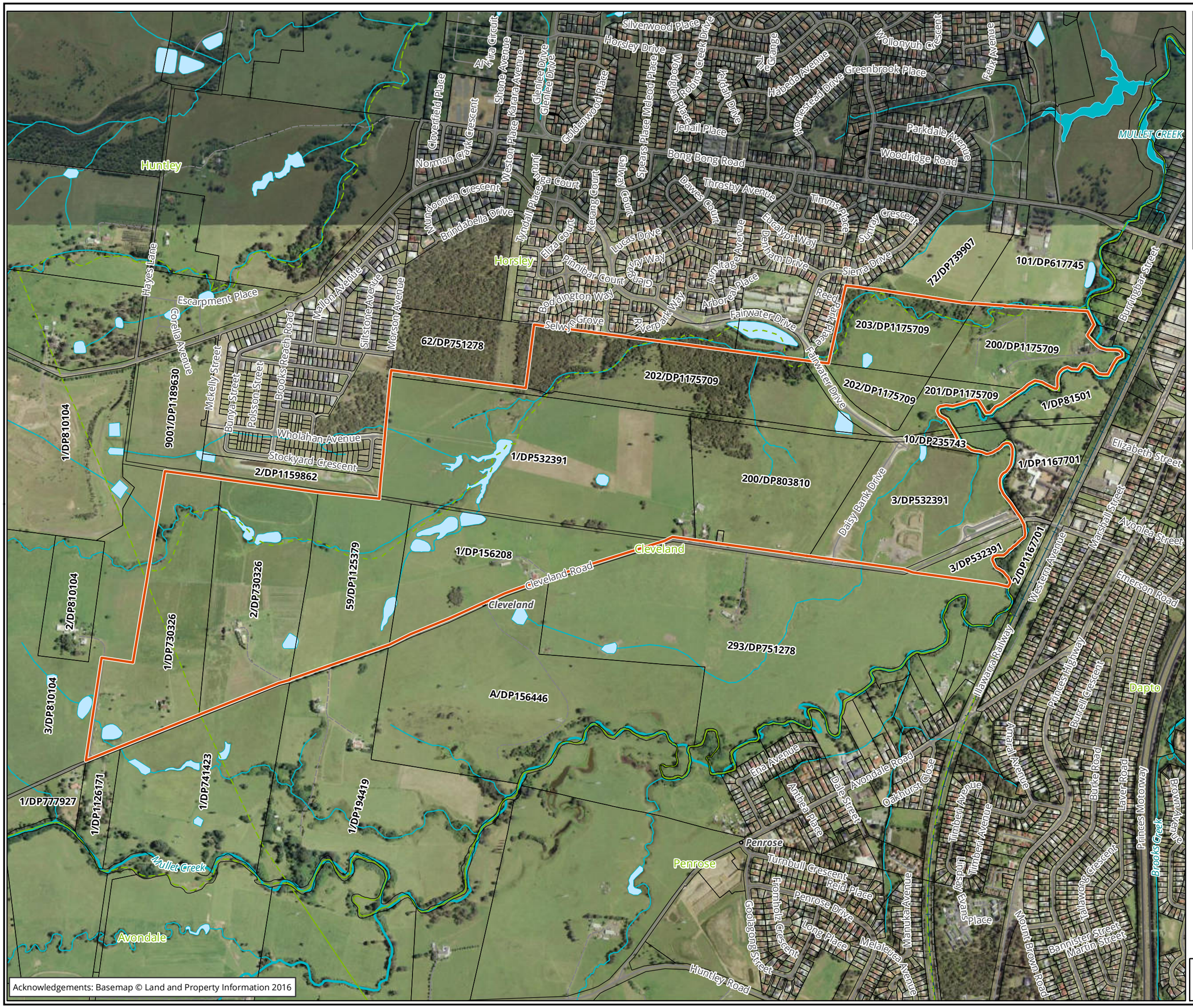
Figure 1 Location of the study area

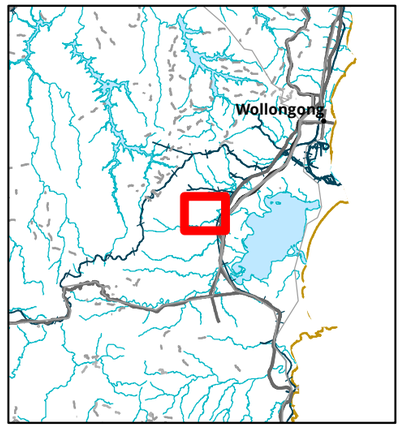
Biosis Pty Ltd
Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 30982
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping\

0 300 600 900 1,200
Metres
N

Scale 1:30,000 @ A4, GDA 1994 MGA Zone 56





Legend

Study area

Lot

Figure 2 Study area detail

0 130 260 390 520 650

Metres

Scale: 1:11,439 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 14 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F2_StudyArea.mxd

2 Proposed development

The proposed development will involve the subdivision and construction of residential housing in Lot 1 and 2 DP 730326, Lot 200 DP 803810, Lot 59 DP 1125379, Lot 1 DP 156208, Lot 1 DP 532391, Lot 312 DP 1188000, Lot 202 and 203 DP 1175709, and Lot 210 DP 1057565 (Figure 3).

This development will include a number of works associated with residential development of the area including:

- Bulk earthworks for landscaping including infilling of existing dams and modification of drainage lines.
- Site compounds and material laydown areas.
- Construction of services and amenities including underground utilities such as electrical, telecommunication and waste water services.
- Construction of roads and associated features such as roundabouts, signage and kerbing.
- Subdivisions and construction of residential dwellings and associated infrastructure such as parks and pedestrian pathways.
- Construction of OSD basins and retention ponds.

Legend

- Study area
- Proposed development footprint

Figure 3 Proposed development

0 100 200 300 400 500

Metres

Scale: 1:10,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 30982
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping\30982_F3_PropDev

3 Desktop assessment

The desktop assessment involves researching and reviewing existing archaeological studies and reports relevant to the study area and surrounding region. This information is combined to develop an Aboriginal site prediction model for the study area, and to identify known Aboriginal sites and/or places recorded in the study area. This desktop assessment has been prepared in accordance with requirements 1 to 4 of the Code.

3.1 Landscape context

It is important to consider the local environment of the study area any heritage assessment. The local environmental characteristics can influence human occupation and associated land use and consequently the distribution and character of cultural material. Environmental characteristics and geomorphological processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly landscape features can contribute to the cultural significance that places can have for people.

3.1.1 Topography and Geology

The study area consists of low lying, mostly cleared, alluvial lowland and floodplain adjacent to Mullet Creek and its tributaries, and an undulating midland valley. The study area is situated within a rural landscape with irregular stands of forest vegetation surrounding homesteads, along drainage lines and upon low knolls.

The geology of the study area consists primarily of quaternary aged alluvial floodplain deposits consisting of quartz fluvial sands, clays and silts. Red brown and grey lithic sandstone is also present in the study area (Stroud et al. 1985, pp. 9029–9129) (Figure 4)

3.1.2 Hydrology

There are a number of hydrological features within and surrounding the study area (Figure 5). They are primarily in the form of small creeks and streams. One unnamed third order creek line runs through the study area from west to east. This creek line drains into the fourth order stream Mullet Creek on the eastern boundary of the study area. There is also a second order creek line which runs north to south off of the northern boundary line. This creek line drains into the same fourth order stream on the eastern boundary of the study area. These creek lines would have provided useful resources for Aboriginal people in the region and could contain evidence of Aboriginal occupation as a result.

3.1.3 Soil landscapes

Soil landscapes have distinct morphological and topological characteristics that result in specific archaeological potential. Because they are defined by a combination of soils, topography, vegetation and weathering conditions, soil landscapes are essentially terrain units that provide a useful way to summarise archaeological potential and exposure.

There are three soil landscapes within the study area; the Fairy Meadow, Shellharbour, and Albion Park soil landscapes (Hazelton & Tille 1990) (Figure 6). The Fairy Meadow soil landscape is associated with the alluvial plains, floodplains, valley flats, swamp landscapes and terraces below the Illawarra Escarpment. Soils present within the Fairy Meadow soil landscape consist of friable alluvial loams and siliceous sands on the upper flood plains with dark brown sands and heavy clays on the lower alluvial flats. The dominant soil materials of the Fairy Meadow soil landscape are outlined in Table 2. The limitation of this type of soil landscape is the flood prone nature of the low wet bearing, highly permeable soils, with high seasonable water table (Hazelton & Tille 1990, pp. 100).

The total depth of Fairy Meadow soil landscape within upper floodplains and terraces is less than 100 centimetres. They overlay Quaternary sediments that consist of quartz sand, lithic fluvial sand, silt and clay. Total soil depth within valley flats is less than 150 centimetres and overlies Quaternary sediments. The Fairy Meadow soil landscape is a swamp landscape that is characterised by soils that are at least seasonally wet, with water tables frequently close to the surface (Hazelton & Tille 1990, pp. 100). Parent soil material includes large amounts of accumulated decayed organic matter. Since they accumulate parent soils and deposit transported soils, swamp soil landscapes would preserve archaeological material; although their susceptibility to flooding and water inundation suggests there is a lower likelihood that they were intensively occupied.

Table 2 Fairy Meadow soil landscape characteristics (Hazelton & Tille 1990, pp. 100).

Soil Material	Description
Fairy Meadow 1 (fa1)	Brownish black loose sandy loam, fa1 is associated with upper floodplains and terraces; typically forms a topsoil up to 20 centimetres thick.
Fairy Meadow 2 (fa2)	Brown sand, fa2 overlies fa1 on upper floodplains, and forms topsoil on valley flats; depths vary, but fa2 is generally up to 40 centimetres thick.
Fairy Meadow 3 (fa3)	Yellowish brown clay that underlies fa2 for a depth of up to 50 centimetres in valley flats.
Fairy Meadow 4 (fa4)	Olive brown clay that underlies fa3 for a depth of up to 80 centimetres in valley flats; it sits above Quaternary sediments.

The Shellharbour soil landscape is associated with rolling low hills with long sideslopes and broad drainage plains which occur on Budgong sandstone on the coastal plain. It is described as a deep prairie soil which occur on crests and supper slopes with brown krasnozems which occur on midslopes, red podzolic soils and prairie soils occur on lower slopes and drainage plains. The dominant soil materials of the Shellharbour soil landscape are outlined in Table 3. The limitation of this soil landscape is the mass movement nature of shallow soils, water erosion hazard, sodicity, hard setting, low permeability, low wet bearing strength with a high shrink swell. The mass movement of shallow soils is not likely to preserve *in situ* archaeological material frequently in the top soil layer; however, archaeological material could be preserved in the layers below albeit in mixed soil contexts.

Table 3 Shellharbour soil landscape characteristics (Hazelton & Tille 1990, pp. 58)

Soil Material	Description
Shellharbour 1 (sh1)	Friable brownish black sandy loam 2-5 millimetre crumb peds.
Shellharbour 2 (sh2)	Hard setting organic rich black light clay, moderately pedal, 5-10 millimetre platy peds.
Shellharbour 3 (sh3)	Mottled dull reddish brown, sandy clay with characteristic stone line.
Shellharbour 4 (sh4)	Brown strongly pedal heavy clay 20-50 millimetre sub angular to columnar peds
Shellharbour 5 (sh5)	Very sticky, strongly pedal dull reddish brown sandy clay loam to sandy clay at depth.

The Albion Park soil landscape is associated with short steep upper slopes that grade into long gentle footslopes. These occur on the Berry Formation on the Coastal Plain. The Berry Formation is comprised of mid grey to dark grey siltstone, mudstone and fine sandstone with localized outcrops of Budgong Sandstone (red brown and grey lithic volcanic sandstone) on mid to upper slopes. Localised outcrops of Bumbo Latite occasionally occur on crests. Reliefs range from 60-100 metres and drainage lines are incised on upper slopes

that grade into broad drainage plains on lower slopes (Hazelton 1992, pp. 40). Soils present within the Albion park soil landscape consist of friable sandy clay loam and clays (Table 4).The Albion Park landscape is an erosional landscape and is unlikely to preserve Aboriginal sites *in situ* due to processes of erosional soil movement. The formation of this landscape through erosional processes combined with the generally sloped nature of landforms within it would have removed artefacts and artefact bearing soils.

Table 4 Albion Park soil landscape characteristics (Hazelton 1992, pp. 41)

Soil Material	Description
Albion Park 1 (ap1)	Friable brownish black sandy clay loam (topsoil), rough faced porous fabric, with <2 millimetre peds.
Albion Park 2 (ap2)	Hardsetting weakly pedal dark brown loam (topsoil), rough faced porous fabric, with <2 millimetre peds.
Albion Park 3 (ap3)	Mottled moderately pedal greyish brown light clay (subsoil), moderately pedal, 50-100 millimetre angular blocky peds, with rough faced, porous fabric.
Albion Park 4 (ap4)	Weakly pedal bright yellowish brown sandy loam (subsoil), rough faced porous fabric, with <2 millimetre peds.
Albion Park 5 (ap5)	Mottled moderately pedal yellow orange heavy clay (subsoil), moderately pedal, 20-50 millimetre sub-angular blocky peds, with rough faced, porous fabric.

3.1.4 Landscape resources

The margins of the Wollongong Plains are characterised by mixed warm temperate and subtropical rainforest complexes on rich shale soils and alluvium under the Illawarra Escarpment, interspersed with patches of lowland forest and woodland communities. The study area is located within areas that have been cleared or retain pockets of disturbed native vegetation, with intact remnant vegetation situated along the creek line corridors.

The Wollongong Plains generally provide a number of resources used by Aboriginal inhabitants. Lithic resources would have been accessible in the outcrops of siltstone, shale and tuffaceous sandstones of the Berry Siltstone formation, while coastal rock platforms provided areas where tools might be ground and sharpened and art might be engraved. Quartz would have been available locally and dispensed through trading with other groups (Donlon & Sefton 1988, pp. 23). Igneous raw materials would have come from the south of the study area in areas like Gerringong, due to its volcanic nature (Donlon & Sefton 1988, pp. 55). Angular cobbles and pebbles of fossilised wood have also been recorded near the study area in the bed of Robins Creek (Sefton 1990, p. 4), which is located north of the current study area.

Aerial imagery and vegetation mapping undertaken by the National Parks and Wildlife Service (NPWS 2002) shows that the study area has been cleared of native vegetation; however, native vegetation communities in the vicinity of the study area and around Lake Illawarra would have been comparable to vegetation found in the study area prior to clearing. These vegetation communities include (NPWS 2002):

- Lowland Woollybutt – Melaleuca Forest located on flat low-lying Shoalhaven Group sediments at elevations between 10 and 35 metres above sea level. It is characterised by the presence of Woolybutt (*Eucalyptus longifolia*), Stringybark (*Eucalyptus globoidea, Eucalyptus eugenioides*), and Honey Myrtle (*Melaleuca decora).*

The bark from Stringybark and red gum species was used as rope and string to make nets, fishing lines, as well as to construct shelters and canoes (Stewart & Percival 1997).Trees in the acacia family also provided

useful resources as the seeds from certain acacia species could be eaten and the bark tannin used for fishing (Stewart & Percival 1997, pp. 8).

Terrestrial and avian resources were used for food, but they also provided a significant contribution to the social and ceremonial aspects of Aboriginal life through their use as ritual implements or even simply through fashioning as personal adornments (Attenbrow 2002, pp. 107). Mammals such as kangaroos, possums and wombats were used as a food source and also for tool making. Bones and teeth were used as points or barbs for hunting spears and fishing spears, while tail sinews are known to have been used as a fastening cord (Attenbrow 2002, pp. 99). Aquatic species such as freshwater crayfish would have been easily accessible in larger waterways (Rosen 1995). Aquatic vertebrates, fish and eels, would also have been present within larger creeks and waterways. Fishing spears were described as being barbed with fish teeth as well as fish bones (Attenbrow 2002, pp. 117).

There are a number of historical records from the nineteenth century observations of Aboriginal people in the Illawarra that refer to activities around Mullet Creek.

Alexander Harris who visited the Illawarra between 1828 and 1838 published his autobiographical work *Settlers and Convicts* in 1847 where he noted usage of Cabbage Trees (*Livistona australis*) as a footbridge over Mullet Creek (Organ 1990: 163):

> *The Mullet Creek where we passed it must have been nearly five and thirty feet wide; and the bridge was one of those slender cabbage trees grown on the bank and flung by some bushman or black across the creek with his axe, either with a view to using it as a bridge or for the sake of the interior part of the head, which is very similar when dressed to cabbage, and is a favourite article of food with many…*

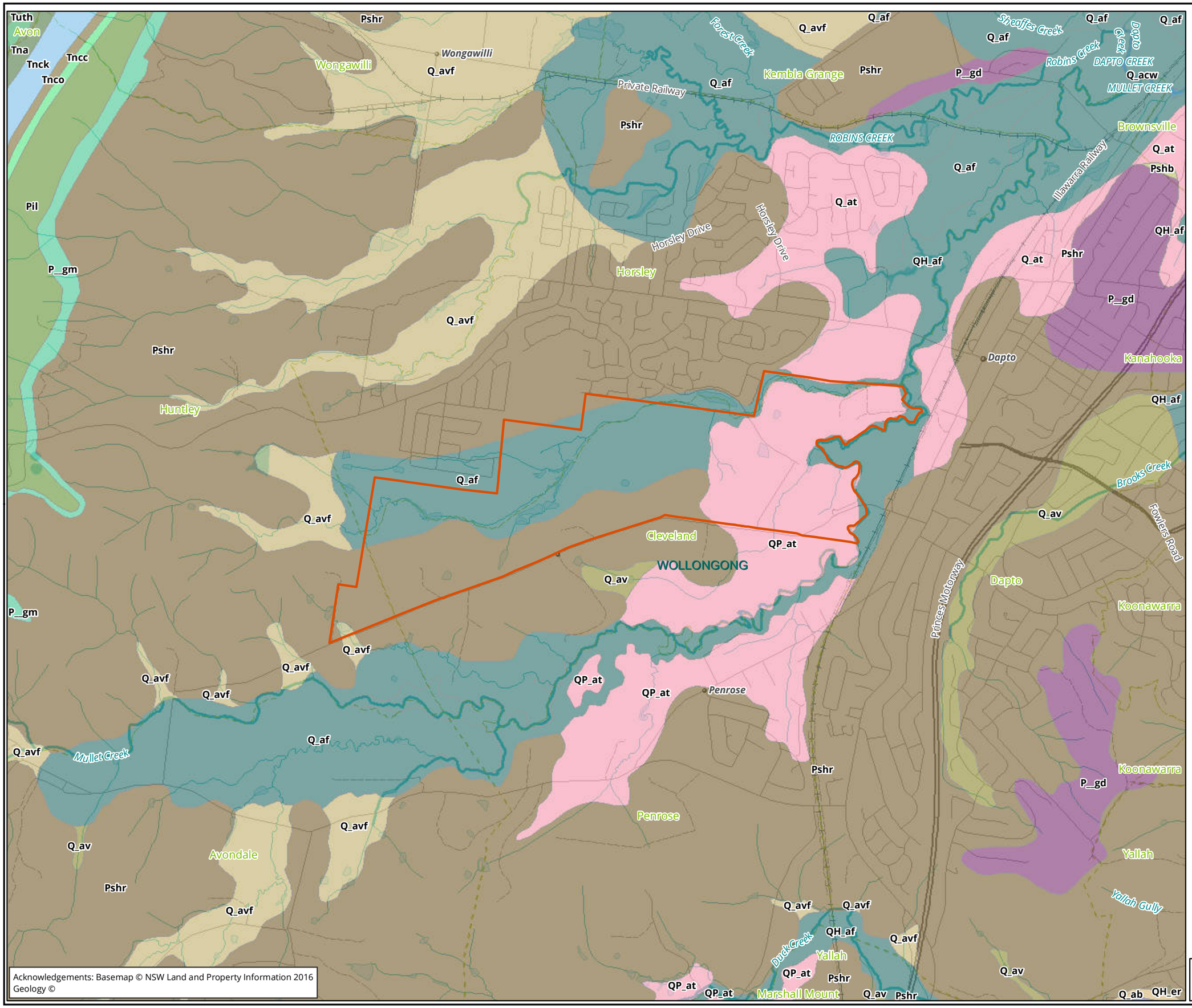
A local settler at the Lake Illawarra, John Brown, noted extensive Aboriginal exploitation of the Mullet Creek area in 1888 (Organ 1990: 348). John Brown noted a great number of Aboriginal canoes on Mullet Creek:

> *…He (Mr George Brown) has always taken a deep and active interest in the lake and its islands, and also in Mullet Creek, down which he had made his first trip in a boat in 1837, blackfellow canoes then being the order of the day…*

3.1.5 Land use history

Within the study area, soil disturbance has been associated with historic pastoral land-use practices. The Dapto area has been subjected to extensive grazing and agricultural practices from 1880's onwards (McDonald 1976). Cedar cutters were the first to open up the Illawarra area from as early as 1805. When they had exhausted the easily accessible timber by 1820, cattle grazing took over and the coastal plain was extensively settled and cleared for pastoral estates and farms. Many early houses were built of rough slab or timber construction (Kass 2010, pp. 66).

This history of pastoralism continued into the 1990s. Title deeds from 1966 indicate that land adjacent to the south-western portion of the road was owned by Robert Martin, a farmer (Land Registry Services Book 2779 No. 564). Additional land across the road was originally owned by Edward Kelly, also a farmer (Land Registry Services Folio 1264 Plan 26). Further evidence for pastoral use of land surrounding Cleveland Road is supplied by land deeds which show a property adjacent to the central portion of the road was owned by Daniel Timothy Nunan, a dairy farmer in 1977(Land Registry Services Book 3290 No. 89).



Acknowledgements: Basemap © NSW Land and Property Information 2016
Geology ©

Legend

Study area

Geological units

- Alluvial backswamp deposits
- Alluvial channel deposits-subaqueous
- Alluvial fan deposits
- Alluvial floodplain deposits
- Alluvial terrace deposits
- Alluvial valley deposits
- Berry Siltstone
- Broughton Formation
- Coal Cliff Sandstone
- Dapto Latite Member
- Estuarine shoreline ridge and dune
- Hawkesbury Sandstone
- Illawarra Coal Measures
- Kangaloon Sandstone
- Minnamurra Latite Member
- Narrabeen Group
- Wombarra Claystone

Figure 4 Geological units in the vicinity of the study area

0 200 400 600 800 1,000

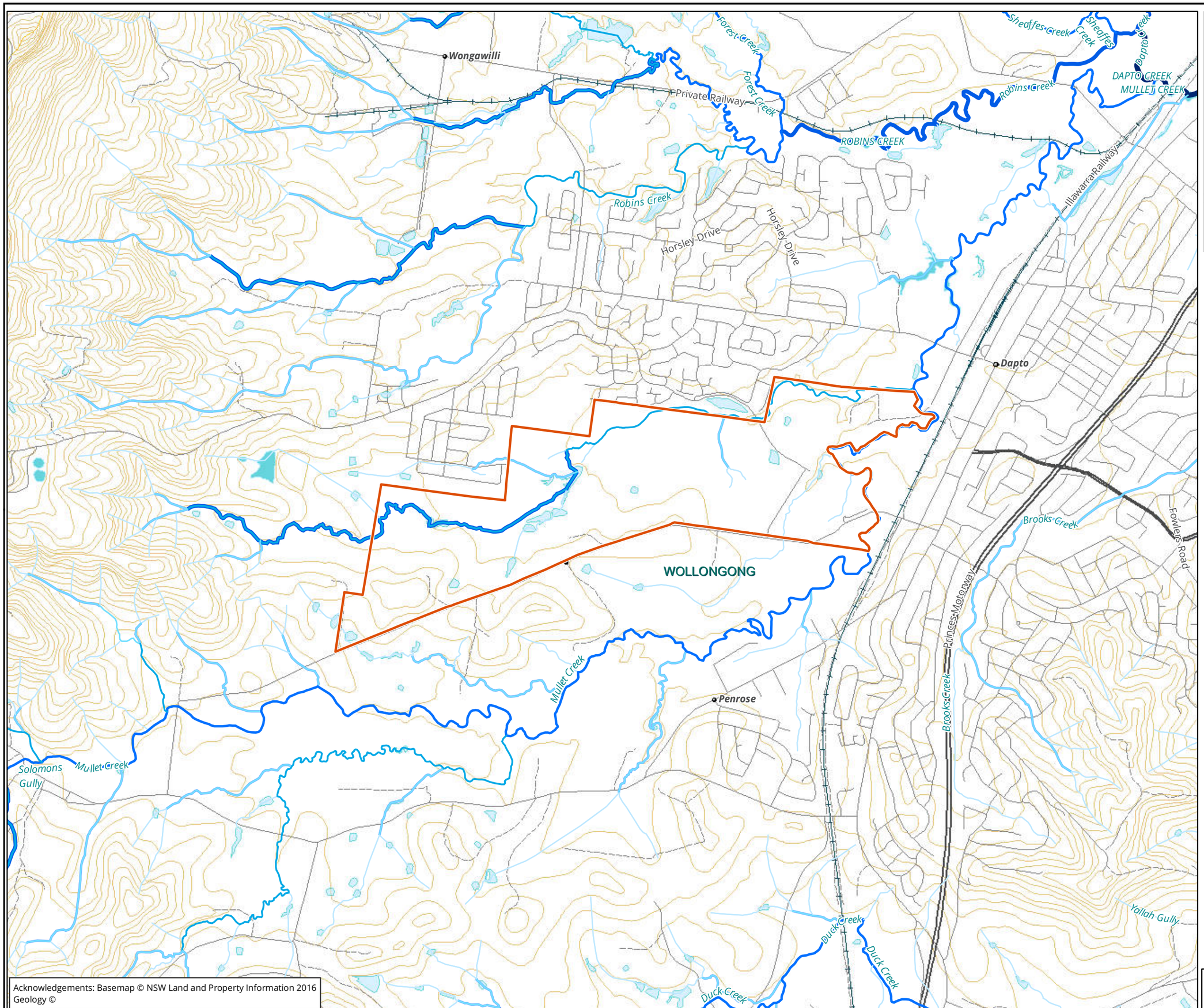
Metres
Scale: 1:20,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

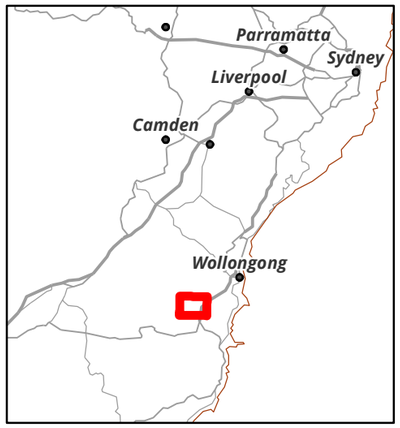
N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F4_Geology.mxd





Legend

- Study area

Strahler Order

- 1
- 2
- 3
- 4
- 5
- 6
- Dam
- Natural watercourse

Figure 5 Hydrology in the vicinity of the study area

0 200 400 600 800 1,000

Metres
Scale: 1:20,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F5_Hydrology.mxd

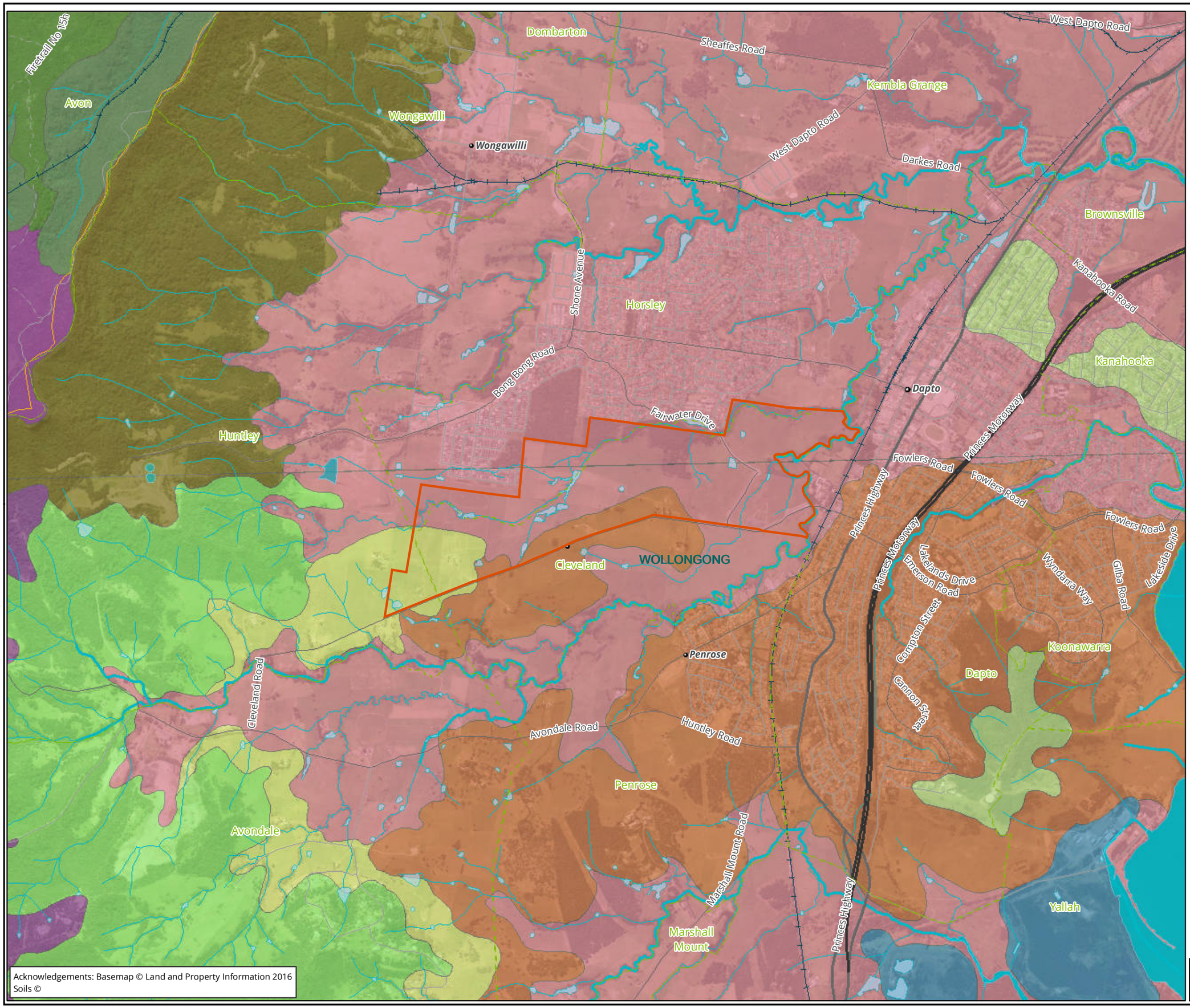


Figure 6 Soil landscapes in the vicinity of the study area

Matter: 30982,
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F6_Soil.mxd

3.2 Previous archaeological work

A large number of cultural heritage surface (surveys) and sub-surface (excavations) investigations have been conducted throughout the region of NSW in the past 30 years. There has been an increasing focus on cultural heritage assessments in NSW due to ever increasing development, along with the legislative requirements for this work and greater cultural awareness of Aboriginal cultural heritage.

The majority of south coast Aboriginal sites date to the last 6,000 years when the sea-level stabilised following the end of the last Ice Age. Prior to this, sea levels were lower and the coast was located much further inland, about 14km to the east of its current position. Coastal sites older than 6,000 years are rare, as most would have been most likely inundated by the rising sea. Pleistocene-age Aboriginal sites on the south coast include a rock shelter at Burrill lake (located approximately 150km south of the study area) which has been dated to 20,830±810BP (ANU-138) (Lampert 1971, pp. 122) and a coastal midden at Bass Point dated to 17,010±650BP (ANU-536) (Bowdler 1970, pp. 254).

3.2.1 Regional overview

A number of Aboriginal cultural heritage investigations have been conducted for the Illawarra region. Models for predicting the location and type of Aboriginal sites with a general applicability to the Lake Illawarra region and thus relevant to the project area have also been formulated, some as a part of these investigations and others from cultural heritage investigations for relatively large developments. A growing number of archaeological surveys have been conducted between the hinterland and the coast as a result of increased development activities, including the present study area and its immediate surrounds.

Sefton (1980) undertook an archaeological survey of the proposed transmission line routes in the West Dapto-Yallah Area of the City of Wollongong, approximately 7 kilometres from the current study area. Two archaeological sites were identified during this survey. Registered site, AHIMS 52-5-0123/Yallah Site 1, consisted of one isolated artefact that was located on the northern bank of a tributary of Duck Creek, made from fossilised wood. AHIMS 52-5-0122/Yallah Site 2 was located within 150 metres of Lake Illawarra on a lower slope and is a sparse scatter of seven artefacts made from chert, jasper and rhyolite. The site was located on a gradual slope, and has been previously disturbed by quarrying, erosion and underground services (Sefton 1980, pp. 10). Both sites are within the close proximity to reliable, permanent sources of water on flat elevated grounds.

Sefton's (1984) study formed part of the Local Environmental Study prior to the Stage 1 of the West Dapto Release Area (WDRA) development in Horsley, north of the study area. A copy of the Sefton's report could not be obtained, but the review was revised from a study undertaken by AMBS in 2006 (AMBS 2006).

The following key elements constitute Sefton's site predictive model for the WDRA:

- Archaeological sites at Bass Point provide evidence of Pleistocene occupation, and there is no evidence to suggest West Dapto could not have been occupied at this time.
- It is possible that stratified occupational deposit could be located in the Pleistocene sediments of the flood plains at West Dapto. Stratified occupational deposit of Holocene age is also likely (and more possible) to occur in the floodplain sediments.
- Ethnohistorical records suggest two major zones of exploitation: (1) the coastal zone, including the shoreline, off shore islands and Lake Illawarra; and (2) the inland zone, including undulating tablelands. Groups who used both areas were small, mobile, and associated with a locality, but also ranged over larger areas. On this basis, it could be expected that the West Dapto area could have been exploited from both east and west directions, in addition to tracks along ridgelines.

- The Lake Illawarra shoreline presents restricted areas for campsites relative to the concentrated resources. Midden sites may not represent base camps (occupation sites) but instead preferred sites for resource exploitation. These preferred sites are expected to occur within two kilometers of the Lake Illawarra shoreline, and would have been established around the lake shore.
- The resources of West Dapto (flora, fauna, available water) would have made the locality attractive to occupation and exploitation. However, resources would have been scattered and at low density in comparison to Lake Illawarra, and the locality was probably not economically self-contained. Base camps would not have been suitable for exploitation of these resources.
- Stone materials are not sourced within the area, with the exception of latite cobbles and occasional quartz pebbles. Consequently, stone would have been conserved at camp sites.
- Tracks connecting the coast to the interior would be expected through the West Dapto area, due to its geographic location between the two. Aboriginal tracks are usually along ridges, and consequently, sites could be expected in the saddles of ridges.
- Along the eastern coastal plain and the foothills of the escarpment to the west, sites are likely to occur on ridgelines or on dry level land within 100 metres of a creek line.
- In the foothills of the Escarpment to the west, sites may also occur further away from water on saddles of the Marshall Mount spur and on level areas of smaller ridgelines along the escarpment slopes and foothills.
- Extractive sites will also be located in West Dapto. These would occur as scarred trees, isolated large cores, tools of latite or small isolated stone artefacts. These sites may occur in all landform contexts, although scarred trees could only be identified in areas where trees have not been fired or cleared.
- It is not expected that latite quarry sites will occur at West Dapto. Although edge ground tools have been located in adjacent areas on the shores of Lake Illawarra, although those tools have been prepared from pebbles or cobbles and not from quarried materials (AMBS 2006, pp. 87–88).

The following four areas were identified in WDRA as having high archaeological potential:

- All level areas of the Western foothills zone and the Coastal Plain within 100 metres of a creek located on:
  - Quaternary deposited flood plains.
  - Budgong Sandstone
  - Berry Siltstone.
- Saddles on the ridges of Marshall Point spur.
- Level areas in the Forest Creek Valley in the Escarpment Protection Zone.
- Level areas of the escarpment slopes on the topographic benches and bluffs.

Three main categories of sites being of potential significance were also identified:

- **Stratified occupational deposits**: may occur in the flood plain deposits of West Dapto, these deposits would have significant research potential and would be rare. Such a site may contain stone artefacts, food refuse and charcoal, which could be dated to establish a chronology of occupation of West Dapto. This would be significant to the public and be of educational significance. If the site were of Pleistocene age, it would be of major heritage significance to the Australian people, such as that identified at Bass Point.
- **Surface camp sites:** these unstratified deposits are likely to contain stone artefacts, and possibly, remnants of shell and charcoal. Bone is unlikely to have survived. These sites may provide

information on settlement patterns, economic exploitation and stone tool manufacture and maintenance. These sites have research potential, but it is also predicted that they will be the most common site type at West Dapto.

- **Scarred trees:** although the identification of scarred trees is recognized to be problematical, any found in West Dapto will be of research potential (i.e. study of individual tree scars, relationship with other site types). Scarred trees are rare in the North Illawarra as in most areas, mature native trees have been burnt, and the rarity of scarred trees increases their significance (AMBS 2006, pp. 90).

Koettig (1992) conducted an assessment of Aboriginal sites for the electrification of the Dapto to Kiama railway line. Landforms surveyed included the low lying coastal plain and foothills. Due to the levels of previous disturbance during the construction of the railway it was considered that any possible archaeological sites would have been destroyed. No sites were located during the survey. Since the railway crosses areas that are deemed as having high archaeological sensitivity, such as dunes, old terraces, areas close to water sources that have not been affected by the recent development, archaeological material could still remain. Any new development outside the boundary of the railway easement was assessed as having archaeological sensitivity (Koettig 1992, pp. 4).

Australian Museum Business Services (AMBS) (2006) completed an Aboriginal Heritage Management Plan for the West Dapto Release Area (WDRA). This large scale study was commissioned by the Wollongong City Council and encompasses the study area. From the initial survey program, a total of 24 archaeological sites; 13 open camp sites, 6 isolated finds, 5 scarred trees were located within the boundaries of the WDRA study area. These were positioned on all landforms including creek lines (6), alluvial flats (3), spanning creek lines and alluvial flats (3), hillslopes (8) and spur crests (4). A second stage of assessment, which included a portion of the current study area, was subsurface testing of an area of 100 square metres (100, 1 metre by 1 metre test pits) undertaken across all representative landforms of the Mullet, Duck and Marshall Mount Creeks catchment area. A third stage of testing was carried out at Darkes Road Town Centre and Bong Bong Road Town Centre.

A total of 425 artefacts were recovered from the following landscape contexts:

- Hillslopes (158, of which 146 were from one test pit).
- Alluvial flats – Pleistocene and Holocene terraces more than 10 metres away from stream channels (118 artefacts).
- Streams – edges of Pleistocene and Holocene terraces within 10 metres of stream channels (86 artefacts).
- Spur crests (63 artefacts).

Three hundred and fifty three of the artefacts were recovered from less than 20 centimetres of deposit. A range of raw materials were represented including, chert, quartz, quartzite, silcrete, silicified tuff and fine-grained siliceous. Artefact types included broken flakes, flakes, flaked pieces and cores. The range of raw materials and artefact types is considered characteristic of the region.

AMBS concluded that from known site patterning it is likely that additional archaeological sites may occur throughout all landforms of the WDRA, although at varying site and artefact densities, and subsequently all parts of the study area are considered to have some archaeological potential. In general, the highest artefact density was encountered along hillslopes, second-order streams, followed by the first order streams, third order streams, alluvial flats, fourth order streams and then spur crests. Although artefact numbers recovered from individual test pit was low, high artefact recovery across all the landforms illustrate that the use of WDRA area was widespread, but not intensive. It was concluded that low density artefact scatters would be relatively common within the entire WDRA area (AMBS 2006, pp. 245).

The report recommended further investigation and management of those areas considered to have higher archaeological potential, including a number of spur crests within the Mullet Creek corridor, the benched foot slopes within the Escarpment foothills adjacent to creek lines and the lower tributaries of major creeks (AMBS 2006, pp. 266). These landforms would have provided camping sites, functioned as travel routes or provided a range of resources.

Areas of cultural value highlighted by the Aboriginal stakeholders throughout the development of the report are closely related to the archaeological record and the natural environment (AMBS 2006, pp. VIII). All archaeological sites were identified as having cultural values, with the connection between cultural and natural values being emphasised. Large scatters and scarred trees were considered of higher significance, as were those sites retained within a natural setting. Conservation of important archaeological sites and natural areas such as creek lines and vegetated areas was a common theme identified among the Aboriginal stakeholder comments.

As part of the WDRA, AMBS commissioned Philip Hughes to complete a geomorphology / archaeological testing program prior to the commencement of the larger sub-surface investigation program. Hughes excavated a series of test pits using a combination of hand excavation and a backhoe within various landforms identified by AMBS (2006). The geomorphic testing revealed that while all landforms had the potential to contain artefact-bearing deposits, archaeological evidence for Aboriginal occupation and use of the Pleistocene terraces would be restricted to the Holocene period (AMBS 2006, pp. 176). Artefact bearing deposits across all landforms comprise soft to firm soils and sediment. The depth of deposits varies across landforms, with the shallowest sediments occurring on ridges and hill slopes, and the deepest sediments occurring on Holocene terraces. 'Richer' archaeological deposits could be expected within Holocene terraces, but they would be disturbed by floods and perhaps buried in deeper alluvium (AMBS 2006, pp. 177). Artefacts were retrieved from alluvial flats at a maximum depth of 60 to 70 centimetres.

Biosis (2011a) completed Aboriginal heritage assessment and impact management study for the proposed water and wastewater servicing of the West Dapto Urban Release Area (WDURA) and Adjacent Growth Areas in 2011. The survey identified three new Aboriginal archaeological sites: AHIMS 52-2-3813/NRE Wongawilli AFT-1, / AHIMS 52-2-3814/ Smiths Lane AFT-2 and AHIMS 52-2-3815/Riverpark Way AFT-3. All of the sites were located in the disturbed context and the potential for further sub-surface deposits was assessed as low (Biosis 2011a, pp. 156–158). Areas of low, moderate and high PAD were identified across the assessed area. These were defined based on the levels of disturbance, sensitive landforms, survey results and the likelihood for intact archaeological deposits. Overall, a small number of high and moderate areas of potential were identified, mainly on ridge crests, creek spurs and on flat grounds near the confluence of creeks (Biosis 2011a, pp. 173). Further archaeological assessment was recommended for areas mapped as having high archaeological potential. Sections of these areas are within the study area. Areas as having high archaeological potential were identified between Reid and Mullet Creeks, and within 150 metres of Reid Creek.

GML (2015) were commissioned by Stockland to complete a land review on the heritage context of all Stockland owned lands in the Dapto area. This assessment included extensive background review, Aboriginal consultation, and some field survey to characterise the area. This assessment led to the revision of previous predictive models and the formulation of a number of predictive statements relating to the local area (2015, pp. 150–151). These statements have been summarised below:

- The area contains a number of alluvial terraces bordering the main creeks in the area. Suitable soil landscapes in these areas have high potential to contain subsurface archaeological deposits.
- The foothill landforms contain numerous palaeochannels showing a long history of the landscape being reworked. Predictive modelling should not rely on current creek location, but should consider the location of these palaeochannels.

- Sites identified in the middle reaches of Robins and Duck Creeks show a link to the extent of flood levels and Lake Illawarra water rises, showing that middens may occur up to 2.5 kilometres from the lake.
- The foot hills of the escarpment are the closest landforms with appropriate areas suitable for intensive Aboriginal activities. Alluvial terraces in this area with slopes of less than 3% are likely to have moderate to high potential.
- Sites on alluvial soils which have been excavated appear to occur in stratified deposits, and such sites should be excavated by stratigraphy to recover spatial data.
- Gravel beds are likely to have been used as sources for the extraction of raw stone materials. Investigations should aim to identify the sources of gravel beds and stone material.
- Within the foothills, the nature and extent of archaeological sites on the alluvial landscapes needs to be better understood. Archaeological sites may be connected with specific landscape locations, such as the upper outer bends of larger creeks, and may only extend away from the bend for 10 metres. Conversely, archaeological sites may be found on sheltered alluvial landforms on flat terraces nestled between the creek bends. The extent and results from archaeological testing, at the regional level, is currently insufficient to describe fine resolution archaeological patterning. The investigation and resolution of such models needs to be developed, so as to inform regional development and thus allow the conservation of key landforms and their Aboriginal sites.
- Archaeological evidence recovered from excavations on the coastal plain has been mainly limited to stone artefacts.
- Based on the sandstone bedrock of the region, creek beds may show evidence of grinding.

Those landforms associated with Aboriginal walking tracks may contain the greatest variety of archaeological evidence, with the potential for material brought up from the coast and down from the plateau.

3.2.2 Local overview

A number of Aboriginal cultural heritage investigations have been conducted within the region (within approximately 5 kilometres of the project area). Most of these investigations were undertaken as part of development applications and included surface and sub-surface investigations. These investigations are summarised below.

Navin Officer (1994) was commissioned by Camp Scott and Furphy to undertake an archaeological survey of the proposed Illawarra water quality project installation at Kembla Grange, approximately 5 kilometres north-east of the current study area. The survey was a targeted survey of creek banks and flats, areas of exposure around an existing dam, and flat ground on the southern part of their study area. These areas had higher degree of ground surface visibility and were considered as being favoured by Aboriginal people for occupation activities. Footslopes, creek banks, creek flats and plains were all aggrading landforms due to colluvial deposition and mass soil movement and deposition of sediments by water. The steep slopes on the spurs and in the north were sampled (Navin Officer 1994, pp. 7). During this survey there were no new Aboriginal sites identified. It was argued that archaeological potential in the proposed works area was low due to the results of previous testing in the similar landforms (Navin Officer 1994).

Navin Officer (2002) conducted an Indigenous heritage assessment for the Smiths Lane, Wongawilli rezoning application. The assessed area is located to the immediate north of Wongawilli Road, approximately 2.7 kilometres north of the current study area. It is within the east-facing slopes of the Illawarra Range and the topography consisted of moderate to low gradient, roughly northwest-southeast oriented, descending spur lines meeting the fluvial corridor and associated valley floor of the Mullet Creek catchment area. Navin Officer noted that the possible paucity of sites in this region could be attributed to lack of ground surface visibility hindering site detection as well as the likelihood that these areas represented a relatively less economically

attractive area than the adjacent coastal and estuarine margins (Navin Officer 2002, pp. 9) (Navin Officer 2002 p.9). No Aboriginal sites were identified. However several areas of limited PAD were noted. These included the main northern spur line and small locally elevated areas adjacent to the main (northern) creek line.

Biosis (2007) was engaged by TCG Planning on behalf of Huntley Heritage Pty Ltd to undertake Aboriginal archaeological assessment for the proposed rezoning and development of a parcel of land previously known as the Huntley Colliery site. The area consisted of 420 hectares of land located to the south of West Dapto; it encompasses an area between Duck and Mullet Creeks in the foothills of the Escarpment and is characterised by highly and gently inclined slopes with broad benches in the west, and low level relief with gentle slopes and alluvial plains at the east. The archaeological survey identified two new Aboriginal archaeological sites. Avondale 1 is a small density artefact scatter located on an exposure on a cattle track at the base of a ridgeline, approximately 20 metres from the confluence of Mullet Creek and one of its tributaries. Avondale 2 is an artefact scatter located on an exposed track close to a natural spring that feeds into a pool of a tributary creek to Mullet Creek. A number of other areas that have moderate archaeological sensitivity were identified. These include:

- Ridgeline crests and broad flat benches - levelled natural topography used for easy access to the Escarpment and good views.
- Areas along tributary systems and alluvial plains – raised areas of land adjacent to water confluences used for repeated occupation.
- Illawarra Plateau – shelters and sandstone platforms used for camping and ceremonial purposes.

Areas along and on top of the Illawarra Escarpment were assessed by local Aboriginal communities as having high cultural significance. It was accentuated that not only material, but also spiritual and cultural connections to the land need to be considered (Biosis 2007, pp. 61). Further archaeological test excavations were recommended for areas mapped as having moderate sensitivity, and a permit to impact two new Aboriginal sites be obtained (Biosis 2007, pp. 67–68).

Archaeological and Heritage Management Solutions (AHMS) (2010) completed Aboriginal and historical archaeological and cultural heritage assessment for the proposed Stockland residential subdivision of land at Bong Bong Road in West Dapto. The proposed subdivision area is located within the spur crest running east-west along Bong Bong Road with sloping grounds towards the Reid Creek to the south and the Robins Creek tributary to the north. Soils present are swampy alluvial deposits. Site prediction modelling from previous studies, particularly previous test excavations undertaken by AMBS in 2006, indicated that alluvial flats in association with lower order streams would contain low density open camp sites that represent short term and transitory occupation (AHMS 2010, pp. 44–45). One previously recorded Aboriginal archaeological site was located within the assessed area, AHIMS 52-2-3277/WDRA_AX_47.

During the archaeological survey one artefact scatter was identified, AHIMS 52-2-3779/WDSY1 and one Potential Archaeological Deposit (PAD), AHIMS 52-2-3778/WDY2. AHIMS 52-2-3779/WDSY1 was located on a terrace between two arms of Robins Creeks within an area that was identified as having archaeological potential by AMBS in 2006. A total of ten artefacts were recorded within two areas of exposure. Artefacts consisted of flakes made of silcrete, fine grained siliceous material, chert, chalcedony and banded chert (AHMS 2010, pp. 57). WDY2 was identified within a small triangular terrace of a tributary creek to Robins Creek. The terrace is about 20 to 30 metres from the creek and is 1.5 to 2 metres above the level of the creek and most likely is not prone to flooding. AHIMS 52-2-3277/WDRA_AX_47 was tested by AMBS in 2006 and three artefacts (silcrete and chert flakes) were recovered from three 1 metre by 1 metre test pits across approximately 50 square metres on a flat adjacent to Robins Creek tributary.

Site AHIMS 52-2-3779/WDY1 was assessed as having moderate archaeological potential. Recommendations were made to undertake further archaeological assessments if any impacts are proposed to any of the three registered Aboriginal sites.

Biosis (2011b) was commissioned by Wollongong City Council to undertake a program of sub-surface testing for the proposed Fairwater Drive extension to Cleveland Road, which included part of the current study area. Five PADs were registered within the proposed works areas that were subject to archaeological test excavations:

- AHIMS 52-5-0583/Cleveland Road PAD-1 is located on a minor rise to the south of Cleveland Road, within the study area and 200 metres from Mullet Creek. Five test pits were excavated on both sides of the small drainage channel. No artefacts were recovered and likelihood for sub-surface deposits to be present was considered low.
- AHIMS 52-5-0584/Cleveland Road PAD-2 is located within alluvial flats 10 metres of the western bank of Mullet Creek. Eight test pits were excavated to the sterile clay layer located at approximately 30 centimetres. Seven artefacts were recovered from four test pits that consist of flakes, a core and debitage made from silcrete, chert and mudstone. The site was assessed as having low scientific and moderate cultural significance.
- AHIMS 52-5-3765/Cleveland Road PAD-3 is located within alluvial flats 200 metres from Mullet Creek on the western side of the drainage line. Four test pits were excavated and no Aboriginal cultural material was identified. Results indicated that AHIMS 52-5-3765 Cleveland Road PAD-3 has undergone partial subsurface disturbance due to the previous residential construction and assumed demolition (Biosis 2011b, pp. 32).
- AHIMS 52-5-0586/Cleveland Road PAD-4 is located within alluvial flats 200 metres from Mullet Creek to the east of the small drainage line. Five test pits were excavated with one artefact recovered, a hammerstone made of andesite. Due to the lack of additional cultural material in other excavated test pits, It was considered that the artefact was an isolated find, and that no further sub-surface deposits are present across the entire PAD area or associated landform (Biosis 2011b, pp. 34). The site was assessed as having low scientific and moderate cultural significance.
- AHIMS 52-5-3765/Cleveland Road PAD-5 is located within alluvial flats 50 metres south of Reid Creek. Three test pits were excavated with no Aboriginal cultural material recovered.

In addition to the five registered PADs, the program of archaeological test excavations also focused on the banks of Mullet Creek and its tributaries. Mullet Creek catchment area has been previously identified as being highly archaeologically sensitive by AMBS (2006). The results of the additional testing identified:

- AHIMS 52-5-0619/Cleveland Road AFT-6 is located within alluvial flats 10 metres south of Mullet Creek. A total of eight test pits were excavated with six artefacts recovered from three test pits located on the eastern side of the small drain. Artefacts consisted of flakes and debitage made from silcrete, chert and mudstone. The site was assessed as having moderate scientific and high cultural significance.
- AHIMS 52-5-0622/Cleveland Road AFT-7 is located within alluvial flats 15 metres from Mullet Creek. Seven test pits were excavated with eight artefacts recovered from four pits, consisting of chert, chalcedony, siltstone and silcrete flakes, a core and debitage pieces. The site was assessed as having low to moderate scientific and high cultural significance.
- AHIMS 52-5-0623/Cleveland Road AFT-8 is located between sites AHIMS 52-5-0583/Cleveland Road PAD-1 and AHIMS 52-5-0622/Cleveland Road AFT-7, within alluvial flats between 50 and 100 metres from Mullet Creek. Three test pits were excavated with one chert flake recovered. The site was assessed as having low to moderate scientific and high cultural significance.

Results of the test excavations revealed that creek and drainage lines had greater number of artefacts than those on the open floodplain (Biosis 2011b, pp. 46). Recovery of at least one artefact in 71.4% of the tested sites demonstrated that the area was broadly used by Aboriginal people in the past with occupation focusing along Mullet Creek corridor (Biosis 2011b, pp. 61); however all deposits were low in density suggesting the study area was not extensively used. Cultural material recovered from all the tested sites are common within the region and had a very limited research potential. Following the outcomes of test excavations, areas of high, moderate and low Aboriginal archaeological sensitivity were mapped. Areas associated with major creek lines with the minimal disturbance were mapped as having high archaeological sensitivity where Aboriginal sites can be expected to be high density artefact scatters. Those areas are associated with Mullet Creek banks. Areas that have moderate archaeological potential were identified around creeks and waterways with some, but minor post contact disturbances, where artefacts may vary in density but would be concentrated in small areas (Biosis 2011b, pp. 58). Further archaeological test excavations were recommended for areas having high and moderate archaeological sensitivity.

Based on the outcomes of the consultation with local Aboriginal community, areas of high cultural sensitivity were also identified. Mullet Creek, as a recognised focal point with many Aboriginal archaeological sites present along its path, holds a very strong association for the local Aboriginal people and their ancestors who extensively utilised the area. A fig tree that was located to the north-west of the assessed area was recorded on AHIMS register as AHIMS 52-5-3831/Cleveland Road FT1; it holds a high cultural and spiritual significance, with the significant potential for it to be a Women's Site (Biosis 2011b, pp. 61).

AHMS (2012) was commissioned by Stockland to undertake Aboriginal cultural heritage assessment for the proposed residential subdivision within two parcels of land, referred to as 'McPhail Lands', north of Bong Bong Road in West Dapto. The assessment followed up from the one completed in 2010 with the revision of the proposed subdivision. Two registered Aboriginal sites were located in the assessed area: AHMS 52-2-3779/WDSY1 and AHIMS 52-2-3778/WDSY2. Additional survey was undertaken for both sites, and test excavations of site WDSY1. The location of site WDSY1 was tested as well as the associated and the surrounding landforms including the second terrace to its west and the spur line. A total of 546 artefacts were recovered from 75 test pits. Most artefacts were located within the western part of the eastern terrace and it was determined that the site extended to the spur crest (AHMS 2012, pp. 98). Division of the test excavation results according to AMBS landform definitions illustrate that the highest density of artefacts occur within alluvial flats, followed by hillslope and then spur lines. Results of test excavations completed by AHMS indicate that the particular areas within the WDRA were subject to higher intensity or long-term occupation and/or use, and indicate focussed occupation and/or use within favoured landforms (AHMS 2012, pp. 101). Site AHMS 52-2-3779/WDSY1 was assessed as having high archaeological significance due to its rarity in the area, high number of artefacts and its research potential for obtaining a maximum age for the deposit using the underlying fluvial deposits (AHMS 2012, pp. 103). Salvage was recommended for site AHMS 52-2-3779/WDSY1 prior to ground disturbance works associated with the proposed development.

Biosis (2015) undertook an ACHA of the Fowlers Road Extension, located adjacent to and within the current study area. As part of this assessment Biosis undertook a field survey of the study area and identified one previously known site AHIMS 52-5-3831/Cleveland Road FT1 which contained high cultural value as a potential 'womans place', however, they did not identify any new sites or areas of potential as part of the field survey. It was determined that the alluvial flats making up the majority of the study area were unlikely to preserve sites due to their susceptibility to flood events and disturbances. Following the field survey, a program of test excavation was undertaken across the entire extent of the road extension study area to determine the validity of AMBS 2006 predictive modelling. Biosis excavated a total of 116 test pits across the alluvial flat landform and identified two artefacts from a single test pit located within 50 metres of a creek line. Biosis suggested that the alluvial flat was not conducive to occupation as a result, likely due to its susceptibility to flooding.

Biosis (2016) was commissioned by MMJ Real Estate to undertake an Aboriginal heritage assessment for 20 Iredell Road and 51 Hayes Lane. This assessment was undertaken in support of a Neighborhood Master Plan for the two properties, but only 20 Iredell Road was surveyed. The area is located approximately 1 kilometre north-east of the current study area. The assessment identified two previously recorded sites (AHIMS 52-2-3283/WDRA_AX_2 and AHIMS 52-2-3284/WDRA_AX_21 as well as four additional sites located within 300 metres of Robins Creek. The assessment identified areas of potential for sub-surface archaeological deposits associated with alluvial flats and areas of moderate potential along ridgelines and hillslopes associated with Robins Creek. The assessment concluded that flat, levelled ground above flood level, as well as extensive views towards the Escarpment, would have made the place ideal for long-term occupation. Swampy soils across the alluvial flats were noted as aggrading, indicating that any archaeological material would have been buried and retained. Recent land use activities in the area would not have resulted in removal or displacement of soil layers, other than the very surface soils. A subsequent survey at Hayes Lane, identified area of PAD associated with a ridgeline crest and creek terrace. Test excavations undertaken within the Hayes Lane land parcel to characterise areas of PAD identified a low density artefact assemblage on the ridgeline landform. No artefacts were identified across the creek terraces and it was determined that there susceptibility to flooding and waterlogging likely removed artefact deposits or made them less suitable areas for occupation (Biosis Pty Ltd 2018).

3.2.3 AHIMS site analysis

A search of the AHIMS database (Client Service ID: 469419) identified 114 Aboriginal archaeological sites within a 6 square kilometre search area, centred on the proposed study area (Figure 7, see in Appendix 1). Thirteen of these registered sites are located within the study area (Table 5).Table 6 provides the frequencies of Aboriginal site types in the vicinity of the study area. The mapping coordinates recorded for these sites were checked for consistency with their descriptions and location on maps from Aboriginal heritage reports where available. These descriptions and maps were relied where notable discrepancies occurred.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic, archaeological survey; hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area. Some recorded sites consist of more than one element, for example artefacts and a modified tree, however for the purposes of this breakdown and the predictive modelling, all individual site types will be studied and compared. This explains why there are 121 results presented here, compared to the 114 sites identified in AHIMS.

Table 5 AHIMS sites located within the study area

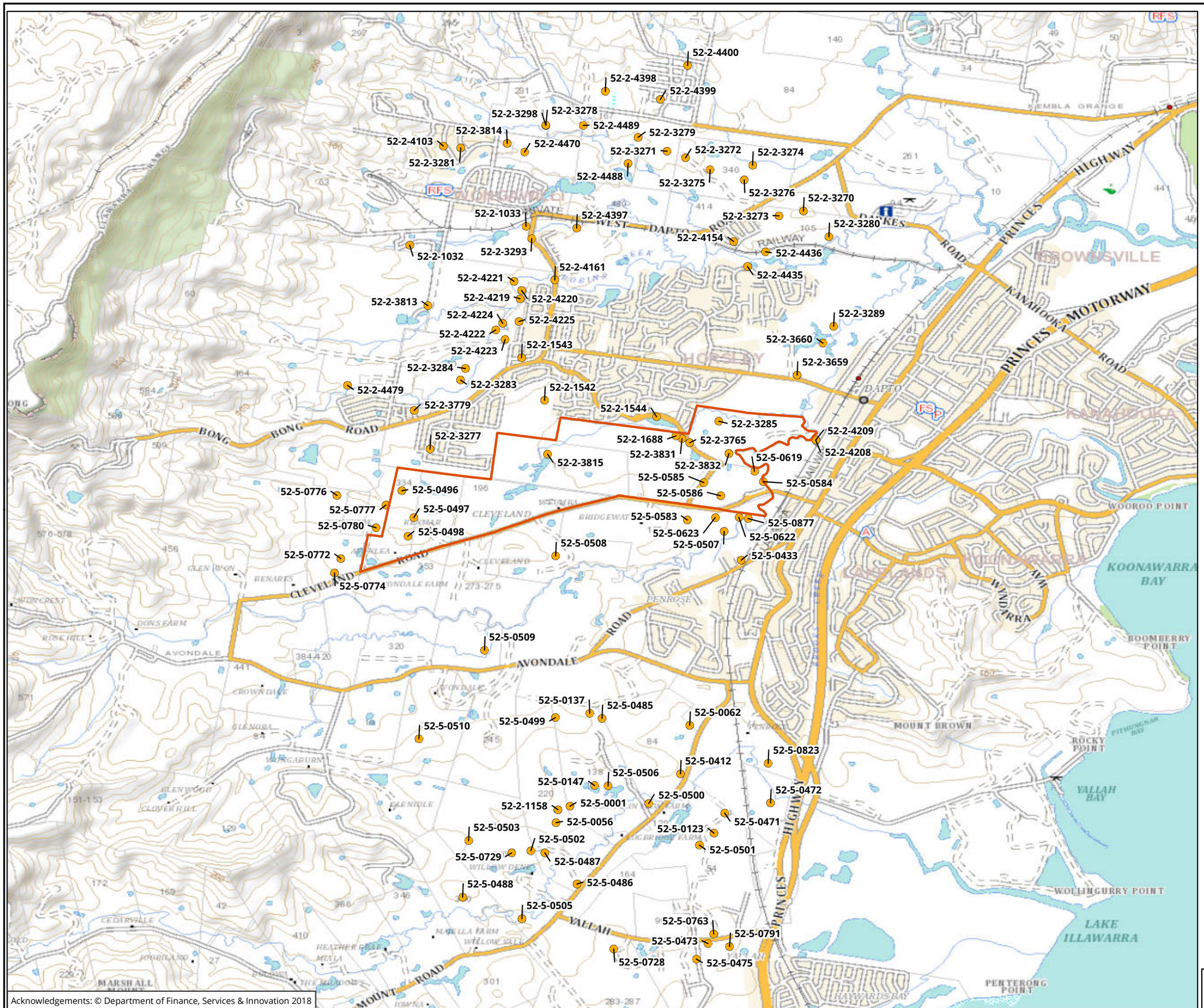
Site ID	Site Name	Site Type	Site status
52-5-0619	Cleveland Road AFT-6	Artefact	Valid
52-2-3831	Cleveland Road FT 1	Aboriginal Ceremony and Dreaming	Valid
52-2-3832	Cleveland Road FT 2	Aboriginal Ceremony and Dreaming	Valid
52-2-3815	Riverpark Way AFT-1	Artefact	Valid
52-2-1688	WD1-1;	Artefact	Valid
52-2-3285	WDRA_AX_22	Artefact	Valid
52-5-0496	WDRA_AX_23	Artefact	Valid
52-5-0497	WDRA_AX_24	Artefact	Valid

Site ID	Site Name	Site Type	Site status
52-5-0498	WDRA_AX_25	Artefact	Valid
52-2-3765	Cleveland Road PAD 3	PAD	Valid
52-5-0585	Cleveland Road PAD 4	PAD	Valid
52-5-0586	Cleveland Road PAD-4	PAD	Destroyed
52-5-0584	Cleveland Road PAD 2	PAD	Valid

Table 6 AHIMS site type frequency

Site type	Number of occurrences	Frequency (%)
Aboriginal ceremony and dreaming	3	2.5
Art (Pigment or Engraved)	1	0.8
Artefact	75	62.0
Modified tree	4	3.3
PAD	37	30.6
Shell	1	0.8
Total	121	100

A simple analysis of the Aboriginal cultural heritage sites registered within 6 square kilometres of the study area indicates that the dominant site type consists of artefacts, representing 62% (n=75), with PAD sites following at 30.6% (n=37). Modified Tree (Carved or Scarred) and Aboriginal Ceremony and Dreaming were represented by 3.3% (n=4) and 2.5% (n=3) respectively. Shell and Art (Pigment or Engraved) site types each represented 0.8 % (n=1 each) of recorded site types.



Acknowledgements: © Department of Finance, Services & Innovation 2018

Legend

Study area

Figure 7 AHIMS records in the vicinity of the study area

NOT TO BE MADE PUBLIC

0 320 640 960 1,280 1,600

Metres

Scale: 1:32,000 @ A3

Coordinate System: GCS GDA 1994

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney,Wangaratta & Wollongong

Matter:
Date: 09 January 2020,
Checked by: skumar, Generated by: skumar
Location:P:\30900s\30982\Mapping\30982_F7_AHIMS.mxd

3.3 Discussion

The West Dapto region would have provided many natural resources for the local Aboriginal inhabitants to exploit. Ethno-historical documentation indicates that the entire region was traditionally occupied by the Wodi Wodi people. Tangible evidence of such occupation is reflected within the archaeological record across the landscape in the form of shell middens, stone artefact sites, isolated artefacts and modified trees.

Previous archaeological work has focussed on specific development activities within the area that have contributed to our understanding of the archaeological and cultural landscape values of the locality. Previous studies provide a general overview of Aboriginal archaeological site modelling and predictive behaviour within the current study area. Predictive modelling undertaken as part of this assessment indicates that areas of archaeological potential have the potential to occur where disturbance has been limited, particularly upon topographies in close proximity to creek lines and on hill crests and saddles within the study area.

The study area is characterised by alluvial flat, hill and creek terrace landforms which GML Heritage (2015) and Biosis (2007) have identified as likely to have moderate to high potential for Aboriginal sites. The results of test excavations undertaken by Biosis in the study area have identified that creek and drainage lines had greater number of artefacts than those on the open floodplain, while test excavations of Bong Bong by AHMS (2012) indicated that the majority of artefacts were found on a creek terraces, followed by hillslopes and spur lines.

The dominant site type recorded in the vicinity of the study area are artefact sites, consisting of low density artefact scatters and isolated artefacts. These sites reflect local patterns of site distribution across the West Dapto area. Higher densities of artefacts and accumulation of shell midden material are generally found associated with Lake Illawarra to the east and indicate significant occupation events. The Escarpment foothills tend to exhibit isolated and low density artefact scatters spread across much of the area, reflecting a long term but less intensive use of the foothills, such as movement corridors or resource gathering areas which are likely to be identified within the study area, while the plain between the Escarpment and Lake Illawarra shows a mixture between the two.

3.3.1 Predictive model

A model has been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to have existed throughout the study area and where they are more likely to be located.

This model is based on:

- Site distribution in relation to landscape descriptions within the study area.
- Consideration of site type, raw material types and site densities likely to be present within the study area.
- Findings of the ethnohistorical research on the potential for material traces to present within the study area.
- Potential Aboriginal use of natural resources present or once present within the study area.
- Consideration of the temporal and spatial relationships of sites within the study area and surrounding region.

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the survey and subsequent sub-surface investigations across the present study area (Table 7). The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the study area.

Table 7 Aboriginal site prediction statements

Site type	Site description	Potential
Flaked stone artefact scatters and isolated artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density 'background' scatters and isolated finds.	High: Stone artefact sites have been previously recorded in the region across a wide range of landforms including alluvial flats, and also within the study area; they have the high potential to be present in undisturbed areas within the study area.
Potential archaeological deposits (PADs)	Potential sub surface deposits of cultural material.	High: PADs have been previously recorded in the region across a wide range of landforms including alluvial flats. They have the potential to be present in undisturbed landforms including alluvial flats..
Shell middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	Low: Shell midden sites have not been recorded within the study area. The lack of permanent water sources suggests a low potential they will occur in the study area.
Quarries	Raw stone material procurement sites.	Low: There is no record of any quarries being within or surrounding the study area and the geology of the study area suggests there is low potential they will occur.
Modified trees	Trees with cultural modifications	Low: A small number of mature native trees have survived within the study area due to extensive vegetation clearing from the 1800's onwards for pastoralism.
Axe grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	Low: The geology of the study area lacks suitable horizontal sandstone rock outcrops for axe-grinding grooves. Therefore there is low potential for axe grinding grooves to occur in the study area.
Burials	Aboriginal burial sites.	Low: Aboriginal burial sites are generally situated within deep, soft sediments, caves or hollow trees. Areas of deep sandy deposits will have the potential for Aboriginal burials. The soil profiles associated with the study area are not commonly associated with burials.

Site type	Site description	Potential
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	Low: The sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist, which are not present in the study area.
Aboriginal ceremony and Dreaming Sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	Low: There are currently no recorded mythological stories for the study area.
Post-contact sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	Low: There are no post-contact sites previously recorded in the study area and historical sources do not identify one.
Aboriginal places	Aboriginal places may not contain any 'archaeological' indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	Low: There are currently no recorded Aboriginal historical associations for the study area.

4 Archaeological survey

An archaeological survey of the study area was undertaken on 9 and 12 October 2018 by Biosis archaeologist Samantha Keats. The survey sampling strategy, methodology and a discussion of results are provided below.

4.1 Archaeological survey objectives

The principle aims of the survey were to:

- Undertake a systematic survey of the study area targeting areas with the potential for Aboriginal heritage.
- Identify and record Aboriginal archaeological sites visible on the ground surface.
- Identify and record areas of Aboriginal archaeological and cultural sensitivity.

4.2 Archaeological survey methodology

The survey methods were intended to assess and understand the landforms and to determine whether any archaeological material from Aboriginal occupation or land use exists within the study area, this included an assessment of mature trees for potential modification in the proposed development area.

A pedestrian survey was undertaken across the study area. Recording during the survey followed the archaeological survey requirements of the Code and industry best practice methodology. Information that recorded during the survey included:

- Aboriginal objects or sites present in the study area during the survey.
- Survey coverage.
- Any resources that may have potentially have been exploited by Aboriginal people.
- Landform elements, distinguishable areas of land approximately 40 metres across or with a 20 metre radius (CSIRO 2009).
- Photographs of the site indicating landform.
- Ground surface visibility (GSV) and areas of exposure.
- Observable past or present disturbances to the landscape from human or animal activities.
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

The identification of natural soil deposits within the study area was undertaken where exposures allowed. Photographs and recording techniques were incorporated into the survey including representative photographs of survey units, landform, vegetation coverage, ground surface visibility and the recording of soil information for each survey unit. Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal cultural heritage and points marking the boundary of the landform elements were recorded using a hand-held Global Positioning System and the Map Grid of Australia (94) coordinate system.

4.3 Archaeological survey results

4.4 Constraints to the survey

With any archaeological survey there are several factors that influence the effectiveness (the likelihood of finding sites) of the survey. The factors that contributed most to the effectiveness of the survey within the study area were low ground visibility due to grass coverage and low exposures.

The survey was restricted to the southern portions of the study area as land access to the northern most portions of the study area was not able to be organised.

4.5 Visibility

In most archaeological reports and guidelines visibility refers to ground surface visibility (GSV), and is usually a percentage estimate of the ground surface that is visible and allowing for the detection of (usually stone) artefacts that may be present on the ground surface (DECCW 2010b). GSV across the study area was typically low (5%) due to extensive grass coverage (Plate 1). Small areas of high GSV were present around fencing and gateways, access tracks and areas of animal grazing.

Plate 1 Photo showing extensive grass coverage across the study area which reduced the ground surface visibilty

4.6 Exposure

Exposure refers to the geomorphic conditions of the local landform being surveyed, and attempts to describe the relationship between those conditions and the likelihood the prevailing conditions provide for the exposure of (buried) archaeological materials. Whilst also usually expressed as a percentage estimate, exposure is different to visibility in that it is in part a summation of geomorphic processes, rather than a simple observation of the ground surface (Burke and Smith 2004, p. 79, DECCW 2010b). Overall, the study area displayed areas of exposure less than 5% due to extensive grass coverage. Areas of limited exposure were located on the banks of dams and creeks, and along drainage lines where water erosion had removed grass cover (Plate 2).

Plate 2 Photo showing exposures on the banks and walls of a drainage line

4.7 Disturbances

Disturbance in the study area is associated with natural and human agents. Natural agents generally affect small areas and include the burrowing and scratching in soil by animals, such as wombats, foxes, rabbits and wallabies, and sometimes exposure from slumping or scouring. Disturbances associated with recent human agents typically cover large sections of the land surface. Examples of human agents include residential development such as landscaping and construction of residential buildings; farming practices, such as initial vegetation clearance for creation of paddocks, fencing and stock grazing; agricultural practices such as fruit orchards; light industrial practices such as nursery and creation of artificial dams throughout the entire study area.

The study area has undergone vast vegetation clearance over almost its entire extent which would have resulted in the removal of topsoil and caused shallow disturbances. Other disturbances that were observed within the study area included water storage dams, access tracks, residential housing and modification to drainage lines (Plate 3 and Plate 4). These disturbances constituted heavier ground disturbances than would be caused by vegetation removal. In addition to these disturbances, the study area has also been used for agricultural practices including cattle grazing which will have caused further disturbances.

Plate 3 Photo showing large water storage dam located within the study area

Plate 4 Photo showing distubances from drainage line modification

4.8 Survey results and discussion

The archaeological survey was undertaken by Biosis archaeologist, Samantha Keats and consisted of a pedestrian survey that targeted areas of mature vegetation and exposure across all landforms in the study area which were within the impact footprint. This method was chosen as the high grass coverage across the study area made it impossible to identify surface artefacts outside areas of exposure.

A number of disturbances were identified within the study area attributed to farming practices, such as cattle grazing and associated paddock fences and artificial dams. It was also noted that drainage lines throughout the study area had also been modified.

A review of previous assessments carried out within the study area and in the local area has identified that a large number of sites have been identified in close proximity and within the study area. There are 13 previously recorded sites located within the study area, two of these AHIMS sites are located within the development footprint and both consisted of isolated or low density artefact scatters and are of low scientific significance.

During the site investigation two new artefact sites and four areas of high archaeological potential were identified within the study area. No Aboriginal modified trees were identified within the proposed development area. These sites identified were located primarily in undisturbed areas along a creek line running through the study area. The selection of the four areas of PAD was made based on the results of previous assessments in the region combined with soils and landform data, as well as evidence of disturbances likely to have disturbed soils (Figure 8).

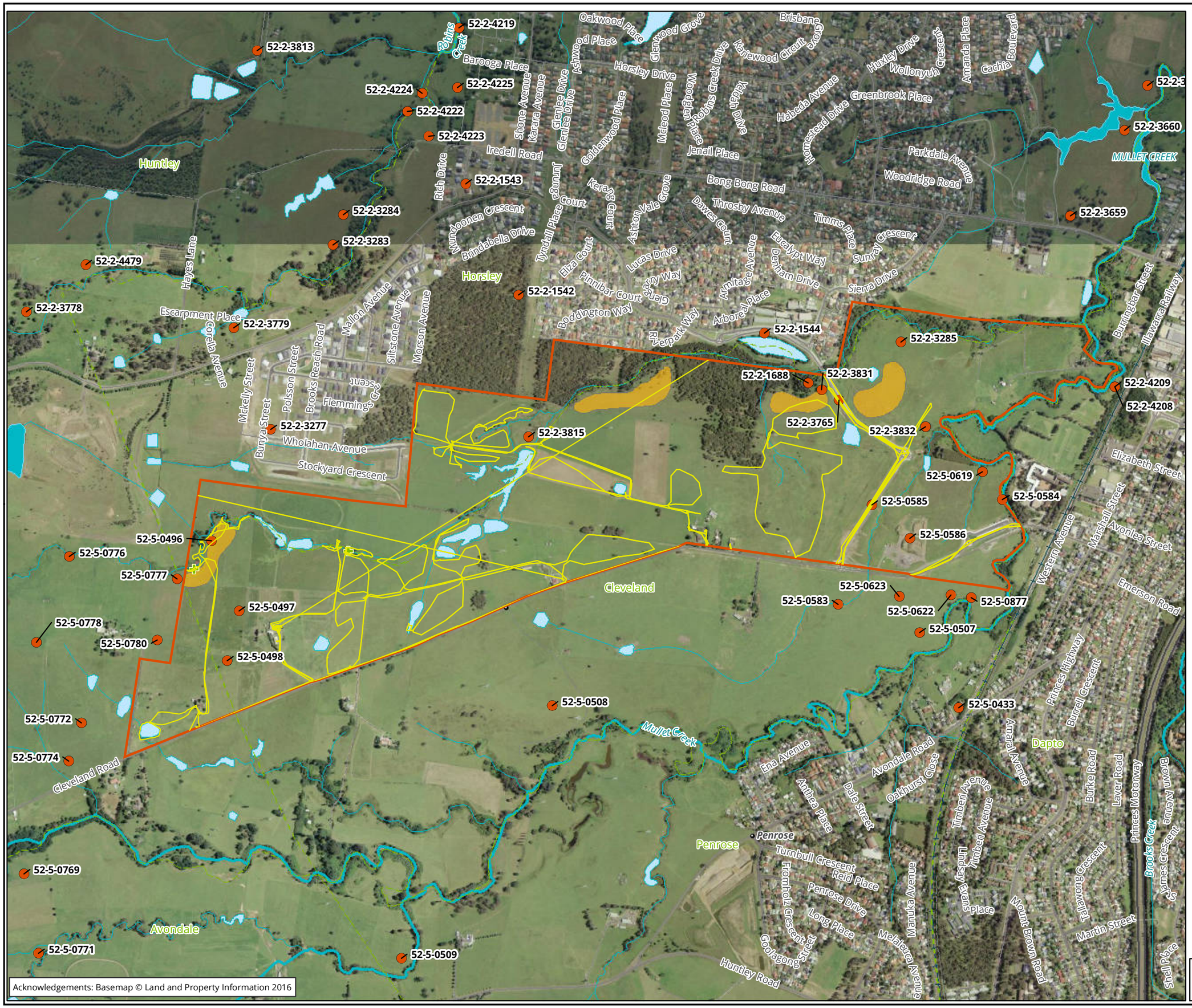
One previously unrecorded isolated artefact site (CR IF1) was located on the western boundary of the study area, next to the creek line. This site consisted of a single basalt complete flake, with flaked platform, and retouched termination (Plate 5). A second previously unrecorded isolated artefact site (CR-IF2) consisting of a complete silcrete flake that had been broken into three fragments by cattle trampling was located on the southern side of the unnamed creek line (Plate 6).

A widespread study of the Dapto area undertaken by AMBS (2006), and encompassing the study area, indicated that sites would be found in all landforms with densities of sites in the following order from highest to lowest: hillslopes, second order streams, first order streams, third order streams, alluvial flats, fourth order streams, and finally spur crests. This model was revised by a heritage land review undertaken by GML Heritage in 2015 (GML Heritage 2015) who identified that alluvial terraces with slopes of less than 3% are likely to have moderate to high potential for Aboriginal sites. The areas of archaeological potential identified during the survey are consistent with the results of GML Heritage (2015) and AMBS (2006), being located on alluvial terraces and hillslopes in close proximity to a third order creek line, and possess potential to contain intact sub-surface archaeological deposits (see Figure 8).

Plate 5 Ventral surface of Isolated artefact CR-IF1

Plate 6 Dorsal surface of isolated artefact CR-IF2

Plate 7 **Photo showing area of potential located on an alluvial terrace overlooking a third order creekline**



Legend

- Study areas
- Survey tracks
- New Surface Artefacts
- AHIMS Records
- Potential Archaeological Deposits

Figure 8 Survey results

0 130 260 390 520 650

Metres

Scale: 1:11,947 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 09 January 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F8_SurveyResults.mxd

5 Test excavation

Following the results of the field survey a test excavation program was undertaken to characterise the extent, nature and archaeological (scientific) value of Aboriginal cultural heritage within identified Aboriginal sites and areas of PAD. The sampling strategy, methodology and results of the test excavation program are discussed below. Test excavations were undertaken from the 13 to 15 January 2020 and the 19 to 21 January 2020 with a team of three Biosis archaeologists and three Registered Aboriginal Parties (RAP).

5.1 Test excavation objectives

The objectives of the sub-surface investigation were to characterise the extent, nature and archaeological (scientific) value of cultural heritage within the following areas:

- CR PAD 1.
- CR PAD 2.

CR PAD 3 and CR PAD 4 were not targeted as part of the test excavations undertaken in this assessment. CR PAD 3 was located outside of the development area and no impacts were proposed so it was left intact. CR PAD 4 was not excavated as the landowner did not permit access to the area during the test excavations.

5.2 Test excavation methodology

Test excavations were conducted in accordance with requirement 16a of the Code with the following methodology:

- Test were conducted in 50 by 50 centimetre units.
- The test pits were excavated by hand (inclusive of trowels, spades and other hand tools) along transects at intervals of between 10 and 20 metres or other justifiable and regular spacing (being no smaller than five metres).
- The first test pit within each PAD area was excavated in five centimetre spits; the subsequent test pits conducted within the site or PAD area were then excavated in either 10 centimetre spits to the base of Aboriginal object-bearing units being the removal of the A-horizon soil deposit down to the sterile B-horizon.
- Test pits may be combined and excavated as necessary in 50 by 50 centimetre units for the purposes of further understanding site characteristics. Note that under the Code, the maximum area that can be excavated in any one continuous area is three metres squared (3 m^2).
- The Code dictated that the maximum surface area of all test excavation units must be no greater than 0.5% of the PAD or area being investigated.
- All excavated soil was dry sieved in 5 millimetre sieves.
- All cultural material will be collected, bagged and clearly labelled. They will be temporarily stored in the Biosis office for analysis (at 30 Wentworth Street Port Kembla NSW 2505).
- For each test pit that was excavated, the following documentation was taken:
  - Unique test pit identification number.

- GPS coordinate of each test pit.
- Munsell soil colour and texture.
- Amount and location of cultural material within the deposit.
- Nature of disturbance where present.
- Stratigraphy.
- Archaeological features (if present).
- Photographic records.
- Spit records.

- Test excavation units were then backfilled as soon as practicable.
- An AHIMS Site Impact Recording form will be completed and submitted to the AHIMS Registrar for any sites impacted during test excavations.
- In the event that suspected human remains are identified works would immediately cease and the NSW Police and EES be notified.
- Test excavations ceased when enough information had been recovered to adequately characterise the objects present with regard to their nature and significance.

5.3 Test excavation results

A total of 73 test pits were excavated within two areas of PAD. Individual test pit and soil analysis results are provided in Appendix 2. Excavation results for each PADs are shown in Table 8 and a detailed discussion of results is provided below.

Table 8 Test excavation results by PAD

PAD	Landform	PAD area (m^2)	Area tested (m^2)	PAD effectively tested (%)	No. of sites	No. of artefacts
CR PAD 1	Hill Slope	3600	2.75	0.08	1	9
CR PAD 1	Alluvial Flat	10900	6.75	0.06	1	1
CR PAD 2	Rise	5800	3.25	0.06	1	4
CR PAD 2	Alluvial Flat	15000	5.5	0.04	0	0

5.3.1 CR PAD 1

Test pits were excavated at 20 m intervals in order to determine the extent and nature of potential sub surface deposits across the area of PAD 1. A total of 38 test pits were excavated within PAD 1 across 6 transects. This resulted in the identification of 10 artefacts in four test pits (Figure 9). All artefacts were located within a loam to loamy silt context at depths between 0 and 20 centimetres and were primarily located at the interface between hillslope and alluvial flat.

Transect 1

Transect 1 was excavated across a lower slope and creek terrace landform and consisted of four test pits. Soils along this transect consisted of a moderately compacted dark grey (7.5YR 4/1) to greyish brown (10 YR 5/2) loamy silt to clayey silt A horizon (Plate 8). This A horizon extended to approximately 200 millimetres at its

deepest and 100 millimetres at its shallowest. Beneath context 1 was a highly compacted dark grey (7.5YR 4/1) to dark greyish brown (10 YR 4/2) silty clay to clay B horizon. This clayey context was very dry and as a result displayed wide cracks associated with shrinking and swelling of the clay. Test pit 4 was located closest to the creek and displayed a slightly different soil profile. It contained a second context between the loamy silt and the silty clay that consisted of a heavily compacted, dark greyish brown (10 YR 4/2) clayey silt with clay mottling that increased with depth until it transitioned in the silty clay to clay context 3. This second context extended between 200 and 250 millimetres.

Plate 8 Soil profile of PAD 1 Transect 1 Pit 2 showing cracking clay at base

Transect 2

Transect 2 was excavated across a lower slope and creek terrace landform and consisted of three test pits (Plate 9). Soils along this transect consisted of a moderately compacted pinkish grey (7.5YR 6/2) to grey (5YR 5/1) loamy silt A horizon. This A horizon extended to approximately 250 millimetres at its deepest and 130 millimetres at its shallowest. Beneath context 1 was a highly compacted grey (5YR 6/1) silty clay to clay B horizon. This clayey context was very dry and as a result displayed wide cracks associated with shrinking and swelling of the clay. Two stone artefacts were identified in pit 2 of this transect which was located at the transition between the hill slope and creek terrace landforms. These artefacts consisted of a chert medial flake fragment and a silcrete complete flake. Both artefacts were recovered from spit 2, between 100 and 200 millimetres.

Plate 9 Soil profile of PAD 1 Transect 2 Pit 2

Transect 3

Transect 3 was excavated across the creek terrace landform and consisted of eight test pits (Plate 10). This transect was placed closest to the creek, with an average distance between 10 and 20 metres Soils along this transect generally consisted of a moderately compacted brown (10YR 4/3) to very dark greyish brown (10 YR 3/2) loamy silt A horizon. This A horizon extended to approximately 290 millimetres at its deepest and 150 millimetres at its shallowest. This was underlain by a highly compacted brown (7.5YR 4/3) to dark reddish grey (5YR 4/2) silty clay to clay B horizon. Several test pits within this transect also displayed a slightly different soil profile. Three test pits exhibited a second context located between the loamy silt context and silty clay context. This context consisted of a dark greyish brown (10YR 4/2) to dark brown (7.5YR 3/2) clayey silt that formed as a transitional layer. This layer typically extended to a depth of 350 to 440 millimetres.

The clayey context forming the B horizon in this transect was very dry and as a result displayed wide cracks associated with shrinking of the clay.

Plate 10 Soil profile in PAD 1 Transect 3 Pit 7

Transect 4

Transect 4 was excavated across a lower slope and creek terrace landform and consisted of eleven test pits (Plate 11). Soils along this transect consisted of a moderately compacted brown (7.5YR 5/4) to very dark greyish brown (10YR 3/2) loamy silt A horizon. This A horizon extended to approximately 290 millimetres at its deepest and 130 millimetres at its shallowest. Beneath context 1 was a highly compacted dark brown (7.5YR 3/2) to very dark greyish brown (10YR 3/2) silty clay to clay B horizon. This clayey context was very dry and as a result displayed wide cracks associated with shrinking and swelling of the clay throughout. Two stone artefacts were identified in pit 1 of this transect which was located at the transition between the hill slope and creek terrace landforms. These artefacts consisted of a silcrete distal flake fragment and a quartzite proximal flake fragment. Both artefacts were recovered from spit 2, between 100 and 200 millimetres.

Plate 11 Soil profile of PAD 1, Transect 4 Pit 5

Transect 5

Transect 5 was excavated across a lower slope and creek terrace landform and consisted of ten test pits (Plate 12). Soils along this transect consisted of a moderately compacted brown (7.5YR 5/4) to very dark greyish brown (10YR 3/2) loamy silt A horizon. This A horizon extended to approximately 290 millimetres at its deepest and 130 millimetres at its shallowest. Beneath context 1 was a highly compacted dark brown (7.5YR 3/2) to very dark greyish brown (10YR 3/2) silty clay to clay B horizon. This clayey context was very dry and as a result displayed wide cracks associated with shrinking and swelling of the clay throughout. A total of six stone artefacts were identified in this transect. Five artefacts were located in pit 9 on the creek terrace landform. These artefacts consisted of two chert angular fragments, a chert proximal flake fragment, a chert complete flake, and a silcrete proximal flake fragment. Artefacts in Pit 2 were identified in spit 1 and spit 2. A single quartz distal flake fragment was also identified in spit 2 of pit 4, also located on the creek terrace landform.

Plate 12 Soil profile in Transect 5 Pit 9, showing large clay shrink crack

Transect 6

Transect 6 was excavated across a lower slope and transitional zone between the slope and creek terrace landforms (Plate 13). A total of two test pits were excavated in this transect. Soils along this transect consisted of a moderately compacted light greyish brown (10YR 6/2) to greyish brown (10YR 5/2) loamy silt A horizon. This A horizon extended to approximately 200 millimetres on the lower slope and 80 millimetres on the transition zone. Context 2 consisted of a highly compacted light brownish grey (10YR 6/2) to brown (10YR 4/3) silty clay to clay B horizon.

Plate 13 Soil profile in PAD 1, Transect 6 Pit 2

5.3.2 CR PAD 2

Test pits were excavated at 20 m intervals in order to determine the extent and nature of potential sub surface deposits across the area of PAD 2. A total of 35 test pits were excavated within PAD 1 across six transects. This resulted in the identification of 10 artefacts identified across three test pits (Figure 9). All artefacts were located within a loam to loamy silt context at depths between 100 and 300 centimetres.

Transect 1

Transect 1 was excavated across a creek terrace landform and elevated rise on the terrace landform (Plate 14). A total of four test pits were excavated along this transect with 3 located on the terrace, and one pit located on the elevated rise. Soils along this transect consisted of a moderately compacted dark brown (10YR 3/2) loamy silt to silty loam A1 horizon. This A1 horizon extended to a depth of between 160 and 295 millimetres. Beneath context 1 was a moderately compacted dark brown (10YR 3/2) to strong brown (7.5YR 5/8) loamy silt A2 horizon. This loamy silt context contained ironstone gravels at its base, which made approximately 10% of the context composition. Context 2 ended at depths between 300 and 400 millimetres. Underlying context 2 was a highly compacted, dark yellowish brown (10YR 3/4) silty clay to clay B horizon.

One chert core fragment was identified within spit 2 of Pit 4. This artefact was located in the loamy silt A horizon on the elevated rise.

Plate 14 Soil profile in PAD 2, Transect 1 Pit 2 on alluvial flats

Transect 2

Transect 2 was excavated across a creek terrace landform and elevated rise on the terrace landform. A total of six test pits were excavated along this transect with four located on the terrace, and two pits located on the elevated rise (Plate 15).

Soils located along the creek terrace consisted of a moderately compacted dark brown (10YR 3/2) loamy silt to silty loam A1 horizon. This A1 horizon extended to a depth between 245 and 290 millimetres. Beneath context 1 was a moderately compacted dark brown (10YR 3/2) silty loam A2 horizon. This loamy silt context contained ironstone gravels at its base, which made approximately 10-20% of the context composition. Context 2 ended at depths between 290 and 300 millimetres. Underlying context 2 was a highly compacted, dark yellowish brown (10YR 3/4) silty clay to clay B horizon.

Soils across the elevated rise in transect 2 differed to those of the creek terrace landform. Context 1 consisted of a moderately compacted, dark brown (7.5YR 3/3) silty loam A1 horizon which extended to a depth up to 250 millimetres. Context 2 consisted of a strong brown (7.5YR 5/8) silty sand of moderate compaction. This context extended to a depth of 600 millimetres before ending on a silty clay, and formed the A2 horizon.

One chert complete flake was identified within spit 2 of Pit 7. This artefact was located in the loamy silt A horizon on the elevated rise.

Plate 15 Representative soil profile of micro-rise landform in PAD 2, Transect 2 Pit 7

Transect 3

Transect 3 was excavated across a creek terrace landform and elevated rise on the terrace landform. A total of eight test pits were excavated along this transect with four located on the terrace, and four pits located on the elevated rise (Plate 16).

Soils located on the alluvial flat consisted of a moderately compacted dark brown (10YR 3/2) to grey (7.5YR 5/1) silt to silty loam A1 horizon. This A1 horizon extended to a depth between 250 and 300 millimetres. Beneath context 1 was a moderately compacted dark brown (10YR 3/2) silt to loamy silt A2 horizon. This loamy silt context contained up to 20% ironstone gravels at its base. Context 2 ended at depths between 330 and 600 millimetres. Underlying context 2 was a highly compacted, dark yellowish brown (10YR 3/4) silty clay to clay B horizon.

Soils across the elevated rise in transect 3 differed to those of the creek terrace landform. Context 1 consisted of a moderately compacted, brown (7.5YR 5/2) silty loam A1 horizon which extended to a depth up to 250 millimetres. Context 2 consisted of a strong brown (7.5YR 5/6) silty sand of moderate to high compaction. This context extended to depths greater than 600 millimetres before ending on a yellowish brown silty clay.

One silcrete medial flake fragment was identified within spit 3 of Pit 8. This artefact was located in the loamy silt A1 horizon on the elevated rise landform.

Plate 16 Soil profile in PAD2, Transect 3 Pit 10

Transect 4

Transect 4 was excavated across a creek terrace landform and elevated rise on the terrace landform. A total of eight test pits were excavated along this transect with three located on the terrace, and five pits located on the elevated rise (Plate 17).

Soils located on the alluvial flat consisted of a moderately compacted dark brown (7.5YR 3/3) to grey (7.5YR 5/1) silt to silty loam A horizon. This A1 horizon extended to a depth between 250 and 300 millimetres. Beneath context 1 was a highly compacted dark brown (10YR 3/2) silty clay to clay B horizon.

Soils across the elevated rise in transect 4 differed to those of the creek terrace landform. Context 1 consisted of a moderately compacted, dark brown (7.5YR 3/3) silty loam A1 horizon which extended to a depth up to 250 millimetres. Context 2 consisted of yellowish brown (10YR 5/6) silty sand of moderate compaction. This context extended to depths up to 700 millimetres before transitioning to a silty clay B horizon.

One petrified wood complete flake was identified within spit 2 of Pit 7. This artefact was located in the loamy silt A1 horizon on the elevated rise landform.

Plate 17 Soils in PAD 2, Transect 4 Pit 5

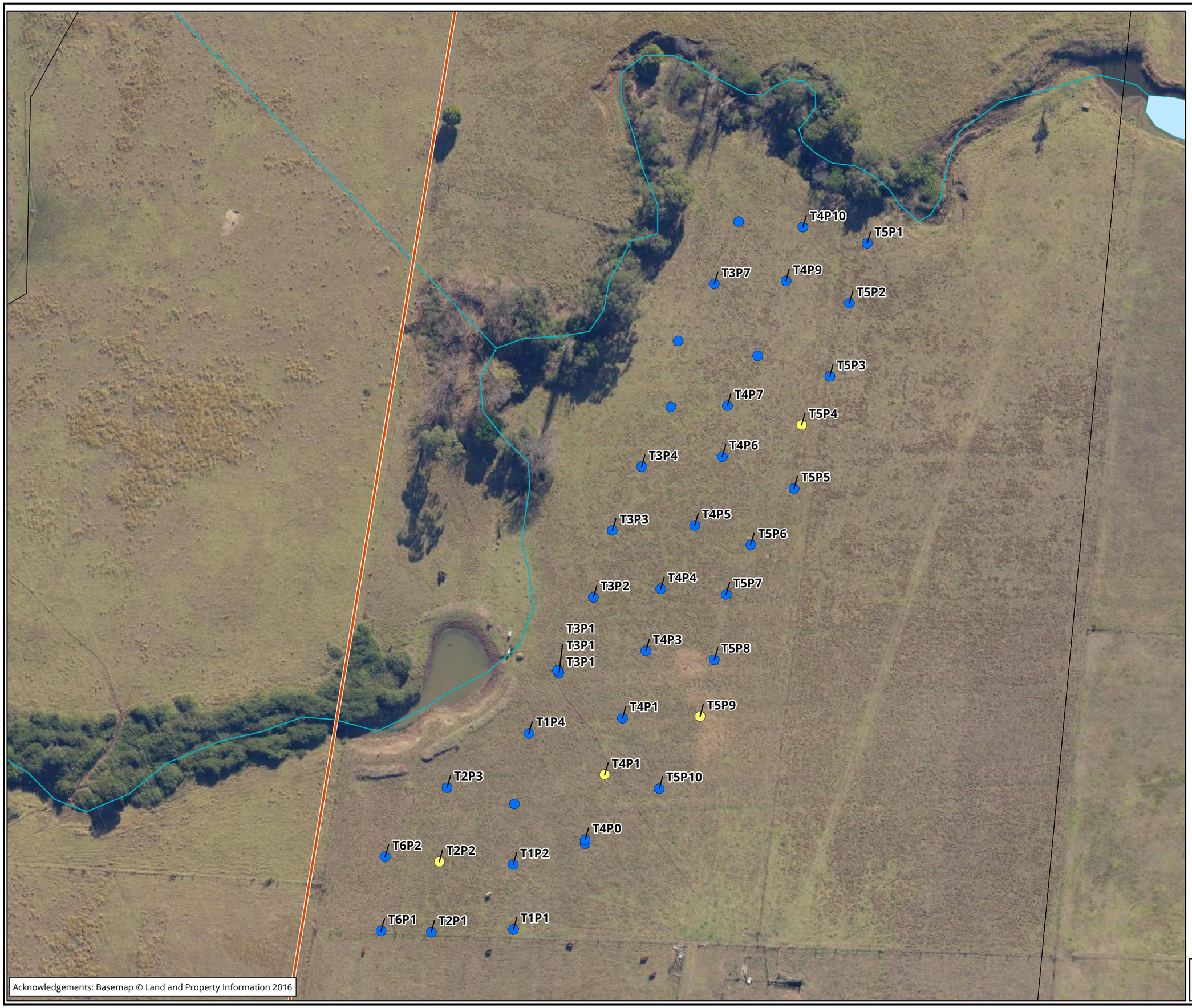
Transect 5

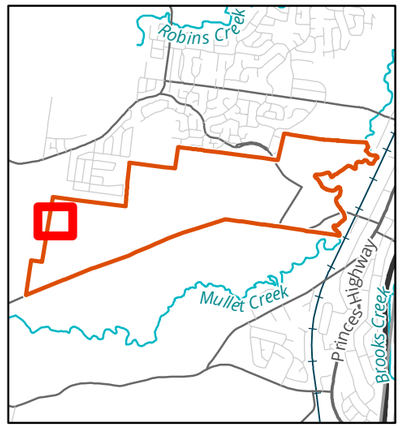
Transect 4 was excavated across the alluvial flat landform. A total of eight test pits were excavated along this transect (Plate 18).

Soils located on the alluvial flat consisted of a moderately compacted dark brown (7.5YR 3/3) to grey (7.5YR 5/1) loamy silt to silty loam A horizon. This A horizon extended to a depth between 250 and 400 millimetres. Beneath context 1 was a highly compacted strong brown (7.5YRYR 5/6) silty clay B horizon that transitioned to clay. One test pit, T5P2, exhibited soils similar to those seen on the elevated rise. This test pit contained a dark brown (7.5YR 3/3) silty loam to a depth of 240 millimetres before transitioning to a yellowish brown (10YR 5/6) silty sand extending beyond a metre.

No artefacts were identified within this transect

Plate 18 Soils in PAD 2, Transect 5 Pit 6





Legend

Study area

Lot

Test pit - Artefact

0

1 - 5

>5

Figure 9.1 Test excavation results CR PAD 1

0 10 20 30 40 50

Metres

Scale: 1:1,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

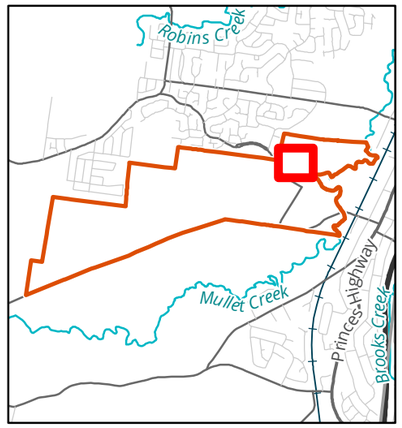
N

biosis

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 10 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F9_TestEx_Results.mxd



Legend

Study area

Lot

Test pit - Artefact

0

1 - 5

>5

Figure 9.2 Test excavation results CR PAD2

0 10 20 30 40 50

Metres

Scale: 1:1,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 10 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F9_TestEx_Results.mxd

6 Analysis and discussion

6.1.1 Artefact density

A total of 14 artefacts were identified during the test excavations, 10 at PAD 1 and 4 at PAD 2. This resulted in an average artefact density of 0.7 artefacts per square metre across both PADs, or a density of 1.05 artefacts per square metre at PAD 1 and a density of 0.4 artefacts per square metre at PAD 2 (Table 9).

Table 9 Artefac densities

PAD	Pit count	Square metres excavated	Artefact count	Density
CR PAD 1	38	9.5	10	1.05
CR PAD 2	38	9.5	4	0.42

The low number of artefacts retrieved makes it difficult to undertake in-depth lithic analysis; however, basic trends in site use can be made through comparisons with other testing programs in close proximity to the study area.

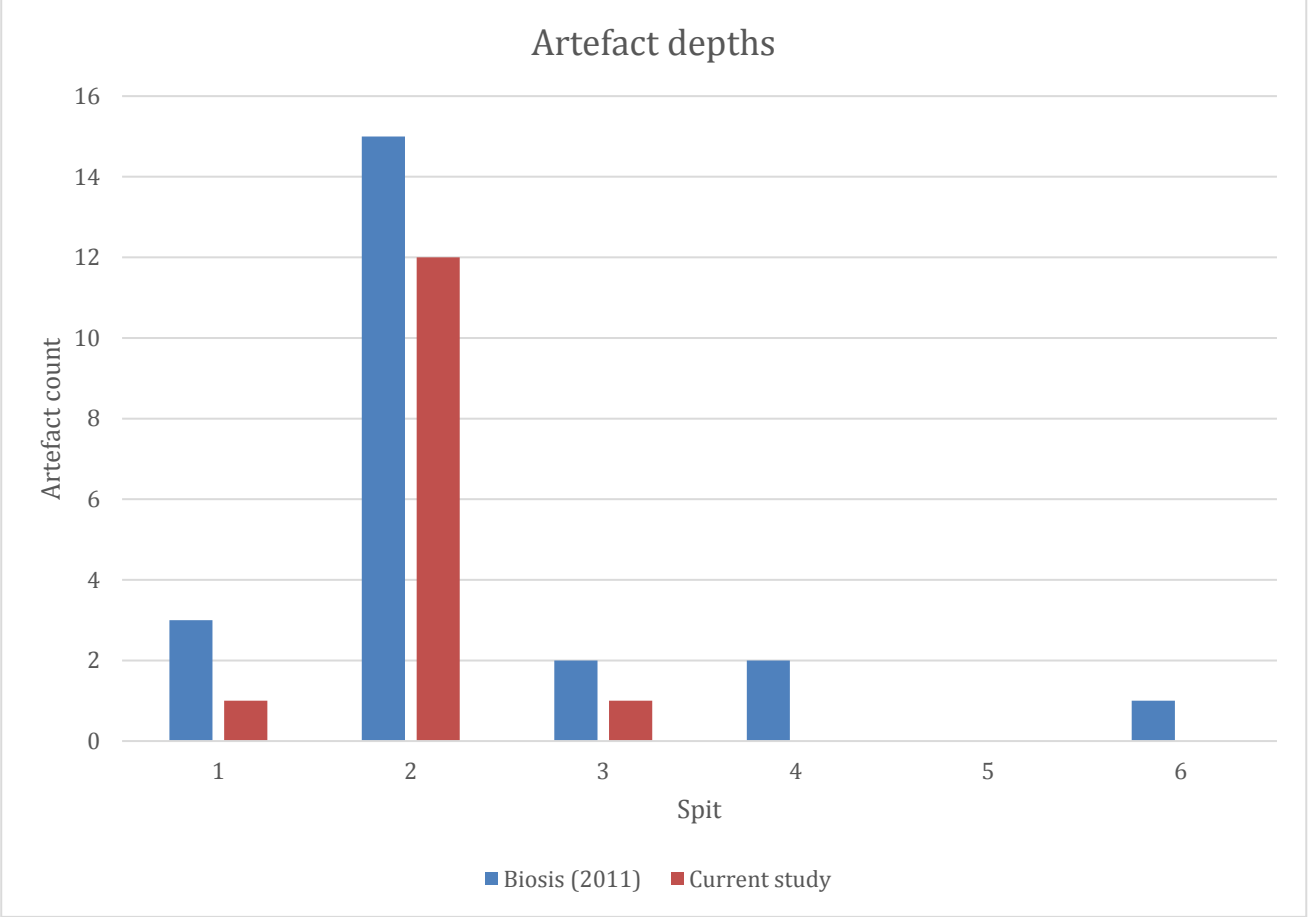
6.1.2 Vertical distribution

The vertical distribution of artefacts across the study area was consistent with what is found across the Dapto area. The majority of artefacts were found within spit 2 (n=2), located between 100 and 200 millimetres in depth. One artefact was also identified in spit 1 and one in spit 3. All 14 artefacts were confined to the same or similar soil contexts, a moderately compacted loamy silt to silty loam A horizon (Table 10).

Table 10 Arteafct counts by depth

PAD	Spit 1	Spit 2	Spit 3
CR PAD 1	1	9	0
CR PAD 2	0	3	1
Total	1	12	1

The vertical distribution of artefacts identified in the current study area were consistent with the results of other test excavations undertaken in the vicinity. Biosis identified the greatest density of artefacts between 100 and 200 millimetres, with lower numbers of artefacts identified in the spit above and below this, mirroring the trends seen in the current study area (Graph 1). It is likely that the period of occupation in the study area occurred during the deposition of artefacts in spit 2, with artefacts located in spit 1 and below spit 2 the result of post depositional processes such as bioturbation, trampling or shrink-swell of clay soils causing movement of artefacts. This hypothesis is supported by the observations of significant cracking of soils in PAD 1 that typically impacted soils below spit 2a s well as loose sterile silty sand at PAD 2 that would have allowed easy artefact movement.



Graph 1 Depths of artefacts in current study area and Biosis (2011b).

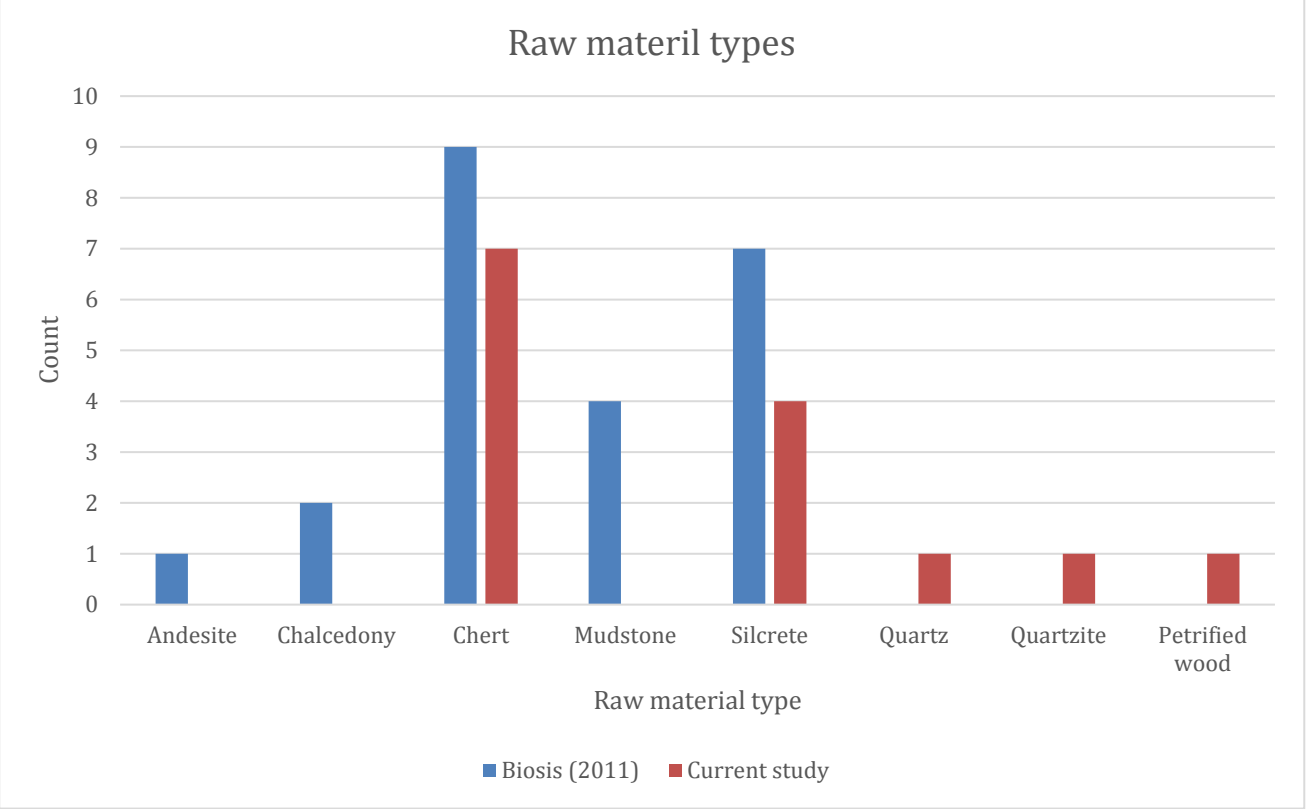
6.1.3 Raw materials and cortex

A total of five different raw material types were identified across the study area, all of which are commonly identified across the Illawarra region (Table 11 and Graph 2). Chert was the most frequent raw material recorded, making up half of the total assemblage. The second most common raw material was silcrete, making up 29% of the assemblage. One instance each of petrified wood, quartz and quartzite were also identified across the assemblage.

Table 11 Raw materials by PAD

PAD	Chert	Petrified wood	Quartz	Quartzite	Silcrete
CR PAD 1	5	0	1	1	3
CR PAD2	2	1	0	0	1
Total	7	1	1	1	4

The proportion of raw material in the study area reflect those identified in other nearby studies. Biosis (2011b) also identified chert followed by silcrete as the two most common raw materials in the area.



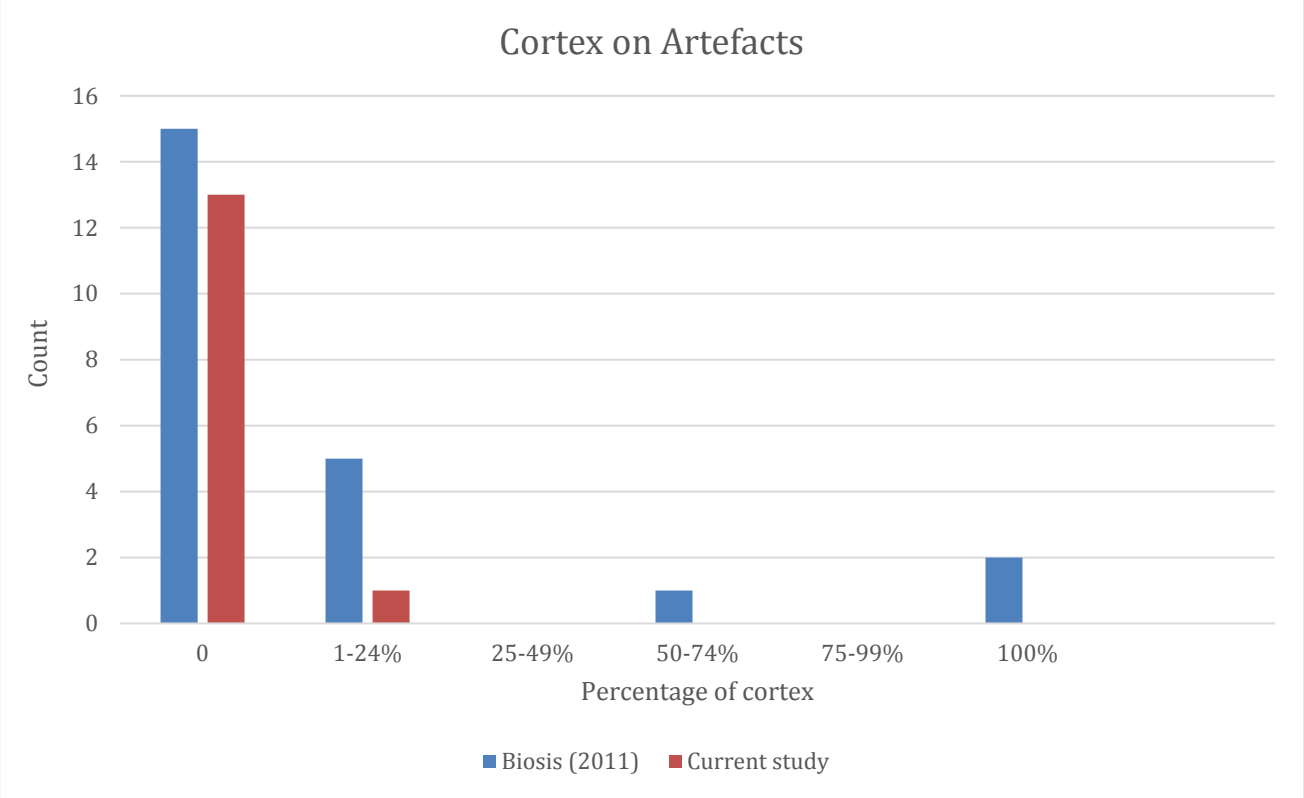
Graph 2 Raw materials identifed in current study and Biosis (2011b)

The cortex (weathered exterior of a rock) provides information about the origin of stone sources. Artefacts with a rough cortex were acquired from a primary source, such as an *in situ* outcrop. Artefacts with a smooth or water-rolled cortex originate from a secondary source, such as a river cobble from a waterway. The amount of cortex on an artefact often indicates the distance artefacts were transported from the source (Hiscock & Mitchell 1993, pp. 12–17) A high percentage of cortex on an artefact can indicate that the source of stone was nearby; while artefacts with less cortex or no cortex were transported further from the source. As cores are transported away from the source they are typically highly reduced and the flakes from these cores are smaller. The amount of cortex present in an assemblage also provides information on the potential uses of a site, as cores and flakes with high cortex are often found at sites were raw material extraction was occurring, whilst small flakes with lower percentages of cortex often dominate faunal and floral resource processing areas further from a raw material source (Odell 2004).

The majority of artefacts within the study area lacked any remaining cortex (n=13). One artefact contained between 1 and 25% cortex remaining on its dorsal surface. This artefact consisted of the petrified wood complete flake form PAD 2. The cortex on this artefact did not display any features that could be used to infer the origin of this raw material, although petrified wood is commonly found as cobbles in the creeks of the Illawarra and it is possible that this raw material was collected from one such creek. The low levels of cortex suggest that no primary reduction occurred within the study area, potentially reflecting that the artefacts were discarded away from raw material sources or areas where primary reduction may have occurred such as high intensity occupation areas.

The results of this assessment largely correspond with the results of other excavations in the vicinity of the study area, in that cortex is usually not present or present in reduced quantities. Comparing with the results of Biosis (2011b) shows that the majority of artefacts had no cortex and where typical of later stages of reduction (Graph 3). It should be noted that unlike in the current assemblage, Biosis (2011b) identified an artefact with 100% recorded cortex, forming an outlier in the data. An artefact with 100% cortex would

typically suggest that there was some primary reduction occurring in the area and could indicate a potentially close source for that raw material. This is not the case however, as the artefact identified with 100% cortex by Biosis (2011b) consisted of an andesite hammer stone. The hammer stone does not form part of the flaked artefact reduction sequence so measurement of cortex on the hammer stone is not compatible with measurements of cortex on flaked artefacts in the area. This outlier can therefore be discounted from the comparison of cortex.



Graph 3 Measurements of cortex on artefacts in current study and Biosis (2011b)

6.1.4 Artefact Types

Artefact types identified within the subsurface assemblage by Biosis consisted of four complete flakes, three proximal flake fragments, two each of medial, distal and angular fragments, and one core fragment (Table 12).

Table 12 Artefact types in study area

Artefact Type	Count	Percentage (%)
Angular Fragment	2	14.29
Core fragment	1	7.14
Flake - Complete	4	28.57
Flake - Distal	2	14.29
Flake - Medial	2	14.29
Flake - Proximal	3	21.43
Grand Total	14	100

A breakdown of types by each area of PAD showed some possible trends in site use (Table 13). Both sites contained the same number of complete flakes and medial flake fragments, however PAD 1 also contained angular fragments, distal and proximal fragments whereas PAD 2 did not. In contrast PAD 2 contained a core fragment, while PAD 1 did not. The limited number of artefacts at both sites suggests there was relatively little artefact reduction occurring at either site, while the lack of tools or artefacts displaying use suggests no long term activities such as food processing or tool manufacture were occurring here.

Table 13 Artefact types by PAD area

Artefact Type	PAD 1	PAD 2
Angular Fragment	2	0
Core fragment	0	1
Flake - Complete	2	2
Flake - Distal	2	0
Flake - Medial	1	1
Flake - Proximal	3	0

6.2 Discussion of results

The results of the current round of test excavations have provided information which is generally consistent with what has been found by previous assessments undertaken by AMBS (2006), GML (2015) and Biosis (2011b) in the vicinity of the study area.

The wide spread AMBS study of the West Dapto Release Area (2006), which encompasses the study area, suggested that all landforms within the study area were subject to some use by Aboriginal people in the past. They found that artefact densities indicated some landforms were subject to greater use than others, noting that:

- The majority of the test pits containing artefacts were located within alluvial flats, followed by hillslopes, then spur crests , then 3rd order, then 2nd order, then 4th and at last 1st order creek lines.
- The highest density of artefacts were present on 2nd order streams, followed by 1st order, then 3rd order streams, then alluvial flats, 4th order streams, spur crests and hill slopes.

The highest number of artefacts recovered by AMBS in the Mullet Creek catchment were from alluvial flats. Of the test pits excavated in this catchment, 62.5% of test pits were found to contain artefacts (AMBS 2006, pp. 188). Artefact density for individual test pits was generally very low, however high recovery rates of artefacts throughout the West Dapto Release Area suggested that the use of the area was widespread rather than intensive (AMBS 2006, pp. 266), with occupation being more intensive or repeated within close proximity to major creek lines and creek convergences where resources were readily accessible (AMBS 2006, pp. 266).

The result of the most recent assessments in the Mullet Creek catchment display some discrepancies with the assessment undertaken by AMBS however. AMBS undertook large scale assessment of the area utilising a methodology that placed a weighted sample of test pits, calculated by dividing 100 test pits up by catchment size, on all landforms with an area. The results of this limited excavation program was then used to develop the AMBS predictive model used across the Dapto area. However, the results of AMBS's testing program

differ to more recent assessments undertaken in the area. In particular, the number of test pits containing artefacts typically varies from what was found by AMBS. As indicated, AMBS had a rate of 62.5% of test pits containing at least one artefact. Comparing this to a host of assessments undertaken in the area, and which included more extensive and targeted test excavations, it is possible to see that recovery rates of artefacts per test pit excavated are generally much lower across a landform than what is represented by AMBS.

Biosis undertook excavations in 2011 to the immediate south-east of the study area, following the predictive modelling formulated by AMBS. These works revealed that out of 46 excavated test pits placed on alluvial flat and drainage depression landform, 13 had artefacts present. This results in 28% of test pits containing artefacts. This was significantly lower than was found by AMBS. The highest number of artefacts were recovered from 100 to 200 millimetres in depth (Biosis 2011b, pp. 51) and located within 50 metres of Mullet Creek (AHIMS 52-2-0619, 52-2-0622 and 52-2-0584) rather than the alluvial plain, however, similar to AMBS, artefact densities were generally very low and artefacts were typically represented by unretouched flakes with little to no cortex present. This result indicates that sites are likely to be focused along the Mullet Creek corridor (Biosis 2011b, pp. 61), with occupation decreasing further away from water and the resources present there. It is also likely that sites present in this corridor will consist of isolated or low density artefact scatters consisting of unretouched flakes and debitage which is representative of sporadic use of the area as a resource collection zone rather than an area of intensive occupation. Cultural material recovered from all the tested sites occurs commonly within the region and had very limited archaeological research potential.

In 2015, Biosis (2015) undertook another program of test excavations adjacent to the study area. This program was located adjacent to the eastern boundary of the current study area and was located across the mullet creek alluvial flats. A total of 116 test pits were excavated across the landform including up to the banks of Mullet Creek and two artefacts were identified from a single test pit. This equated to only 0.86% of test pits on the alluvial flats containing artefacts. The two artefacts that were identified were located within 50 metres of Mullet Creek, similar to what was found by Biosis (2011b). These artefacts consisted of a chert broken (split) flake and one quartz complete flake that were identified between 100 and 300 millimetres in depth. Biosis did not undertake any lithic analysis due to the small size of the assemblage, however both the raw materials and artefact types they identified consistent with previous assessments and the current assessment. The results of the Biosis (2015)further suggest that the study area was utilised as a resource collection zone, with artefacts present consisting of isolated or low density scatters of low archaeological potential.

All sites identified in the study area by the current assessment consisted of low density and sporadically placed sites, with 18% of test pits containing an artefact. Sites were found to generally be located in close proximity to sources of water, similar to Biosis (2011b). The largest site (CR PAD 1)identified by the current assessment was located within 50 metres of a tributary of Mullet Creek, while the second, less dense site (CR PAD 2) was located on a micro rise on the alluvial flats within 100 metres of a creek line. Artefacts making up sites were consistent with Biosis and AMBS, with chert and silcrete forming the most common raw material types in all assessments. Similarly, cortex was low across all studies, and there was little variation in artefact types across the assessments with complete flake and flake fragments most common and no use wear evident on artefacts. Artefacts were also generally isolated to the top 3 spits which corresponded with silty to loamy A1 soil horizons.

The results of the current and previous assessments in the study area indicated that the area was utilised to some degree, although occupation in the area was not intensive. The creek and its surrounding alluvial plains offered a variety of resources that were utilised by Aboriginal people and the area was likely used as resource gathering zone rather than areas of intensive occupation. This is supported by the existence of sporadic low density artefact scatters in close proximity to Mullet Creek and within the study area. The results of these assessments indicate that sub-surface deposits will consist of low density artefact scatters, which share common characteristics with existing identified sites and contain low scientific significance.

7 Scientific values and significance assessment

The two main values addressed when assessing the significance of Aboriginal sites are cultural values to the Aboriginal community and archaeological (scientific) values. This report will assess scientific values while the ACHA report will detail the cultural values of Aboriginal sites in the study area.

7.1 Introduction to the assessment process

Heritage assessment criteria in NSW fall broadly within the significance values outlined in the Australia International Council on Monuments and Sites (ICOMOS) Burra Charter (Australia ICOMOS 2013). This approach to heritage has been adopted by cultural heritage managers and government agencies as the set of guidelines for best practice heritage management in Australia. These values are provided as background and include:

- **Historical significance** (evolution and association) refers to historic values and encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.
- **Aesthetic significance** (Scenic/architectural qualities, creative accomplishment) refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.
- **Social significance** (contemporary community esteem) refers to the spiritual, traditional, historical or contemporary associations and attachment that the place or area has for the present-day community. Places of social significance have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be determined through consultative processes with local communities.
- **Scientific significance** (Archaeological, industrial, educational, research potential and scientific significance values) refers to the importance of a landscape, area, place or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or object and will consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

The cultural and archaeological significance of Aboriginal and historic sites and places is assessed on the basis of the significance values outlined above. As well as the ICOMOS Burra Charter significance values guidelines, various government agencies have developed formal criteria and guidelines that have application when assessing the significance of heritage places within NSW. Of primary interest are guidelines prepared by the Commonwealth Department of the Environment and Energy, EES, NSW Department of Planning, Industry and Environment. The relevant sections of these guidelines are presented below.

These guidelines state that an area may contain evidence and associations which demonstrate one or any combination of the ICOMOS Burra Charter significance values outlined above in reference to Aboriginal heritage. Reference to each of the values should be made when evaluating archaeological and cultural significance for Aboriginal sites and places.

In addition to the previously outlined heritage values, the EES Guidelines (OEH 2011) also specify the importance of considering cultural landscapes when determining and assessing Aboriginal heritage values. The principle behind a cultural landscape is that 'the significance of individual features is derived from their inter-relatedness within the cultural landscape'. This means that sites or places cannot be 'assessed in isolation' but must be considered as parts of the wider cultural landscape. Hence the site or place will possibly have values derived from its association with other sites and places. By investigating the associations between sites, places, and (for example) natural resources in the cultural landscape the stories behind the features can be told. The context of the cultural landscape can unlock 'better understanding of the cultural meaning and importance' of sites and places.

Although other values may be considered – such as educational or tourism values – the two principal values that are likely to be addressed in a consideration of Aboriginal sites and places are the cultural/social significance to Aboriginal people and their archaeological or scientific significance to archaeologists. The determinations of archaeological and cultural significance for sites and places should then be expressed as statements of significance that preface a concise discussion of the contributing factors to Aboriginal cultural heritage significance.

7.2 Archaeological (scientific significance) values

Archaeological significance (also called scientific significance, as per the ICOMOS Burra Charter) refers to the value of archaeological objects or sites as they relate to research questions that are of importance to the archaeological community, including indigenous communities, heritage managers and academic archaeologists. Generally the value of this type of significance is determined on the basis of the potential for sites and objects to provide information regarding the past life-ways of people (Burke & Smith 2004, pp. 249, NPWS 1997), For this reason, the NPWS summarises the situation as 'while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential' (NPWS 1997, pp. 26). The NPWS criteria for archaeological significance assessment are based largely on the ICOMOS Burra Charter.

Research potential

Research potential is assessed by examining site content and site condition. Site content refers to all cultural materials and organic remains associated with human activity at a site. Site content also refers to the site structure – the size of the site, the patterning of cultural materials within the site, the presence of any stratified deposits and the rarity of particular artefact types. As the site contents criterion is not applicable to scarred trees, the assessment of scarred trees is outlined separately below. Site condition refers to the degree of disturbance to the contents of a site at the time it was recorded.

The site contents ratings used for archaeological sites are:

0 - No cultural material remaining.

1 - Site contains a small number (e.g. 0–10 artefacts) or limited range of cultural materials with no evident stratification.

2 - Site contains a larger number, but limited range of cultural materials; and/or some intact stratified deposit remains; and/or are or unusual example(s) of a particular artefact type.

3 - Site contains a large number and diverse range of cultural materials; and/or largely intact stratified deposit; and/or surface spatial patterning of cultural materials that still reflect the way in which the cultural materials were deposited.

The site condition ratings used for archaeological sites are:

0 - Site destroyed.

1 - Site in a deteriorated condition with a high degree of disturbance; lack of stratified deposits; some cultural materials remaining.

2 - Site in a fair to good condition, but with some disturbance.

3 - Site in an excellent condition with little or no disturbance. For surface artefact scatters this may mean that the spatial patterning of cultural materials still reflects the way in which the cultural materials were laid down.

Pearson and Sullivan (1995, pp. 149) note that Aboriginal archaeological sites are generally of high research potential because 'they are the major source of information about Aboriginal prehistory'. Indeed, the often great time depth of Aboriginal archaeological sites gives them research value from a global perspective, as they are an important record of humanity's history. Research potential can also refer to specific local circumstances in space and time – a site may have particular characteristics (well preserved samples for absolute dating, or a series of refitting artefacts, for example) that mean it can provide information about certain aspects of Aboriginal life in the past that other less or alternatively valuable sites may not (Burke & Smith 2004, pp. 247–8). When determining research potential value particular emphasis has been placed on the potential for absolute dating of sites.

The following sections provide statements of significance for the Aboriginal archaeological sites recorded during the sub-surface testing for the assessment. The significance of each site follows the assessment process outlined above. This includes a statement of significance based on the categories defined in the Burra Charter. These categories include social, historic, scientific, aesthetic and cultural (in this case archaeological) landscape values. Nomination of the level of value—high, moderate, low or not applicable—for each relevant category is also proposed. Where suitable the determination of cultural (archaeological) landscape value is applied to both individual sites and places (to explore their associations) and also, to the Study Area as a whole. The nomination levels for the archaeological significance of each site are summarised below.

Representativeness

Representativeness refers to the regional distribution of a particular site type. Representativeness is assessed by whether the site is common, occasional, or rare in a given region. Assessments of representativeness are subjectively biased by current knowledge of the distribution and number of archaeological sites in a region. This varies from place to place depending on the extent of archaeological research. Consequently, a site that is assigned low significance values for contents and condition, but a high significance value for representativeness, can only be regarded as significant in terms of knowledge of the regional archaeology. Any such site should be subject to re-assessment as more archaeological research is undertaken.

Assessment of representativeness also takes into account the contents and condition of a site. For example, in any region there may only be a limited number of sites of any type that have suffered minimal disturbance. Such sites would therefore be given a high significance rating for representativeness, although they may occur commonly within the region.

The representativeness ratings used for archaeological sites are:

- 1 - common occurrence.
- 2 - occasional occurrence.

- 3 - rare occurrence.

Overall scientific significance ratings for sites, based on a cumulative score for site contents, site integrity and representativeness are:

- 1-3 low scientific significance.
- 4-6 moderate scientific significance.
- 7-9 high scientific significance.

Each site is given a score on the basis of these criteria – the overall scientific significance is determined by the cumulative score. This scoring procedure has been applied to the Aboriginal archaeological sites identified during the sub-surface testing. The results are in Table 16.

7.2.1 Statements of archaeological significance

The following archaeological significance assessment is based on Requirement 11 of the Code. Using the assessment criteria detailed in Scientific Values and Significance Assessment, an assessment of significance was determined and a rating for each site was determined. The results of the archaeological significance assessment are given in Table 14 below.

Table 14 Scientific significance assessment of archaeological sites recorded within the study area.

Site name	Site content	Site condition	Representativeness	Scientific significance
CR PAD 1	1	1	1	3-low
CR PAD 2	1	1	1	3-low
CR PAD 3	Unknown	Unknown	Unknown	Unknown
CR PAD 4	Unknown	Unknown	Unknown	Unknown
CR IF1	1	1	1	3-low
CR IF2	1	1	1	3-low
52-5-0496	1	1	1	3-low
52-5-0497	1	1	1	3-low
52-5-0498	1	1	1	3-low
52-2-3815	1	1	1	3-low
52-2-1688	1	1	1	3-low
52-2-3831	1	3	3	7-high
52-5-0585	0	0	0	0-none
52-5-0586	0	0	0	0-none (destroyed)
52-5-0584	1	0	1	3-low
52-5-0619	1	1	1	3-low
52-2-3832	1	3	3	7-high
52-2-3765	0	0	0	0-none

52-2-3285	1	1	1	3-low

Table 15 Statements of scientific significance for archaeological sites recorded within the study area.

Site name	Statement of significance
AHIMS pending/CR PAD 1	PAD 1 consists of low density subsurface deposit located on at the junction of hillslope and alluvial flat landforms within 50 metres of a first order creek line. A total of 10 artefacts consisting of 2 complete flakes, 2 distal flake fragments, 2 angular fragments, 1 medial flake fragment and 3 proximal flake fragments were identified across four test pits. Artefacts consisted of chert, quartz, quartzite and silcrete raw materials and were identified in the top 200 mm of soil deposit. The common nature of the site and limited density and range of artefact types indicates low scientific significance.
AHIMS pending/CR PAD 2	PAD 2 consists of low density subsurface deposit located on a mini rise on the alluvial flat landforms within 100 metres of a first order creek line. A total of four artefacts consisting of 2 complete flakes, 1 medial flake fragment and 1 unidirectional core were identified across four test pits. Artefacts consisted of chert, petrified wood and silcrete raw materials and were identified between 100 and 300 mm of soil deposit. The common nature of the site and limited density and range of artefact types indicates low scientific significance.
AHIMS pending/CR PAD 3	CR PAD 3 consists of an area of PAD located on an alluvial flat landform within 50 metres of a creek line. The scientific significance of this site is currently unknown.
AHIMS pending/CR PAD 4	CR PAD 4 consists of an area of PAD located on an alluvial flat landform within 50 metres of a creek line. The scientific significance of this site is currently unknown.
AHIMS pending/CR IF1	CR IF1 was located on the western boundary of the study area, next to the creek line. This site consisted of a single basalt complete flake, with flaked platform and retouched termination.
AHIMS pending/CR IF2	CR IF2 consisted of a complete silcrete flake that had been broken into three fragments by cattle trampling and was located on the southern side of a creek line. This site was in a disturbed context and consisted of a common site type in the area. The site contains low scientific significance.
AHIMS 52-5-0496/WDRA_AX_23	WDRA_AX_23 consisted of three artefacts recovered from a 1m x 1m test pit excavated on a terrace adjacent to a first order creek line. The artefacts consisted of two chert and one petrified wood flakes, one of which contained retouch and use wear. These artefacts were recovered from upper 20 cm of deposit. This site represents a common site type in the area and contains a low density deposit. The site contains low scientific significance.
AHIMS 52-5-0497/WDRA_AX_24	WDRA_AX_24 consisted of one quartz broken flake recovered from a 1m x 1m test pit excavated on a hillslope landform. The artefact was recovered from between 10 and 20 cm in depth. AMBS (2006) assigned this site with low archaeological potential. This site represents a common site type in the area and has a limited range of artefact types. The site contains low scientific significance.
AHIMS 52-5-0498/WDRA_AX_25	WDRA_AX_25 consisted of three chert artefacts and one petrified wood artefact recovered from two 1m x 1m test pits excavated as a part of a 40 square metre

	excavation program on a hill crest landform. This site was assigned low archaeological potential by AMBS (2006). The artefact was recovered from the upper 30 cm of soil and consisted of one complete flake and three broken flakes. This site represents a common site type in the area and has a limited range of artefact types. The site contains low scientific significance.
AHIMS 52-2-1688/WD1	Artefacts at AHIMS 52-2-1688/WD1 were recovered from the upper 26cm of the soil profile and consisted of silicified wood, chert and quartz flakes and one unidentified sedimentary core. Navin Officer stated that it was unlikely the artefacts were in situ, due to the extensive land use modifications of the topsoil from where artefacts were recovered (Navin Officer 1993, pp. 11). Given the dense grass cover, size of the test area and the limitations of subsurface testing, Navin Officer considered that there was a possibility that more artefacts were present both on surface and subsurface in WD1. However, potential for archaeologically significant sites and/or undisturbed archaeological deposits was assessed to be minimal (Navin Officer 1993, pp. 12). A Consent to Destroy was issued by National Parks and Wildlife in 1993 in order to destroy the site, however, AHIMS currently lists this site as valid.
AHIMS 52-2-3831/Cleveland Road FT 1	Cleveland Road FT1 was identified by the Aboriginal community as a potential birthing tree during the Biosis (2011b) assessment of the Fairwater Drive extension to Cleveland Road. Aboriginal birthing trees are a rare site type in the region and there is potential that sub-surface deposits are present at the base of this tree, therefore the site contains high scientific significance.
AHIMS 52-2-3832/Cleveland Road FT 2	Cleveland Road FT2 was identified by the Aboriginal community as a potential birthing tree during the Biosis (2011b)assessment of the Fairwater Drive extension to Cleveland Road. Aboriginal birthing trees are a rare site type in the region and there is potential that sub-surface deposits are present at the base of this tree, therefore the site contains high scientific significance.
AHIMS 52-2-0619/Cleveland Road AFT-6	This site was located within alluvial flats 10m from Mullet Creek Eight test pits were excavated across this site and six artefacts were recovered from three of these pits. Artefacts consisted of two flakes and four pieces of debitage and were made from silcrete, chert and mudstone. The site was assessed as having low significance as it is a common site type in the region and contained a limited range of artefact types.
AHIMS 52-5-0584/Cleveland Road PAD 2	This site is located within alluvial flats 10m from the western bank of Mullet Creek. Eight test pits were excavated to the sterile clay layer and seven artefacts were recovered from four test pits. Artefacts consisted of three flakes, a core and three pieces of debitage and were made from silcrete, chert and mudstone. The site was assessed as having low significance as it is a common site type in the region and contained a limited range of artefact types.
AHIMS 52-5-0585/Cleveland Road PAD 3	This site was located within alluvial flats 200m from Mullet Creek on the western side of the drainage line. Four test pits were excavated across this PAD and no Aboriginal cultural material was identified. Results indicated that Cleveland Road PAD 5 has undergone partial subsurface disturbance due to the previous residential construction and assumed demolition (Biosis 2011b, pp. 32). This is not a valid site and the area has since been disturbed as part of the construction of Daisy Banks Drive
AHIMS 52-5-	This site is located within alluvial flats 200m from Mullet Creek to the east of the small

0586/Cleveland Road PAD 4	drainage line. Five test pits were excavated with one artefact recovered, a hammer stone made of andesite. Due to the lack of additional cultural material in other excavated test pits, It was considered that the artefact was an isolated find, and that no further sub-surface deposits are present across the entire PAD area or associated landform. The site was assessed as having low scientific value due to its isolated nature and has since been destroyed under an AHIP.
AHIMS 52-5-3765/Cleveland Road PAD 5	This site was located within alluvial flats 50m south of Reid Creek. Three test pits were excavated in this area of PAD by Biosis and no Aboriginal cultural material was recovered. It was determined that this area was associated with a braided drainage channel and had been heavily disturbed as a result. This is not a valid site and the area has since been disturbed as part of the construction of the Fairwater Drive extension to Daisy Banks Drive.
AHIMS 52-2-3815/Riverpark Way AFT-1	This site consisted of an isolated chalcedony flake that was originally identified on the surface of a drainage channel. The site was identified with low scientific potential due to its location in the disturbed drainage channel and isolated nature.
AHIMS 52-2-3285/WDRA_AX_22	WDRA_AX_22 consisted of two artefacts that were recovered from the upper 10 cm of a 1m x 1m test pit. The site was located on an alluvial flat that was subject to overbank flows. AMBS (2006) assigned the site with low archaeological potential and due to the common nature and limited artefact types the site is of low scientific significance.

8 Impact assessment

As previously outlined, the project proposes to subdivide and develop the study area into a number of residential lots.

8.1 Predicted physical impacts

The proposed development will involve a number of construction works that will have the potential to directly impact on Aboriginal sites in the study area (Figure 10) . These works include

- Bulk earthworks for landscaping including infilling of existing dams and modification of drainage lines.
- Site compounds and material laydown areas.
- Construction of services and amenities including underground utilities such as electrical, telecommunication and waste water services.
- Construction of roads and associated features such as roundabouts, signage and kerbing.
- Subdivisions and construction of residential dwellings and associated infrastructure such as parks and pedestrian pathways.
- Construction of OSD basins and retention ponds.

A summary of impacts is provided below in Table 16.

Table 16 Summary of potential archaeological impacts

AHIMS site no.	Site name	Significance	Type of harm	Degree of harm	Consequence of harm
AHIMS pending	CR PAD 1	Low	Direct	Partial	Partial loss of value
AHIMS pending	CR PAD 2	Low	Direct	Total	Total loss of value
AHIMS pending	CR PAD 3	Low	No harm	None	No loss of value
AHIMS pending	CR PAD 4	Low	Direct	Total	Total loss of value
AHIMS pending	CR IF1	Low	Direct	Total	Total loss of value
AHIMS pending	CR IF2	Low	Direct	Total	Total loss of value
52-5-0496	WDRA_AX_23	Low	No harm	None	No loss of value
52-5-0497	WDRA_AX_24	Low	Direct	Total	Total loss of value

52-5-0498	WDRA_AX_25	Low	Direct	Total	Total loss of value
52-2-3815	Riverpark Way AFT-1	Low	No harm	None	No loss of value
52-2-1688	WD1	Low	No harm	None	No loss of value
52-2-3831	Cleveland Road FT 1	High	No harm	None	No loss of value
52-5-0585	Cleveland Road PAD 3	None	No harm	None	No loss of value
52-5-0586	Cleveland Road PAD 4	Low	No harm	None	No loss of value
52-5-0584	Cleveland Road PAD 2	Low	No harm	None	No loss of value
52-5-0619	Cleveland Road AFT-6	Low	No harm	None	No loss of value
52-2-3832	Cleveland Road FT 2	High	No harm	None	No loss of value
52-2-3765	Cleveland Road PAD 5	None	No harm	None	No loss of value
52-2-3285	WDRA_AX_22	Low	No harm	None	No loss of value

8.2 Management and mitigation measures

Ideally, heritage management involves conservation of sites through the preservation and conservation of fabric and context within a framework of 'doing as much as necessary, as little as possible' (Marquis-Kyle & Walker 1994, pp. 13). In cases where conservation is not practical, several options for management are available. For sites, management often involves the salvage of features or artefacts, retrieval of information through excavation or collection (especially where impact cannot be avoided) and interpretation.

Avoidance of impact to archaeological and cultural heritage sites through design of the development is the primary mitigation and management strategy, and should be implemented where practicable. The development has been designed to avoid aboriginal sites were possible; however, it is not feasible to avoid all sites without significantly altering the project design and as such mitigation measures have been implemented to retrieved as much information as possible.

A survey of the study area was undertaken to identify potential surface and subsurface sites that may be present in the study area. This survey identified two surface artefacts and four areas of potential archaeological deposit. Test excavations were then undertaken in the study area to determine the nature of the PAD sites and retrieve as much data as possible about Aboriginal occupation of the study area. Two areas of PAD (CR PAD 1 and CR PAD 2) were tested, as these areas were located within the development footprint and impacts could not be avoided. Testing was not undertaken at one area of PAD (CR PAD 3) as the site was located outside of the development footprint and no impacts would occur. This allowed the perseveration of that site for future generations in accordance with the principles of intergenerational equity. One are of PAD (CR PAD 4) was also unable to be tested as the landowner had restricted land access. It is recommended that this area of PAD be tested by a suitably qualified archaeologist prior to development of the area to ensure as much information can be retrieved before impacting it.

In addition to the test excavations undertaken in the study area it is also recommended that collection of surface artefacts is undertaken to preserve these artefacts for future generations and it is recommended that a cultural heritage management plan be implemented to ensure the continued protection and management of the two fig tree sites, as well as any artefact and PAD sites that are located outside of the development footprint.

Legend

- Study area
- Lot
- Client footprint
- PAD
- AHIMS

Test pit - Artefact

- 0
- 1 - 5
- >5

Figure 10.1 Aboriginal sites in the study area

0 50 100 150 200 250

Metres
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 14 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F10_AboriginalSites.mxd

Legend

- Study area
- Lot
- Client footprint
- PAD
- AHIMS

Test pit - Artefact

- 0
- 1 - 5
- >5

Figure 10.2 Aboriginal sites in the study area

0 50 100 150 200 250

Metres
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

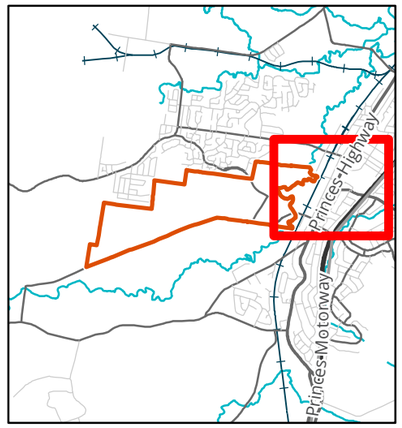
N

biosis
Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 14 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F10_AboriginalSites.mxd

Acknowledgements: Basemap © Land and Property Information 2016



Legend

- Study area
- Lot
- Client footprint
- PAD
- AHIMS

Test pit - Artefact

- 0
- 1 - 5
- >5

Figure 10.3 Aboriginal sites in the study area

0 50 100 150 200 250

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Sydney, Newcastle, Wangaratta & Wollongong

Matter: 30982,
Date: 14 February 2020,
Checked by: MJS, Drawn by: SSK, Last edited by: skumar
Location:P:\30900s\30982\Mapping
30982_F10_AboriginalSites.mxd

9 Recommendations

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the study area and influenced by:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practise, widely considered to include:
  - Ethos of the Australia ICOMOS Burra Charter.
  - The Code.

Prior to any impacts occurring within the study area, the following is recommended:

Recommendation 1: Application for an Aboriginal Heritage Impact Permit for sites AHIMS 52-5-0497/WDRA_AX_24, AHIMS 52-5-0498/WDRA_AX_25, CR PAD 1, CR PAD2, CR IF1, CR IF2, CR PAD4.

It is recommended that an AHIP application is made to impact on sites AHIMS 52-5-0497/WDRA_AX_24, AHIMS52-5-0498/WDRA_AX_25 and AHIMS 52-2-3285 CR PAD 1, CR PAD2, CR PAD4, CR IF1, and CR IF2 which cannot be avoided by the proposed development works. It is recommended that this AHIP be for a timeframe of 15 years.

For information about AHIPs and their preparation, see below.

Advice preparing AHIPs

An AHIP is required for any activities likely to have an impact on Aboriginal objects or Places or cause land to be disturbed for the purposes of discovering an Aboriginal object. Environment, Energy and Science (EES) issues AHIPs under Part 6 of the NPW Act.

AHIPs should be prepared by a qualified archaeologist and lodged with the EES. Once the application is lodged processing time can take between 8-12 weeks. It should be noted that there will be an application fee levied by the EES for the processing of AHIPs, which is dependent on the estimated total cost of the development project.

Where there are multiple sites within one study area an application for an AHIP to cover the entire study area is recommended.

Recommendation 2: Surface collection of CR IF1 and CR IF2

It is recommended that surface artefacts at sites CR IF1 and CR IF2 are collected as part of a surface salvage program in accordance with the proposed AHIP application prior to the commencement of works

Recommendation 3: Further investigation of AHIMS pending/CR PAD 4 is required

Access to AHIMS pending/CR PAD 4 was not available at the time of this assessment and test excavations could not be undertaken in this area. It is recommended that test excavations of this site are undertaken by an experienced archaeologist prior to submission of an AHIP to ascertain if this site needs to be included before impacts can occur.

Recommendation 4: Avoidance of sites AHIMS 52-5-0496/WDRA_AX_23, AHIMS 52-2-

3815/Riverpark Way AFT-1, AHISM 52-2-1688/WD1, 52-2-3831/Cleveland Road FT 2, AHIMS 52-2-3832/Cleveland Road FT 2, AHIMS 52-2-3285/WDRA_AX_22, AHIMS 52-5-0619/Cleveland Road AFT-6, 52-0584/Cleveland Road PAD 2, CR PAD 3

AHIMS sites 52-5-0496/WDRA_AX_23, AHIMS 52-2-3815/Riverpark Way AFT-1, AHIMS 52-2-1688/ WD1, AHIMS 52-2-3831/Cleveland Road FT 1, AHIMS 52-2-3832/Cleveland Road FT 2, AHIMS 52-0584/Cleveland Road PAD 2, AHIMS 52-5-0619/Cleveland Road AFT-6, and CR PAD 3 are located outside of the propose development footprint and it is recommended that impacts to these sites are avoided.

Recommendation 5: Development of a CHMP

It is recommended that a CHMP be developed in consultation with the RAP's, DPE and EES prior to the commencement of works. The CHMP will outline Aboriginal site management requirements including the management of identified sites, unexpected finds, and further works required prior to development.

Management options – previously identified sites

The CHMP should provide provisions to ensure that the identified sites located outside of the development area are not unintentionally impacted during works. This should include provision for exclusion fencing and development of suitable no go buffers if required.

Stop works provision – previously unidentified sites or objects

The CHMP should include a stop work provision for any potential heritage sites identified during construction, not identified as part of this assessment or the CHMP

All Aboriginal places and objects are protected under the NPW Act. This protection extends to Aboriginal objects and places that have not been identified but might be unearthed during construction. If construction proceeds, work must cease if Aboriginal objects or places are identified which have not previously been identified as part of this assessment or have not been approved for harm under a CHMP. OEH and the archaeologist must be notified to make an assessment of the find and advise on subsequent management.

Historical archaeological sites are protected under the relics provisions (s139 – 146) of the NSW *Heritage Act 1977*. Should any historical archaeological sites be identified during any phase of the proposed development, all works must cease in the vicinity of the find and the project archaeologist and OEH notified. Should the archaeological nature of the find be confirmed the Heritage Branch of the NSW Department of Planning, will require notification.

Stop works provision – Discovery of Aboriginal Ancestral Remains

The CHMP should also include a provision for the discovery of Aboriginal Ancestral Remains

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity the Diocese must:

- Immediately cease all work at that location and not further move or disturb the remains
- Notify the NSW Police and EES's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location
- Not recommence work at that location unless authorised in writing by EES.

Heritage training and induction

The CHMP should develop a training and heritage induction for all employees, contractors and associated subcontractors working on site. The induction training should address elements related to:

- Relevant legislation.
- CHMP conditions.
- Location of identified heritage sites.
- Basic identification skills for Aboriginal and non-Aboriginal artefacts and human remains.
- Procedure to follow in the event of an unexpected heritage item find during construction works.
- Procedure to follow in the event of discovery of human remains during construction works.
- Penalties and non-compliance.

Long term care and control agreement

As part of the CHMP, a long term care agreement of artefacts should be developed for all Aboriginal artefacts identified during the test excavations and salvage works. This should be undertaken in consultation with the RAPs.

Recommendation 6: Discovery of Unanticipated Historical Relics

Relics are historical archaeological resources of local or State significance and are protected in NSW under the *Heritage Act*. Relics cannot be disturbed except with a permit or exception/exemption notification. Should unanticipated relics be discovered during the course of the project, work in the vicinity must cease and an archaeologist contacted to make a preliminary assessment of the find. The Heritage Council will require notification if the find is assessed as a relic.

Recommendation 7: Continued consultation with the registered Aboriginal stakeholders

As per the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010b), it is recommended that the proponent provides a copy of this draft report to the Aboriginal stakeholders and considers all comments received. The proponent should continue to inform these groups about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project.

References

AHMS 2010. Aboriginal and Historical Archaeological and Cultural Heritage Assessment: Lots 1/549692, 60/1063539 and 601/1054648, Bong Bong Road, West Dapto, NSW,.

AHMS 2012. 'McPhail Lands' Aboriginal Cultural Heritage Assessment, Report for Stockland.

AMBS 2006. Volume 1: Aboriginal Heritage Management Plan: West Dapto Release Area, An unpublished report to Wollongong City Council.

Attenbrow V 2002. Sydney's Aboriginal Past: Investigating the archaeological and historical records, University of New South Wales Press Ltd, Sydney.

Australia ICOMOS 2013. The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance, Australia ICOMOS, Burwood, VIC.

Biosis 2007. Huntley Eco-Park, Aboriginal Archaeological Assessment, New South Wales. Report to TCG Planning,.

Biosis 2011a. Water and Wastewater Servicing of the West Dapto Urban Release Area and Adjacent Growth Areas: Aboriginal Heritage Assessment and Impact management, Report for Sydney Water.

Biosis 2011b. Fairwater Drive extension to Cleveland Road, Report for Wollongong City Council.

Biosis 2016. Iredell Road Cultural Heritage Assessment. Report for MMJ,.

Biosis Pty Ltd 2015. Fowlers Road Extension, West Dapto, NSW: Archaeological Report. Report to Cardno,.

Biosis Pty Ltd 2018. Hayes Lane, Huntley Aboriginal cultural heritage assessment,.

Bowdler S 1970., Bass Point: the excavation of a south eastern Australian shell midden showing cultural and economic change,BA Honours Thesis, University of Sydney.

Burke H & Smith C 2004. The Archaeologist's Field Handbook, Allen and Unwin, Crows Nest.

CSIRO 2009. Australian soil and land survey field handbook, 3rd edn, CSIRO Publishing & National Committee on Soil and Terrain, Collingwood, Victoria.

DECCW 2010a. Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales, Department of Environment and Climate Change, Sydney NSW.

DECCW 2010b. Aboriginal Cultural Heritage Consultation Requirements for Proponents, Department of Environment and Climate Change, Sydney NSW.

Donlon D & Sefton C 1988. Investigation of a midden at Judbooley Park, Windang, including assessment of Human Skeletal Remains, Report for the City of Wollongong.

GML Heritage 2015. Dapto Land Review, Report for Stockland.

Hazelton P & Tille P. 1990. Soil Landscapes of the Wollongong-Port Hacking 1:100 000 Sheet, Soil Conservation Service of NSW, Sydney.

Hazelton PA 1992. Soil Landscapes of the Kiama 1:00,000 Sheet, Department of Conservation and Land Management (incorporating the Soil Conservation Service of NSW), Sydney.

Hiscock P & Mitchell S 1993. Stone artefact quarries and reduction sites in Australia: towards a type profile, Australian Heritage Commission, Canberra, ACT.

Kass T 2010. A Thematic History of the City of Wollongong, Wollongong City Council, Wollongong.

Koettig M 1992. Assessment of Aboriginal Sites Proposed Electrification of Railway Line: Dapto to Kiama, Report to Epps and Associates.

Lampert R 1971. Coastal Aborigines of Southeastern Australia. In: Prehistory of Australia, Mulvaney D, Kamminga J (eds.), Smithsonian University Press.

Marquis-Kyle P & Walker M 1994. The illustrated Burra Charter : making good decisions about the care of important places, Australia ICOMOS with the assistance of the Australian Heritage Commission, Sydney.

McDonald W. 1976. Nineteenth-Century Dapto, Illawarra Historical Society, Wollongong, http://ro.uow.edu.au/ihspubs/4.

Navin Officer 1993. Archaeological Investigation of Proposed Subdivision Site No. 12285 West Dapto, NSW, Report to K.W.Williams and Associates Pty Ltd.

Navin Officer 1994. Archaeological Survey of proposed Illawarra Water Quality Project Installation, Kembla Grange, NSW, Report to Camp Scott and Furphy.

Navin Officer 2002. Smith Lane, Wongawilli Rezoning Application. Report for Forbes Rigby Pty Ltd,.

NPWS 1997. Aboriginal Cultural Heritage: Standards and Guidelines Kit.

NPWS 2002. Native vegetation of the Illawarra escarpment and coastal plain: bioregional assessment study part 1, National Parks and Wildlife Service, Hurstville NSW.

Odell G 2004. Lithic Analysis, Springer Science, New York.

OEH 2011. Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW, Office of Environment and Heritage.

Pearson M & Sullivan S 1995. Looking after heritage places : the basics of heritage planning for managers, landowners and administrators, Melbourne University Press, Carlton, Vic.

Rosen S 1995. Heritage Assessment for Nepean Tunnel Amplification Project, Sydney Water.

Sefton C 1980. Aboriginal Cultural Resources Study Illawarra Region, Illawarra Regional Planning Committee, Wollongong.

Sefton C 1984. West Dapto archaeological potential study, Unpublished report to Wollongong City Council.

Stewart K & Percival B 1997. Bush foods of New South Wales: a botanic record and an Aboriginal oral history, Royal Botanic Gardens Sydney, Sydney NSW.

Stroud W, Sherwin L, Roy H, & Baker C 1985. Wollongong - Port Hacking 1:100 000 Geological Sheet, 1st edn, Geological Survey of New South Wales, Sydney.

Appendices

Appendix 1 AHIMS results

THE FOLLOWING APPENDIX IS NOT TO BE MADE PUBLIC

Appendix 2 Test excavation results