

A photograph of a natural landscape featuring a field of tall, dry grass in the foreground, with a dense line of trees and shrubs in the background under a cloudy sky. The image is partially obscured by a large blue and green graphic overlay at the bottom.

Kariong Sand and Soil Supplies: Archaeological Report

FINAL REPORT

Prepared for Jackson Environment and Planning Pty Ltd

23 September 2020

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- Jackson Environment and Planning Pty Ltd: Dr Mark Jackson.

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- Mathew Smith and Taryn Gooley (field investigation).
- Dave Kazemi and Anne Murray (mapping).

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Glossary

ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
Consultation requirements	<i>Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010</i> (DECCW 2010a)
AR	Archaeological Report
CBD	Central Business District
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	<i>Environmental Planning and Assessment Act 1979</i>
GPS	Global Positioning System
GSV	Ground Surface Visibility
IPC	Independent Planning Commission
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	<i>National Parks and Wildlife Act 1974</i>
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PAD	Potential Archaeological Deposit
Study area	Lot 4 DP 227279
SEPP	State Environmental Planning Policy
SSD	State Significant Development
the Code	<i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> (DECCW 2010)

Summary

Biosis Pty Ltd was commissioned by Jackson Environment and Planning Pty Ltd to undertake an Aboriginal Cultural Heritage Assessment (ACHA) of a proposed development of an extension of the Kariong Sand and Soils Supplies site and to support a State Significant Development (SSD) at 90 Gindurra Road, Somersby, New South Wales (NSW) (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 SSD will be assessed under Section 4.36 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 (SSD 8660). The project will be assessed by the Independent Planning Commission (IPC) under delegation from the Minister of Planning.

The site is located in the Somersby Industrial Estate and is located approximately 4 kilometres west of the Gosford central business district (CBD). It encompasses 10.8 hectares of private and the adjacent road reserves.

There are 36 Aboriginal cultural heritage sites registered with the Aboriginal Heritage Information Management System (AHIMS) register in the vicinity of the study area, however there are no recorded sites located within the study area. Background research has identified that reports completed by, J. C. Lough and Associates (1981) and AMBS (2002), have identified an engraving site, SIE 26, as either being located 60 metres to the west of the study area (AMBS 2002). SIE 26 has not been recorded on the AHIMS register. Biosis has checked the coordinates for this site, and through mapping and background research, has been able to confirm that this site is not located within the study area, and is likely located approximately 60 metres to the west of the study area. The location of this site was also checked during the field investigation, and was unable to be relocated.

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).

An archaeological field investigation of the study area was undertaken by Mathew Smith (Project Archaeologist, Biosis) on 2 February 2018, with two representatives of the Darkinjung Local Aboriginal Land Council, Anthony Freeman and Timothy Oliver. A supplementary field investigation of the study area was conducted on Wednesday 11 September 2019 by Taryn Gooley (Team Leader – Heritage, Biosis), Tracey Howie (Awabakal & Guringai Pty Ltd) and Robert Pankhurst (Guringai Elder). No previously unrecorded Aboriginal cultural heritage sites were identified during the field investigation, and no areas of (archaeological) sensitivity were identified. Due to the high levels of disturbance identified in the northern section and the lack of sandstone exposures and overhangs suitable for rock, engravings, shelters and grinding grooves, there is a low potential for Aboriginal sites to be present within the study area.

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 impacts occurring within the study area, the following is recommended:

Recommendation 1: No further archaeological investigation required

No further archaeological investigation or works are required to be undertaken for the study area. The study area has been assessed as having low archaeological potential and no further investigations are required in this area. This recommendation is conditional upon Recommendations 2 to 5.

Recommendation 2: Boundary fencing

Appropriate boundary fencing is recommended to be used in order to clearly outline the boundary of the study area and to ensure that the proposed works will not impact upon rock engraving SIE 26.

Recommendation 3: Recording of SIE 26 on AHIMS

The engraving site, SIE 26, is to be recorded on AHIMS. Further investigation and conservation efforts are to be conducted by either the landholder or Environment, Energy and Science GROUP (EES).

Recommendation 4: Discovery of unanticipated Aboriginal objects and discovery of Aboriginal ancestral remains

All Aboriginal objects and places are protected under the *National Parks and Wildlife Act 1974* (NPW Act). It is an offence to disturb an Aboriginal site without a consent permit issued by EES. Should any Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal site or object the archaeologist will provide further recommendations. These may include notifying EES and Aboriginal stakeholders.

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 you must:

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

Recommendation 5: Continued consultation with the registered Aboriginal parties

As per consultation requirements it is recommended that the proponent provides a soft copy of this report to the Aboriginal stakeholders for comment. 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 Jackson Environment and Planning Pty Ltd to undertake an ACHA of the proposed industrial development (the study area) (Figure 1 and Figure 2). 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.

The SSD will be assessed under Section 4.36 of the Environmental Planning and Assessment Act 1979 NSW and Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 (SSD 8660). The project will be assessed by the IPC under delegation from the Minister of Planning.

This investigation has been carried out under Part 6 of the 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 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 in the Somersby Industrial Estate and is located approximately 4 kilometres west of the Gosford CBD. It encompasses 10.8 hectares of private and the adjacent road reserves.

The study area is within the:

- Central Coast LGA
- Parish of Gosford
- County of Northumberland.

The study area is bounded by Gindurra Road to the north, Kangoo Road to the south, rural residential houses to the east, and bushland to the west.

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 this assessment include:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- NPW Act.
- NSW *National Parks and Wildlife Amendment Act 2010*.
- Infrastructure State Environmental Planning Policy 2007 (SEPP).
- Gosford Local Environmental Plan 2014 (LEP).
- Gosford Development Control Plan 2013.

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 Darkinjung 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 investigation 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
Taryn Gooley BASc (Hons) Archaeology	<p>Taryn has successfully completed numerous projects throughout the Newcastle, Port Stephens, Lake Macquarie, Hunter Valley, and North Western NSW regions.</p> <p>Taryn has extensive experience in undertaking remote archaeological surveys and large scale archaeological testing and salvage excavation programs. Taryn has participated in and managed a number of long term archaeological programs under Part 4 and Part 5 of the EP&A Act.</p>	<ul style="list-style-type: none"> • Project management • Technical advice • Field investigation
Matthew Smith BA, BSc (Hons)	<p>Mathew joined Biosis in 2016 and is currently a Project Archaeologist in Wollongong, NSW. Since joining the company Mathew has worked on a number of Aboriginal cultural heritage projects in the Illawarra and Far West regions of NSW, where he has developed his skills in Aboriginal archaeology.</p> <p>As part of these projects Mathew has conducted desktop assessments, archaeological surveys and Aboriginal excavations, as well as writing the archaeological reports following these assessments. Mathew specialises in lithic identification and analysis, and has conducted lithic analysis of assemblages from the Illawarra, Sydney and Far West regions.</p>	<ul style="list-style-type: none"> • Field investigation
Anthea Vella B.Arch, M.AHM	<p>Anthea is an Archaeologist based in the Newcastle Office and joined in 2018. Anthea graduated from Flinders University with a Master of Archaeology and Heritage Management. Anthea has experience with desktop assessments, project administration, collating internal and external research, and reporting. Anthea also has experience in Aboriginal test excavations, historical excavations, and geophysical skills in GPR data collection, processing and interpretation.</p>	<ul style="list-style-type: none"> • Aboriginal community consultation • Report writing • Project management
Madeleine Lucas BA (Hons) Archaeology BSC	<p>Madeleine joined Biosis at the Newcastle Office as a Research Assistant – Heritage in 2019. She completed her Honours in Archaeology in 2018. Madeleine has undertaken fieldwork in England and Australia as an undergraduate volunteer. Madeleine possesses experience in undertaking Aboriginal community consultation, background research and data entry. Madeleine also has zooarchaeological skills in identification of faunal remains and taphonomic analysis.</p>	<ul style="list-style-type: none"> • Data entry and report preparation

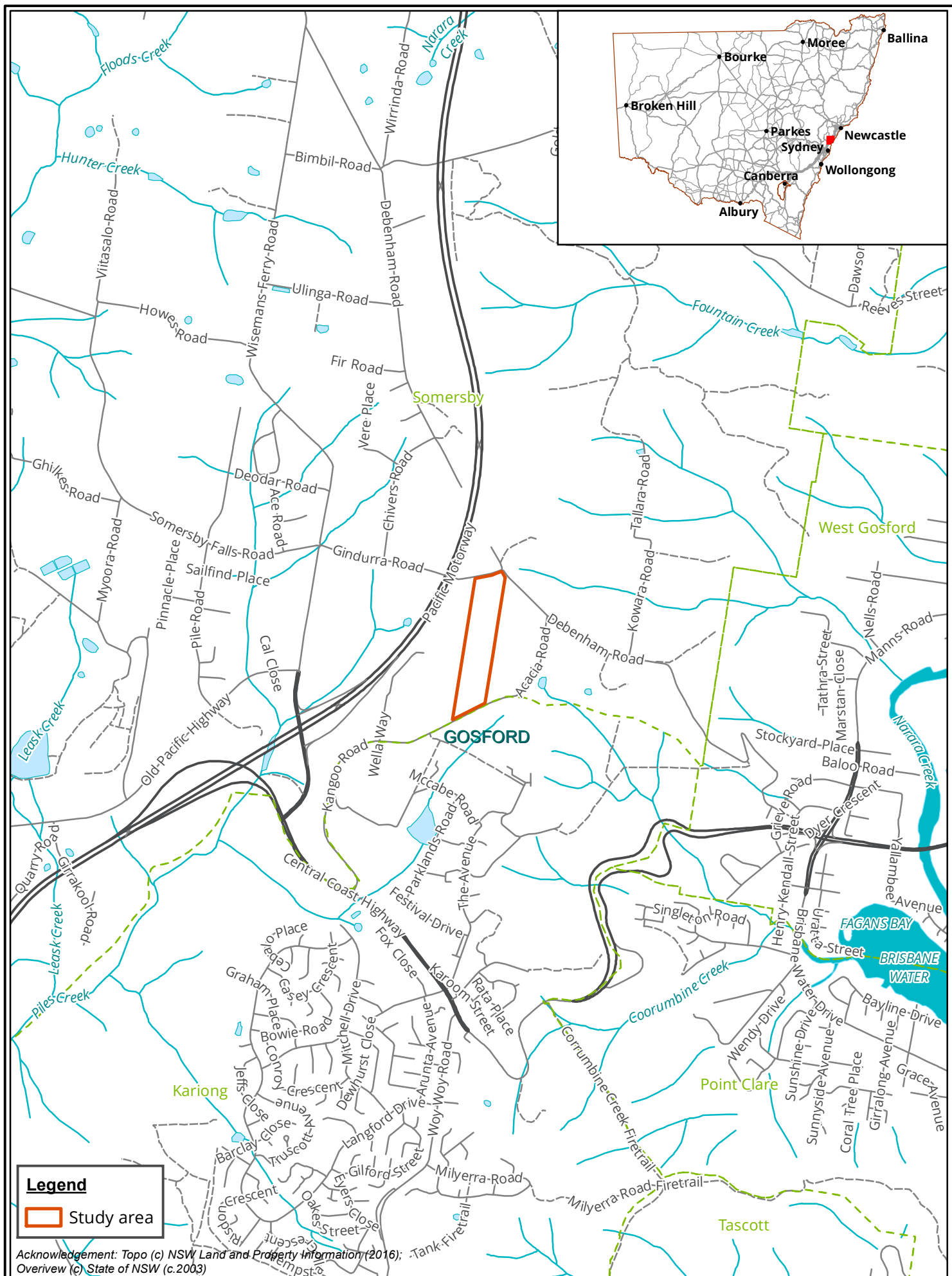


Figure 1 Location of the study area



Legend
 Study area

Acknowledgement: Topo (c) NSW Land and Property Information (2016);
 Overview (c) State of NSW (c.2003)

Figure 2 Study area detail

2 Proposed development

The Kariong Sand and Soil Supplies development will involve the construction and operation of a best practice recycling and landscape supplies facility that will enable the receipt of up to 200,000 tonnes of sand, soil and building materials each year. The project transform the site into a state-of-the-art facility turning sand, soil and building materials into 100% recycled building and landscaping supplies. The facility aims to produce a number of building and landscape products, providing them for re-use mainly in the Central Coast region.

The proposed development will seek to expand the current facility into a best-practice recycling plant that will assist the Central Coast in achieving the NSW Government's target of an 80% recycling rate for construction and demolition waste by 2021.

The project will involve the development of a largely undeveloped industrial site, to enable the facility to be used to receive, process and recycle construction and demolition waste, as well as supply building and landscape supplies for local projects. All waste materials will be received and processed indoors, to minimise impacts on the environment and neighbours.

The front part that will be visible from Gindurra Rd will be the landscaping supply operations, including landscaping along the road frontage and landscape storage bays behind the set back area. A fully enclosed warehouse where sorting and recycling operations will be conducted will be visible from the front of the site. Along the eastern boundary, a noise barrier and a native landscape buffer will be planted to avoid noise impacts on nearby rural dwellings, and to provide an aesthetically pleasing interface between the edge of the Somersby Industrial Estate and nearby rural zone lots and dwellings.

Waste processing and recycling operations for selected materials, including crushing and mulching will be done on the southern section of the site, where processing will also be done in dedicated buildings to avoid any impacts on nearby land uses. These operations are to be conducted at maximum distance from any sensitive receptors. The southern section of the site will retained as bushland to provide a natural buffer between the development and other residential areas more than a kilometre away from the southern boundary of the site.

Advanced water capture, rainwater harvesting, water treatment and dust suppression systems will be integrated in all buildings and outdoor areas to prevent dust being formed. The site will also include an advanced membrane filtration plant to enable much of the water captured from the site to be fully reused across the site for operational uses. The site will also include its own weather monitoring station, high volume air samplers for continuous air quality and dust analysis, and continuous noise loggers to confirm compliance with consent and licence conditions. The site will be fully serviced with fire suppression systems.

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 hydrology

The study area is located within a slope with two first order streams, located approximately 100 metres north east of the study area, and approximately 150 metres south-east of the study area (Figure 3). Piles Creek, a third order stream is located approximately 980 metres south-west of the study area.

Predictive models which have been developed for the region have a tendency to favour higher order streams as the locations of campsites as they would have been more likely to provide a stable source of water and by extension other resources which would have been used by Aboriginal groups.

The stream order system used for this assessment was originally developed by Strahler (1952). It functions by adding two streams of equal order at their confluence to form a higher order stream, as shown in Plate 1. As stream order increases, so does the likelihood that the stream would be a perennial source of water.

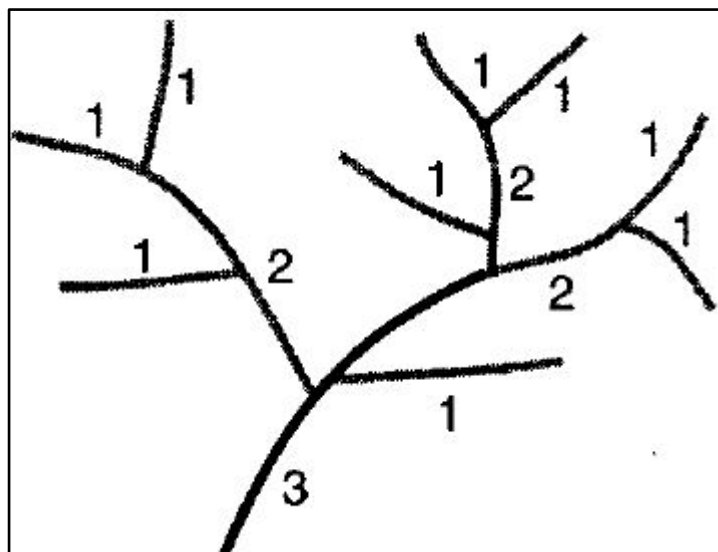


Plate 1 Diagram showing Strahler stream order (Ritter et al. 1995, p.151)

The study area is located within Hawkesbury Sandstone geological unit which overlies the Narrabeen group of the Sydney Basin (Figure 4). The Hawkesbury Sandstone geological unit consists of medium to coarse-grained quartz sandstone with minor shale and laminate lenses with a maximum thickness of 290 metres. This dominant pure quartzose sandstone produces sandy soils, particularly upon flat ridgelines. The Hawkesbury Sandstone unit was formed by alluvial to deltaic processes which are evident from current bedding. Red-brown concentric bands present within the sandstone unit have been formed post deposition, and have been produced by weathering. The Hawkesbury Sandstone unit is highly resistant to erosion, and vertical cliff formations within this geological unit are formed from vertical joint fractures where sandstone breaks off along softer thin horizontal layer of shales within the sandstone formation (Geoscience Australia 2019).

3.1.2 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.

The Sydney Town soil landscape is present within the study area (Figure 5). It is topographically characterised by undulating to rolling hills and moderately inclined slopes on quartz sandstone along the edge of the Somersby Plateau. The slope gradient of this soil landscape ranges from 5-25%. Sandstone beaches occasionally occur and are often exposed along narrow incised drainage lines. The soils within the landscape are highly permeable, and strongly acidic with very low fertility, and are subject to permanent waterlogging and present a very high erosion hazard (Table 2).

Table 2 Sydney Town soil landscape characteristics (Murphy 1993)

Soil Material	Description
Sydney Town 1 (st1)	20 – 100cm of loose brown sand or sandy loam, with apedal single grained structure and porous sandy fabric that usually occurs as topsoil. Ranges from dark brown (10YR 3/2) when organic matter content is high to greyish yellow brown (10YR 6/2, 10YR 5/2, 10YR 4/2) when organic matter content is low. Soil colour often becomes lighter with depth. Sandstone fragments, charcoal and roots are common.
Sydney Town 2 (st2)	50 – 150cm of earthy bright brown sandy clay loam, with apedal massive structure and porous earthy fabric that usually occurs as a subsoil. Soil colours are bright and are commonly yellowish brown (10YR 6/8, 2.5YR 6/6, 2.5YR 6/7, 2.5YR 6/8) and brown (7.5YR 5/8). Sandstone fragments are common, but charcoal and roots become less.
Sydney Town 3 (st3)	50 - 150cm of strong pedal clay, with strong pedal structure when dry, and apedal when saturated. This soils possesses a rough-faced ped fabric and commonly occurs as subsoil from shale lenses within the Hawksbury Sandstone. Soil colour ranges from bright reddish brown (5YR 5/6) in well drained areas to light grey (10YR 8/1) in poorly drained areas. Stratified ironstone gravels are common within this soil material.
Sydney Town 4 (st4)	50 – 150cm of grey massive mottled sand clay loam with apedal massive structure and porous earthy fabric. This soil material generally occurs as a subsoil in wet areas. The soil colour is characterised by pallid grey soil colours such as light grey (2.5Y 7/1) and greyish yellow (2.5Y 6/2). In wet situations there are often rusty piped mottles around root traces. Sandstone and charcoal fragments are rare or absent, and few roots are present.

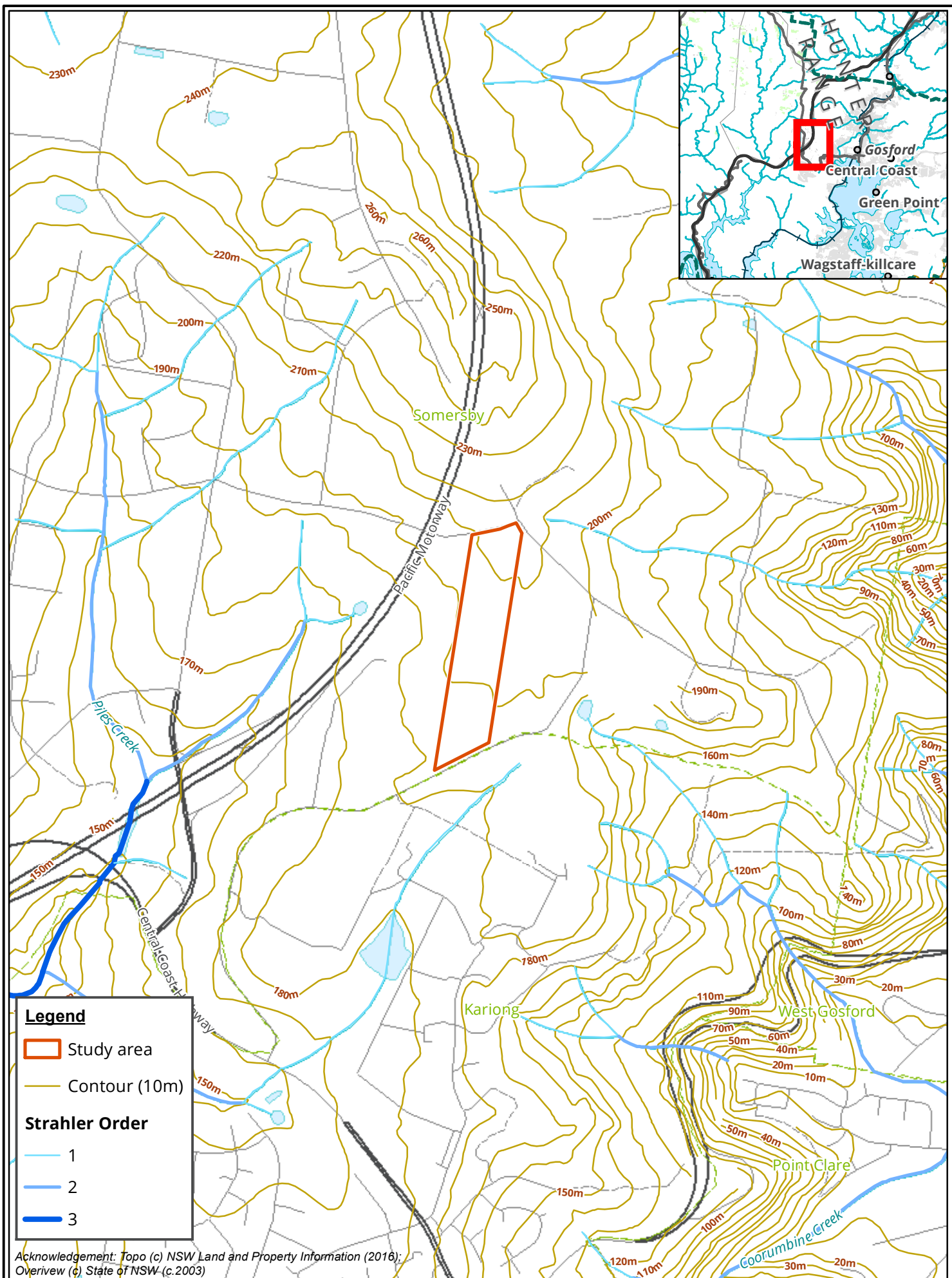
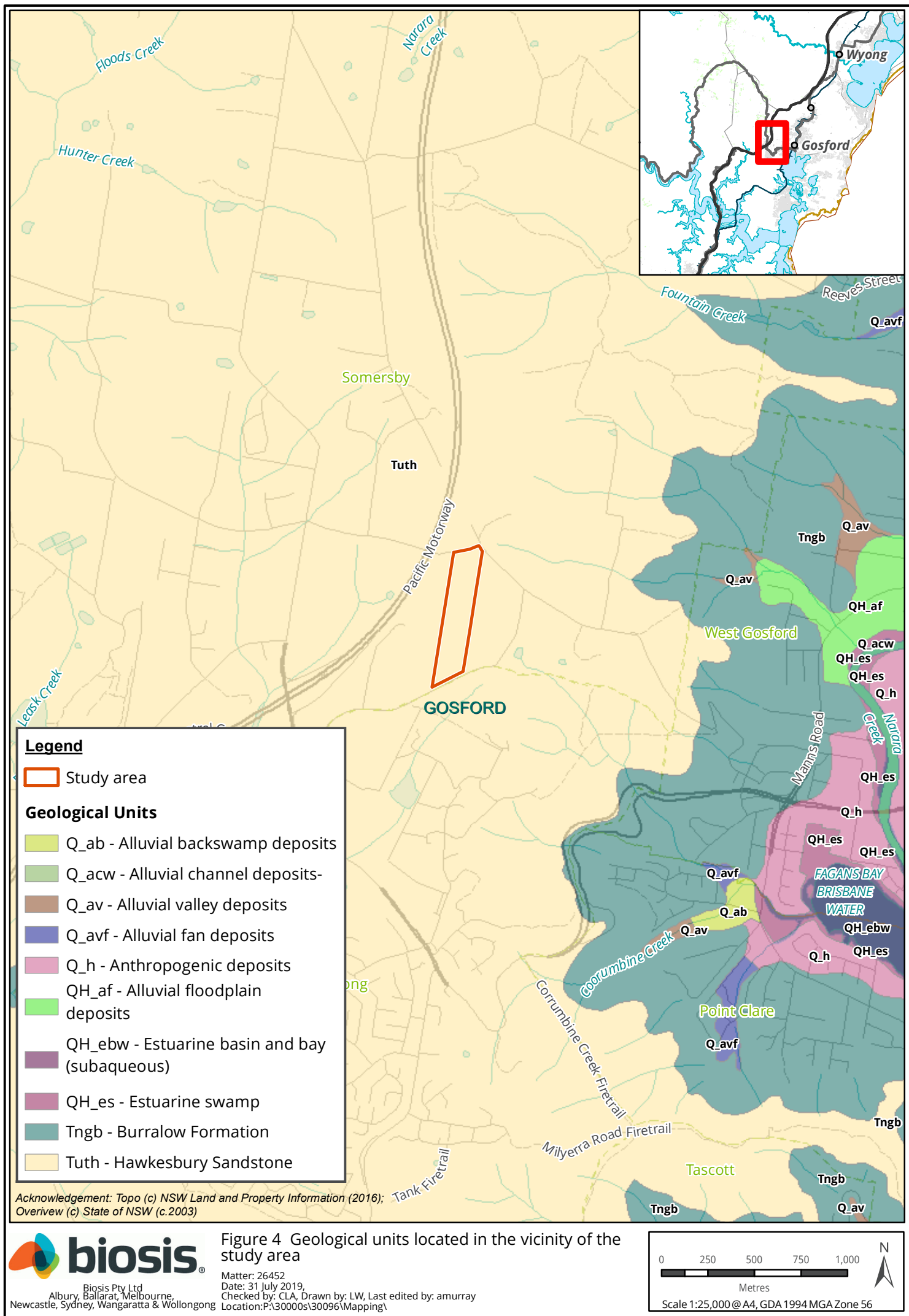


Figure 3 Topography and hydrology located in the study area



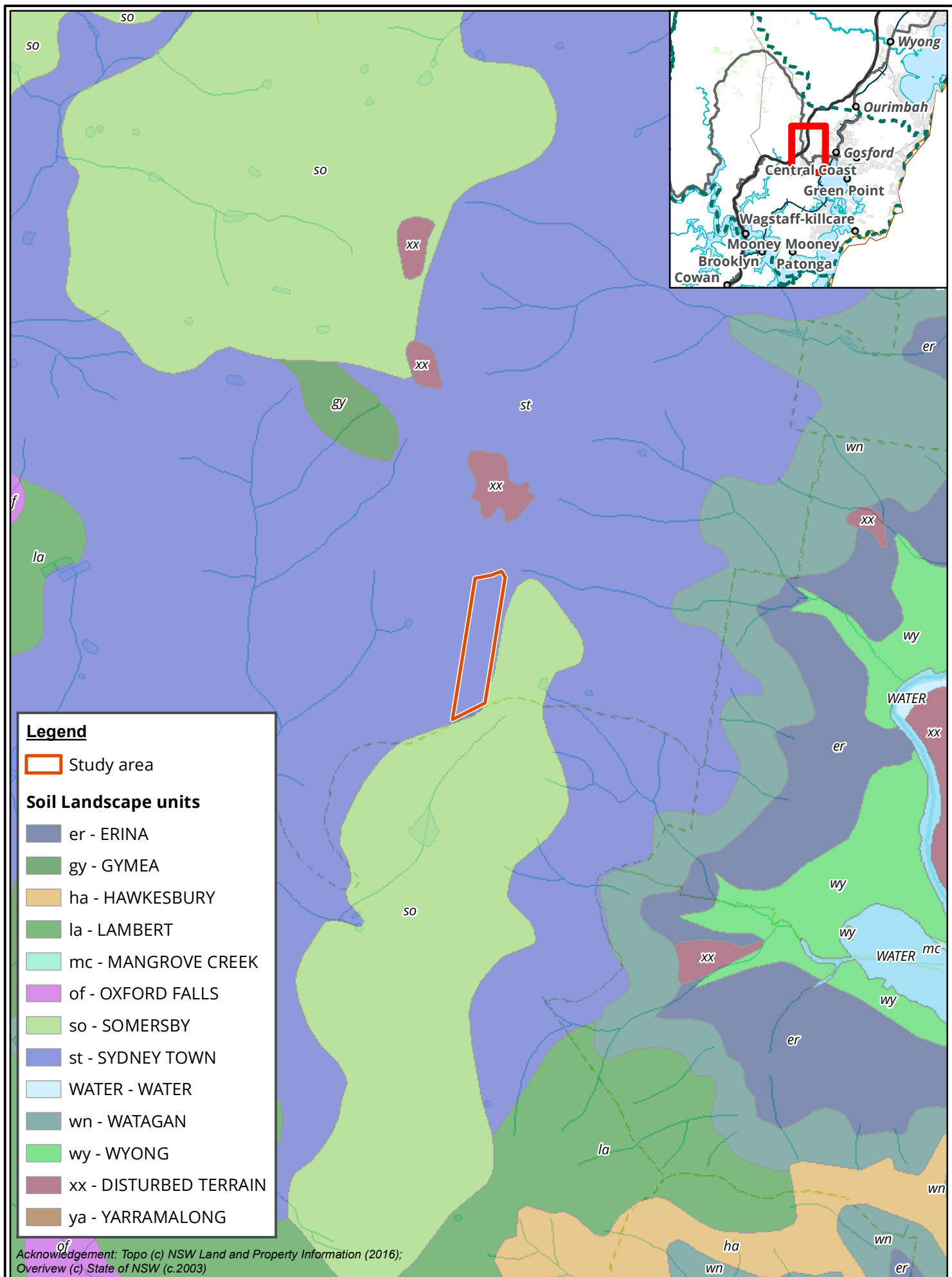


Figure 5 Soil landscapes within the study area

3.1.3 Landscape resources

The study area would have originally been vegetated by low eucalypt open-woodland and scrub, which has been extensively cleared throughout the Sydney Town soil landscape. The Sydney Town soil landscape would have generally provided a number of resources used by Aboriginal inhabitants. Common native species would have included the Scribbly Bark *Eucalyptus haemastoma*, Brown Stringy Bark *Eucalyptus capitellata*, Red Bloodwood *Eucalyptus gummifera*, Smooth-barked Apple *Angophora costata*, Sydney Peppermint *Eucalyptus piperita* and Old Man Banksia *Banksia serrata*. Common understorey shrubs include Grey Spider Flower *Grevillea spp.*, Flaky-barked Tea-tree *Leptospermum attenuatum* and Drumsticks *Isopogon spp.*. Poorly drained areas support scrubland of Heath Banksia *Banksia ericifolia* and Dagger Hakea *Hakea teretifolia* (Murphy 1993).

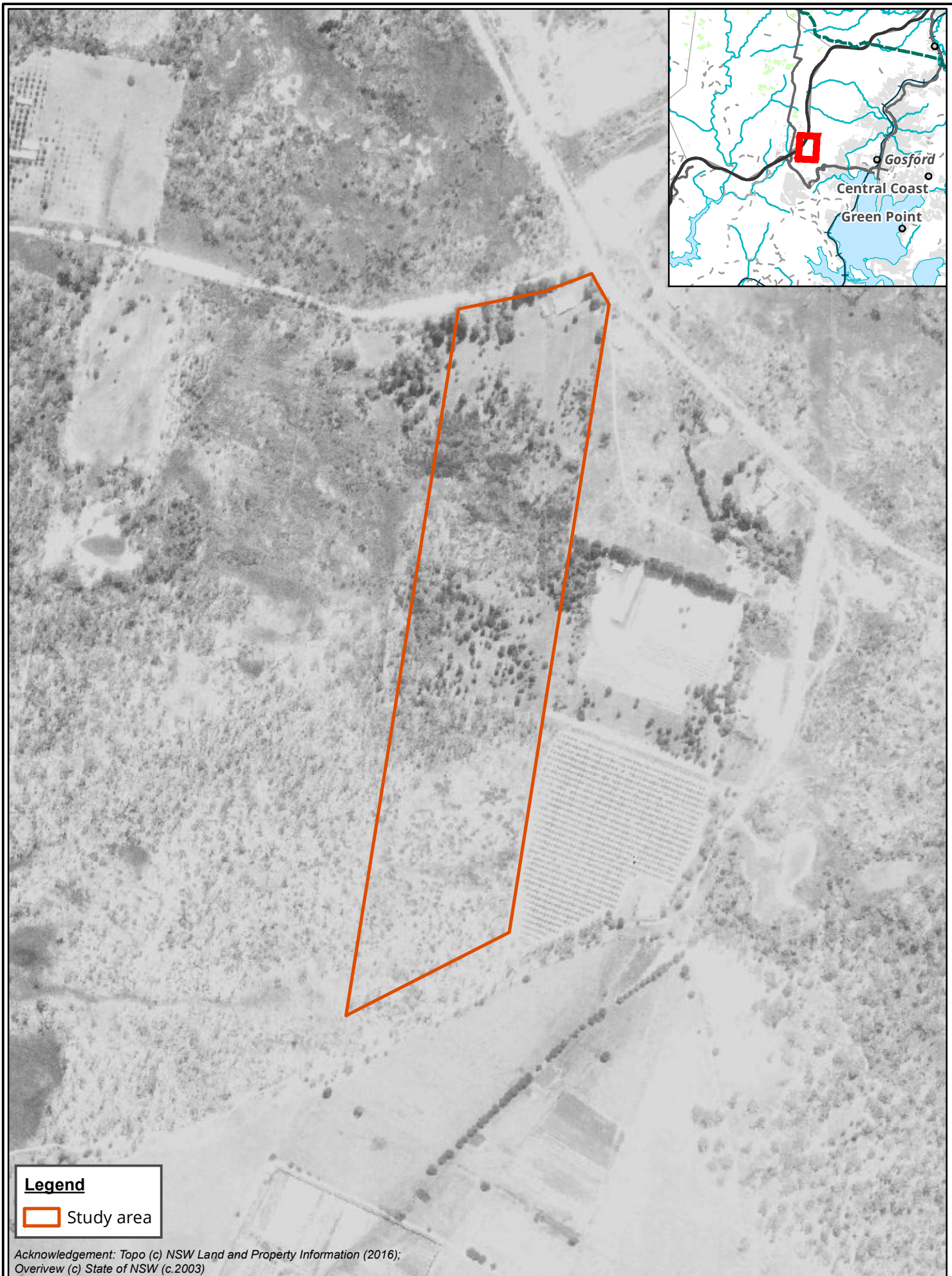
Plant resources were used in a variety of ways. Fibres were twisted into string, which was used for many purposes, including the weaving of nets, baskets and fishing lines. String was also used for personal adornment. Bark was used in the provision of shelter; a large sheet of bark being propped against a stick to form a gunyah (Attenbrow 2002).

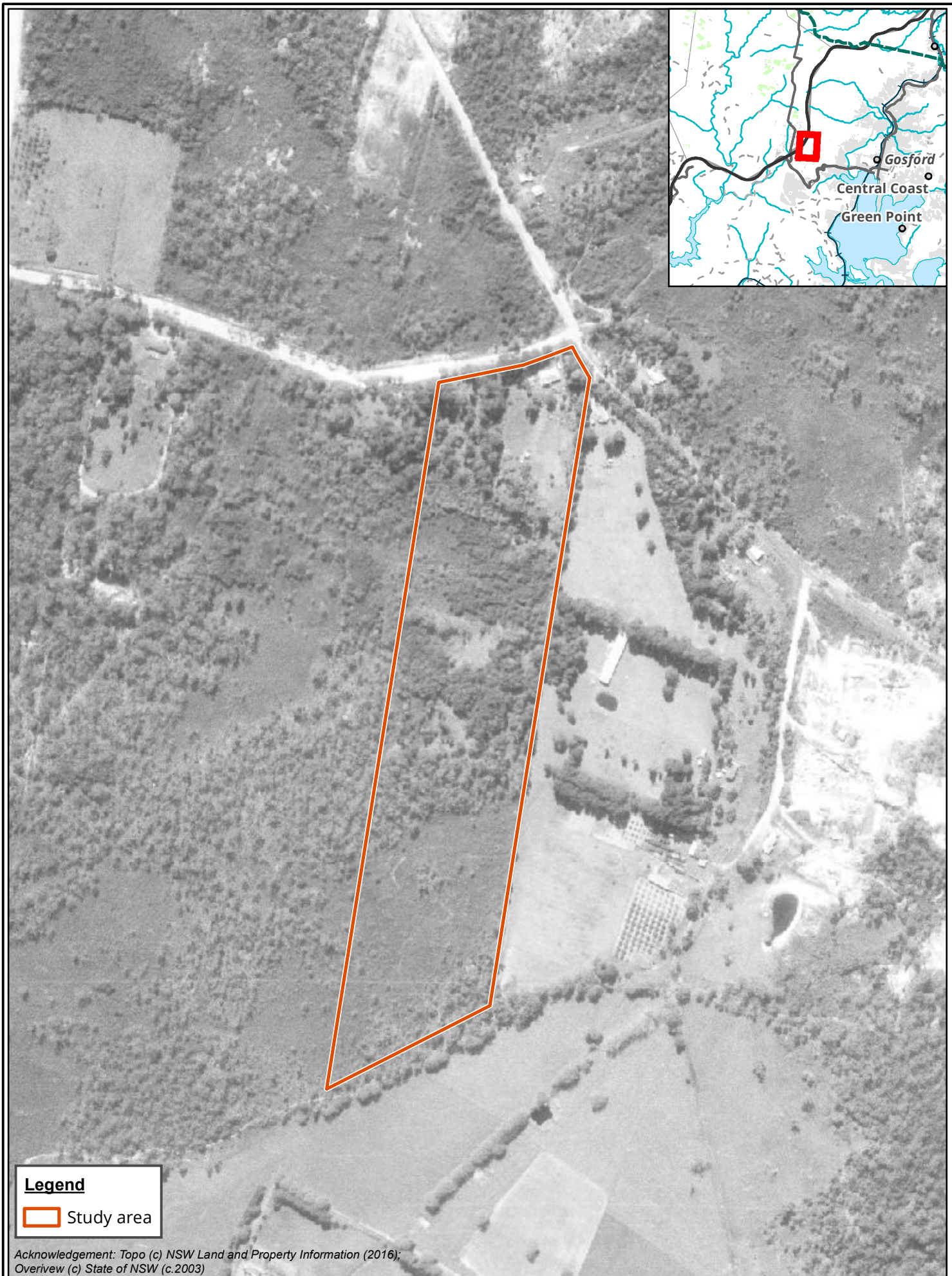
A variety of terrestrial native animals such as kangaroos, wallabies, and possum would have been an important food source. Animal products were also used for tool making and fashioning a myriad of utilitarian and ceremonial items. For example, tail sinews are known to have been used to make fastening cord, while 'bone points', which would have functioned as awls or piercers, are often an abundant part of the archaeological record. Animals such as brush-tailed possums were highly prized for their fur, with possum skin cloaks worn fastened over one shoulder and under the other. Kangaroo teeth were incorporated into decorative items, such as head bands (Attenbrow 2002).

3.1.4 Land use history

Historic imagery of the study area dating from 1966 (Figure 6) shows that the study area was less thickly vegetated and the northern section of the study area had been extensively cleared around a rural dwelling that occupied the north-eastern corner of the lot. Adjacent land located to the east of the study area is also occupied by various rural dwellings, and the land appears to have also been extensively cleared for farming and agricultural purposes.

Later historic imagery from 1984 (Figure 7) shows that the study area had experienced an increase in regrowth vegetation that resembles the current day study area (see Figure 2). The northern portion of the study area remains occupied by the rural dwelling shown in Figure 6 and an accompanying structure to the south. There is no indication of the present day quarry that currently occupies the site. The adjoining lands to the east remain occupied by rural dwellings, and continued use of the land for agricultural and farming practices is prevalent and an artificial dam has been installed.





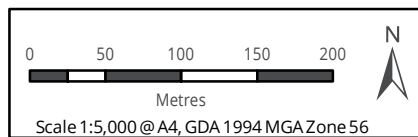
Legend

Study area

Acknowledgement: *Topo* (c) NSW Land and Property Information (2016);
Overview (c) State of NSW (c.2003)

Figure 7 1984 aerial imagery of the study area and locality

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 Date: 31 July 2019,
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 Location: P:\30000s\30096\Mapping\



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.

3.2.1 Regional overview

A number of Aboriginal cultural heritage investigations have been conducted for the Gosford region. Models for predicting the location and type of Aboriginal sites with a general applicability to the Gosford region and thus relevant to the study area have also been formulated, some as a part of these investigations and others from cultural heritage investigations for relatively large developments.

Vinnecombe (1980) completed an archaeological survey of the Gosford/Wyong region, to collect sufficient site records and site type information to determine patterns of site distribution. The survey area was divided into three environmental zones, including coastal estuarine areas of the Brisbane Water/Bouddi Peninsular, marginal estuarine areas of lower Mangrove Creek and inland freshwater areas of Mangrove Creek. The initial large scale assessment involved systematic survey of 10 km² locations; however this initial work did not consider a number of environments and landforms, thus further areas of the open coast, Tuggerah Lake/Central Coast Lagoons were surveyed. This survey work resulted in the recording of a number of middens, engravings and rock shelters.

The assessment identified regional patterns for site types within the various environmental zones. Site predictions indicated that the most frequently occurring site types were rock shelters with art and/or deposit, followed by axe grinding grooves, and engravings. Vinnicombe's analysis of the survey findings, ethnohistorical information and environmental context, indicated that resources were exploited seasonally along the coast during the summer months and throughout the hinterland during the winter months.

Attenbrow (1981) undertook a study of the Mangrove Creek Dam catchment, which included an inundation area of 1,215 hectares. The aim of the investigation was to assess the relationship between chronological and spatial site patterns within the Upper Mangrove Creek catchment, with demographic and human behavioural patterns within the area. This work involved the excavation of a number of Indigenous shelter sites, resulting in basal occupation dates at Mussel Shelter of 8,460±120 BP (SUA-1560) and Loggers Shelter of 11,050±136 BP (SUA-931). These results indicated the continual and extensive occupation of the Mangrove Creek catchment and that the 'coastal hinterland' was inhabited and exploited for longer and more intensively than first thought. Attenbrow compared the results from the excavated material at Mangrove Creek with sites in the MacDonald River Valley and Brisbane Waters region. This analysis identified variations within artefact types and available stone and faunal resources suggesting that site usage patterns varied within and between similar landscape units.

Navin & Officer (1994) were contracted by Sinclair Knight and Partners to provide a preliminary cultural heritage assessment on behalf of Optus, for the proposed cable route to be installed from Sydney to Newcastle, and onwards to Orange. The purpose of the assessment was to provide a predictive model for site locations within the study area that would influence the cable route. Within the report the archaeological sensitivity of five landforms (Sandstone Ranges of the Sydney Basin, Central Lowlands of the Hunter Valley, Cumberland Plain, the Coastal Margin and Plain, Western Rangelands) were assessed, and a predicted site location criteria was provided for each landform.

Mcdonald (2008) undertook a large scale study of engravings and rock shelter with art sites within the Sydney Basin. The survey area included the Hawkesbury catchment between MacDonald River and Broken Bay. The study focused solely on defining the nature and extent of art sites in the Sydney Basin. At the time of the study, over five thousand previously recorded Aboriginal archaeological sites had been recorded. 1370 of

these were rock shelter sites with associated art, and 1450 were engraving sites. Based on information on the registered site records of engraving sites, 55.9% of engraving sites were located upon ridgelines, 41% on hillsides, and few sites were located in valley bottoms. Almost 70% of rock shelters with art sites were located on hillsides, 31.7% occurred on the tops of ridgelines and 16.7% occurred at the bottom of valleys.

3.2.2 Local overview

A number of Aboriginal cultural heritage investigations have been conducted within the region (within approximately 10 kilometres of the study area). Most of these investigations were undertaken as part of development applications and included surface and sub-surface investigations. These investigations are summarised below.

Dallas (1981) completed an archaeological survey of a proposed area to undergo development at Kariong for Douglas Sanger Pty Ltd, on behalf of the Land Commission of NSW. The dominant site types within the area were rock engravings or grinding grooves, although occupation site with deposits and rock paintings were also present. Middens have also been recorded along the shores of Brisbane Waters. The field survey focussed on areas of disturbance and exposure, and the rocky creek beds and open exposed areas of sandstone. Any sandstone overhangs along the drainage lines or Piles Creek that were over 1 metre high were inspected during the survey effort. A natural spring was also identified and it was predicted that its presence would suggest a high quantity of sites within the area. Three sites had been previously recorded in the area, but were not relocated during the survey effort. 14 unrecorded Aboriginal sites were identified within the survey area. This included three potential occupation shelters which were excavated, however, the deposits were found to be sterile. From the results of the survey two distinct groups or 'clusters' of site complexes were deduced. Dallas concluded that these sites provide a "spatially dense and varied record of art and occupation activities that should remain undisturbed, and a buffer zone be developed" (Dallas 1981).

Keotigg & McDonald (1983) were commissioned by Lester Firth Associates Pty Ltd to complete a survey of archaeological sites in the Mount Penang Area, Somersby, where rural residential development was proposed. The area surveyed was approximately 175 hectares and targeted every rock surface in the area, which were inspected on foot. 8 sites were previously recorded within the area. Of these 8 sites, 3 were not relocated. A further six unrecorded sites were identified during the survey effort. Keotigg and McDonald summarised that the predominant sites types within the plateau/escarpment are of Gosford/Somersby region were rock engravings, shelter sites (PAD) and grinding grooves.

Du Cros & Rich (1986) undertook an archaeological survey of behalf of the Department of Lands of Crown Land that was proposed for future industrial development near Mount Penang, NSW. Two Aboriginal engravings site had been recorded within the vicinity of the area to be surveyed (45-3-29 and 45-3-30). Site 45-3-29 was located during the survey effort and it was recommended that the site location be properly recorded by a surveyor. Site 45-3-30 was not relocated and it was suggested by du Cros and Rich that the site may have been destroyed or was not correctly plotted and may be present outside of the area surveyed. It was recommended that site 45-3-29 be protected, and if future developments were to propose harm to the site further archaeological assessment would be required and consent to destroy would need to be obtained.

McDonald (1997) was commissioned by The Department of Public Works & Service to undertake to an assessment of the Mount Penang Juvenile Justice Centre. Redevelopment was proposed for a section of land that was at the time being used for farming and agricultural purposes. No Aboriginal sites had been previously recorded within the vicinity of the Juvenile Justice Centre, and no new Aboriginal sites were located during the survey. The unsuccessful attempt to identify the presence of Aboriginal sites within the area were attributed to the high level of existing disturbance within the area, as well as the absence of appropriate sandstone surfaces suitable for engravings.

J. C. Lough and Associates (1981) conducted an archaeological field survey for the NSW Department of Environment and Planning with the aim to identify, locate and assess the significance of the Somersby Industrial Estate. A number of Aboriginal sites had been previously recorded within the area that were consistent with site patterns of plateaus within the Gosford, Patonga and Wisemans Ferry regions. The archaeological survey targeted all rock surfaces and sections of sandstone with the potential to present rock engravings were also inspected at night using the night-Carbide technique. Rock shelters within the area were observed and inspected for artefactual deposits. The possibility of locating artefact scatters and isolated finds was limited by poor ground visibility. It was recommended that if the protection of sites within this area was to be threatened by further developments then the significance of the site must be assessed and an appropriate course of action be undertaken. Lough and Associates also identified SIE 26, an engraving site, as being located 60 metres to the west of the study area. As part of this current assessment Biosis completed background research in order to determine the location of the engraving site. The initial assessment conducted by Lough & Associates (1981) lacks adequate site descriptions, photographs, and site drawings. Biosis completed mapping using the coordinates from the report, and located the site as approximately 120 metres to the west of the study area. The coordinates listed in the report are in the AGD 1966 ISG 56 1 grid referencing system, and there are likely to be errors in transferring these coordinates into GDA94.

AMBS (2002) completed a plan of management for the Somersby Industrial Park for the NSW Department of Environment and Planning. The management plan completed by AMBS (2002) lists Aboriginal site SIE 26 as being located approximately 60 metres to the west of the study area. This site is not recorded on the AHIMS database. SIE 26 consists of an engraving site of three macropods about 450 millimetres long located on a small rock surface (J. C. Lough & Associates 1981). However, during the field investigation, AMBS was not able to locate the site. The report speculates that the site may be closer to the road and inferred that the site was likely to be covered with soil, vegetation, and dumped rubbish (Australian Museum Business Services 2002, vol. 2, pg. 92). The AMBS report references drawings from the Lough & Associates report, however these were not able to be located within the Lough & Associates report. In particular, AMBS has included a site plan of SIE 26 (Plate 2), which indicates that the engravings are located to the south east of Gindurra Road. Biosis has not been unable to access these site drawings and it is unclear how AMBS were able to access them. The Somersby plan of management shows the area AMBS has identified as SIE 26 with a 30 metre buffer (Plate 3) (Connell Wagner Pty Ltd 2005). SIE 26 is not located within the study area, as confirmed through background research and the field investigation as detailed Section 4.

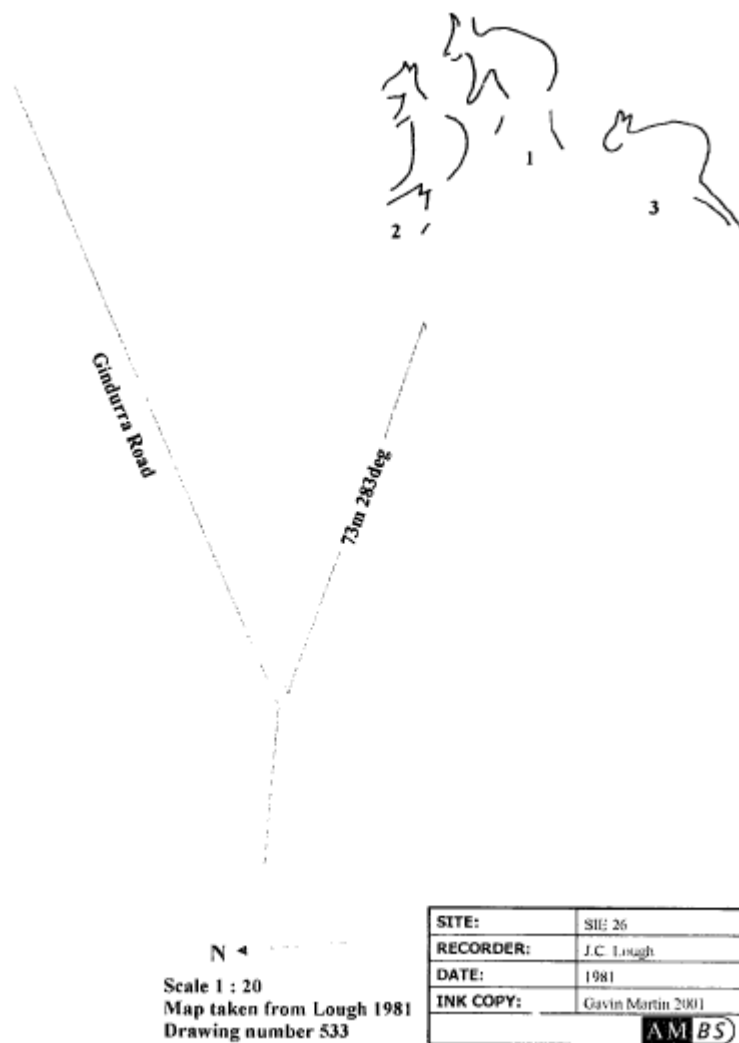


Figure 2-24. SIE 26 Site Plan

Plate 2 SIE 26 site plan (Australian Museum Business Services 2002)

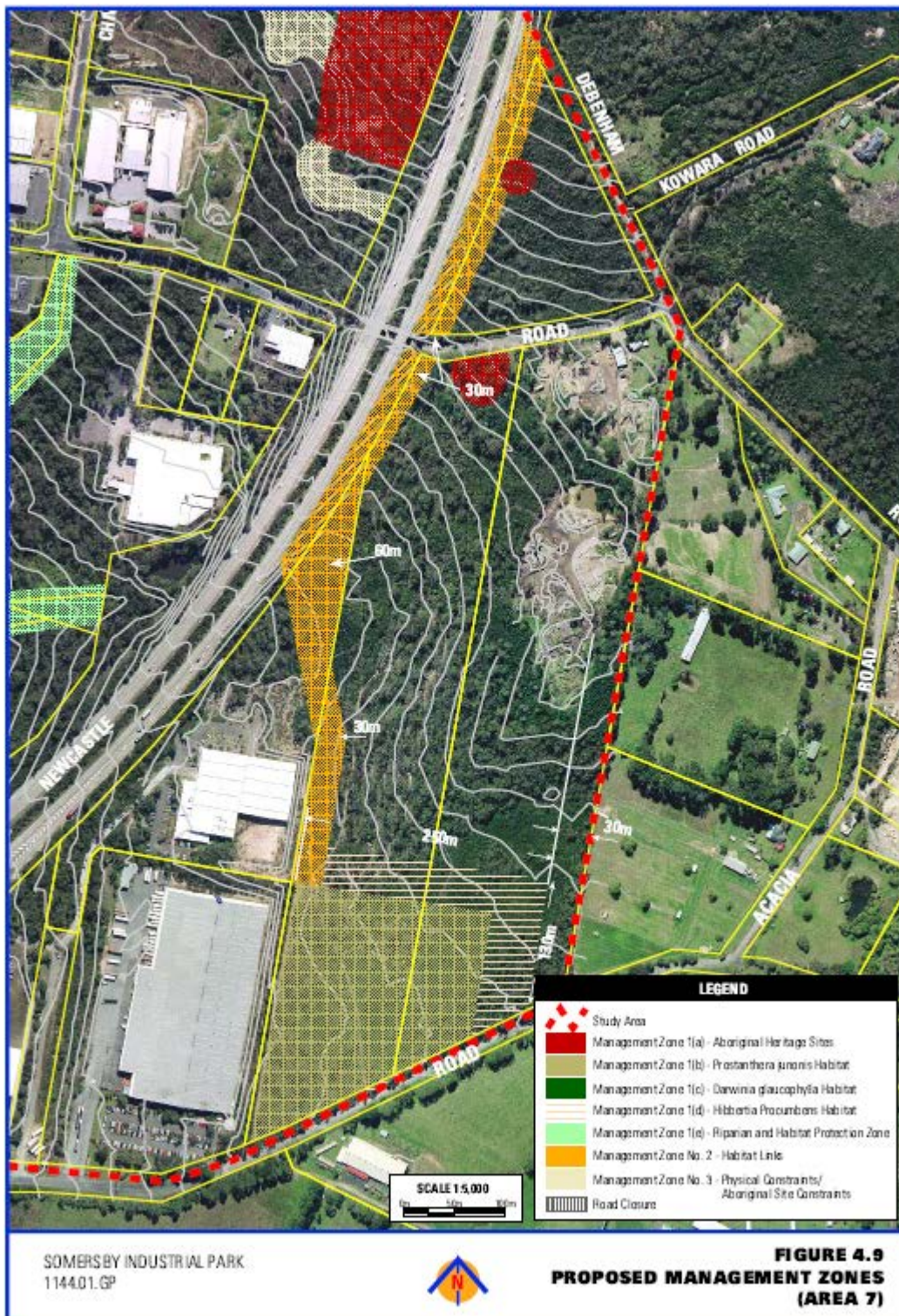


Plate 3 Somersby plan of management figure showing suspected location of SIE 26 as determined by AMBS (Connell Wagner Pty Ltd 2005)

Biosis Pty Ltd (2008) completed an archaeological assessment for Arup Sustainability on behalf of the NSW Roads and Traffic Authority that assessed the potential impacts to heritage items and places where the proposed road connection works between Kangaroo Road and Langford Drive at Kariong were proposed. A survey of the proposed road alignment was undertaken and focused on the relocation of AHIMS sites that

had been previously located within vicinity of the alignment. During the survey effort previously recorded sites within the area were revisited and reassessed. None of these sites were however located within the alignment. No new Aboriginal Archaeological sites were identified during the survey.

Biosis Pty Ltd (2018) completed an Aboriginal archaeological assessment for the study area. This assessment included background research and a field investigation. The study area was observed to be highly disturbed by human activity within the study area. Poor levels of ground surface visibility and the lack of appropriate sandstone exposures and overhangs suitable for rock engravings, shelters and grinding grooves also contributed to the low potential for the study area. No new Aboriginal sites were identified during the survey.

3.2.3 AHIMS site analysis

A search of the AHIMS database (Client Service ID: 423782) identified 35 Aboriginal archaeological sites within a 5 kilometre by 5 kilometre search area, centred on the proposed study area (Table 3). None of these registered sites are located within the study area. Table 3 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. As noted above, SIE 26, was recorded by Lough (1981), and was found to have not been recorded in the AHIMS database. The coordinates provided by Lough (1981), indicate SIE 26 is located approximately 120 metres to the west of the study area, however AMBS determined that SIE 26 is located approximately 60 metres to the west of the study area (Plate 3) as part of their 2002 assessment.

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 42 results presented here, compared to the 35 sites identified in AHIMS.

Table 3 AHIMS site type frequency

Site type	Number of occurrences	Frequency (%)
Art (Pigment and Engraved)	25	60%
Grinding Groove	7	17%
Artefact	4	10%
Water Hole	3	7%
Modified tree	1	2%
Stone Arrangement	1	2%
Shell	1	2%
Total	42	100.00%

A simple analysis of the Aboriginal cultural heritage sites registered within the 5 kilometre by 5 kilometre buffer of the study area indicates that the dominant site type is art, representing 60% (n=25) of the site types. While grinding grooves represent 17% (n=7) followed by artefacts at 10% (n=4) and watering holes at 3%

(n=3). The remaining site types include modified trees, stone arrangements and shell, all representing 2% (n=1).

3.2.4 Predictive statements

A series of predictive statements have been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist 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 4). The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the study area.

Table 4 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.	Moderate: Stone artefact sites are commonly recorded on level, well-drained topographies in close proximity to reliable sources of fresh water. Due to the level of disturbance within the study area and the low occurrence of the site type occurring within the region, the potential for artefacts to be present within the study area is assessed as moderate to low.
Potential Archaeological Deposits (PADs)	Potential sub surface deposits of cultural material.	Moderate: PADs have not been previously recorded within the vicinity of the study area. PADs are likely to be present within areas adjacent to water courses or on high points in undisturbed landforms, or present as occupational deposits within rock shelters.
Grinding Grooves	Grooves created in stone platforms through ground stone tool manufacture.	Moderate: Suitable horizontal sandstone rock outcrops could occur along drainage lines which are associated with the Sydney Town Soil landscape in which the study area is located.

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.	Moderate: These sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist. The study area is located on Hawkesbury Sandstone, which could contain the availability of rocks shelters.
Shell Middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	Low: Shell midden sites have been infrequently recorded within the vicinity of the study area. There is a low potential for shell middens to be located in the study area as the first order drainage line is not a permanent water source. Shell middens within the region may be more closely associated to the shore lines of Brisbane Waters.
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.
Scarred Trees	Trees with cultural modifications	Low: Due to extensive vegetation clearance, only a small number of mature native trees have survived within the study area.
Quarries	Raw stone material procurement sites.	Low: There is no record of any quarries being within or surrounding the study area.

Site type	Site description	Potential
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.

4 Archaeological field investigation

An archaeological field investigation of the study area was undertaken by Mathew Smith (Project Archaeologist, Biosis) on 2 February 2018, with two representatives of the Darkinjung Local Aboriginal Land Council, Anthony Freeman and Timothy Oliver. A supplementary field investigation of the study area was conducted on Wednesday 11 September 2019 by Taryn Gooley (Team Leader – Heritage, Biosis), Tracey Howie (Awabakal & Guringai Pty Ltd) and Robert Pankhurst (Guringai Elder). The field investigation sampling strategy, methodology and a discussion of results are provided below.

4.1 Archaeological field investigation objectives

The principle aims of the field investigation were to:

- To undertake a systematic field investigation 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 Field investigation methods

The field investigation was conducted on foot. Recording during the field investigation followed the archaeological field investigation requirements of the Code and industry best practice methodology. Information that recorded during the field investigation included:

- Aboriginal objects or sites present in the study area during the field investigation.
- Field investigation coverage.
- Any resources that may have potentially have been exploited by Aboriginal people.
- Landform elements, distinguishable areas of land approximately 40m across or with a 20m 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; and,
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, the identification of natural soil deposits within the study area was undertaken. Photographs and recording techniques were incorporated into the field investigation including representative photographs of field investigation units, landform, vegetation coverage, ground surface visibility and the recording of soil information for each field investigation unit were possible. Any potential Aboriginal objects observed during the field investigation 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 Constraints to the field investigation

With any archaeological field investigation there are several factors that influence the effectiveness (the likelihood of finding sites) of the field investigation. The factors that contributed most to the effectiveness of the field investigation within the study area were the high levels of disturbance and heavy vegetation coverage in the southern section of the study area. The northern section of the study area displayed heavy disturbances including landscaping, excavations and use as stockpiling areas, which limited the ability to identify the natural ground surface. The heavy vegetation coverage in the southern section of the study area, hampered the field investigation significantly as the field team was unable to access areas of the study area and instead were confined to the less dense outer boundaries of the vegetated area (Plate 4 and Plate 5). Additionally, visibility in these areas was so low, that it was impossible to observe the ground surface or landforms present in the vegetated area.



Plate 4 Photo looking towards inaccessible area of dense vegetation



Plate 5 Photo looking towards inaccessible area of heavy vegetation

4.4 Visibility

In most archaeological reports and guidelines visibility refers to ground surface visibility, 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). Visibility varied across the study area, the northern section of the study area had moderate levels (70%) of visibility as disturbances had removed grass coverage (Plate 6). The southern section of the study area had no visibility (0%) as heavy vegetation coverage made it impossible to see the ground surface (Plate 7).



Plate 6 East facing photo showing areas of high visibility around disturbances



Plate 7 West facing photo showing area of zero visibility due to heavy vegetation coverage

4.5 Exposure

Exposure refers to the geomorphic conditions of the local landform being investigated, 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 & Smith 2004, p.79, DECCW 2010b). The study area displayed areas of moderate exposure around the disturbances associated with the previous land use in the northern section (40%), although imported gravel often obscured the ground surface (Plate 8), with the heavy vegetation cover in the southern section reducing exposures levels to 0%.



Plate 8 Photo of exposure in northern section of study area

4.6 Disturbances

Disturbance in an area can be 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 action cover large sections of a land surface. The 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 nurseries and creation of artificial dams.

The primary disturbances associated with the study area are from human agents. The northern section of the study area was used as a soil and sand recycling business and has undergone extensive modification and disturbance. At the time of the field investigation large stockpiles of sand, gravel and concrete were observed in the study area (Plate 9 and Plate 10) evidence of significant soil disturbances from landscaping and the use of heavy equipment were observed throughout the northern section, with mounds of soil pushed up into piles by machinery (Plate 11), and evidence of significant bulk earthworks having been conducted.



Plate 9 Stockpiles of sand and gravel in study area



Plate 10 Concrete stockpiles in study area



Plate 11 Heavy machinery and area of significant landscaping

4.7 Field investigation results and discussion

The archaeological field investigation consisted of a total of two meandering transects that traversed accessible areas of the study area, targeting areas of ground surface exposure and landforms (Figure 8). The results of the field investigation have been summarised in Table 5 and Table 6 below.

The majority of AHIMS sites in the vicinity of the study area consist of rock engravings and grinding grooves, as is to be expected in areas of sandstone geology, which the study area overlies. The field investigation did not identify any sandstone exposures within the study area which could contain rock engravings or grinding grooves.

No previously unrecorded Aboriginal sites or objects were located during the field investigation. The northern section of the study area was determined to be significantly disturbed by the previous and current use of the study area as a sand and soil recycling centre. This would have significantly impacted soil deposits and resulted in the disturbance and destruction of potential sites. The southern section of the study area was heavily vegetated and could not be accessed during the field investigation due to this vegetation. Observations of the vegetation in this area consisted of shrubs and small trees, with occasional mature scribbly gums showing evidence of burning present.

Observations made in the field by the field investigation teams indicated that the southern portion of the study area is low lying, suggesting Aboriginal occupation of the southern portion of the study area is unlikely. Robert Pankhurst provided information during the supplementary field investigation that he frequently traversed the study area during the 1960s and 1970s, and Aboriginal objects were not present within the study area. He noted that the property to the west of the study area and to the north of the study area contained Aboriginal objects as well as Aboriginal engravings.

Robert also provided information relating to the rock engraving site SIE 26 recorded by Lough (1981) and mapped by AMBS as being located approximately 60 metres to the west of the study area. The suspected location of the rock engraving site was inspected by the field team during the supplementary field investigation. Areas of sandstone cropping were noted, however dense vegetation was observed and no engravings were identified. Robert indicated that the engraving is located within the area mapped by AMBS (Plate 3) and that the engraving is likely covered by soil deposits, leaf litter and illegally dumped rubbish. Robert requested that the site be recorded on the AHIMS database if it is not already, and that further investigation and conservation efforts are conducted by either the landholder or EES.

Due to the high levels of disturbance identified in the northern section and the lack of sandstone exposures and overhangs suitable for rock, engravings, shelters and grinding grooves, there is a low potential for Aboriginal sites to be present within the study area (Figure 9). Tracey Howie and Robert Pankhurst indicated they were satisfied that the proposed works will not impact on previously unrecorded Aboriginal objects, or engravings and that by implementing appropriate controls such as boundary fencing the works will not impact on rock engraving site SIE 26.

Table 5 Survey coverage

Survey Unit	Landform	Survey unit area (m ²)	Visibility (%)	Exposure (%)	Effective coverage area (m ²)	Effective coverage (%)
1	Slope	66573	0	0	6946	10.43%
1	Slope (modified)	40960	70.00%	40.00%	12288	30.00%

Table 6 Landform summary

Landform	Landform area (m ²)	Area effectively surveyed (m ²)	Landform effectively surveyed (%)	No. of Aboriginal sites	No. of artefacts or features
Slope	66573	6946	10.43%	0	0
Slope (modified)	40960	12288	30.00%	0	0

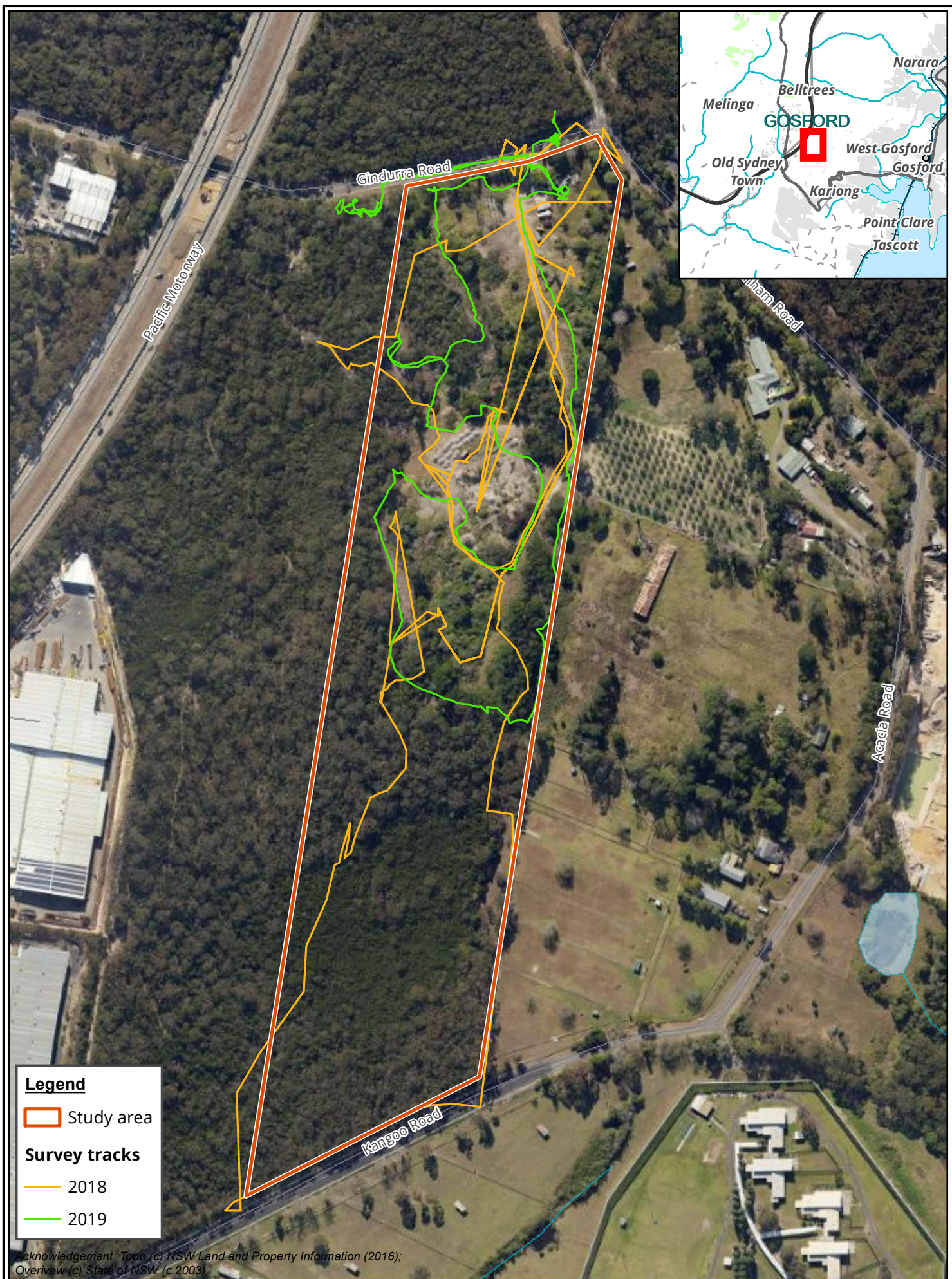


Figure 8 Survey results

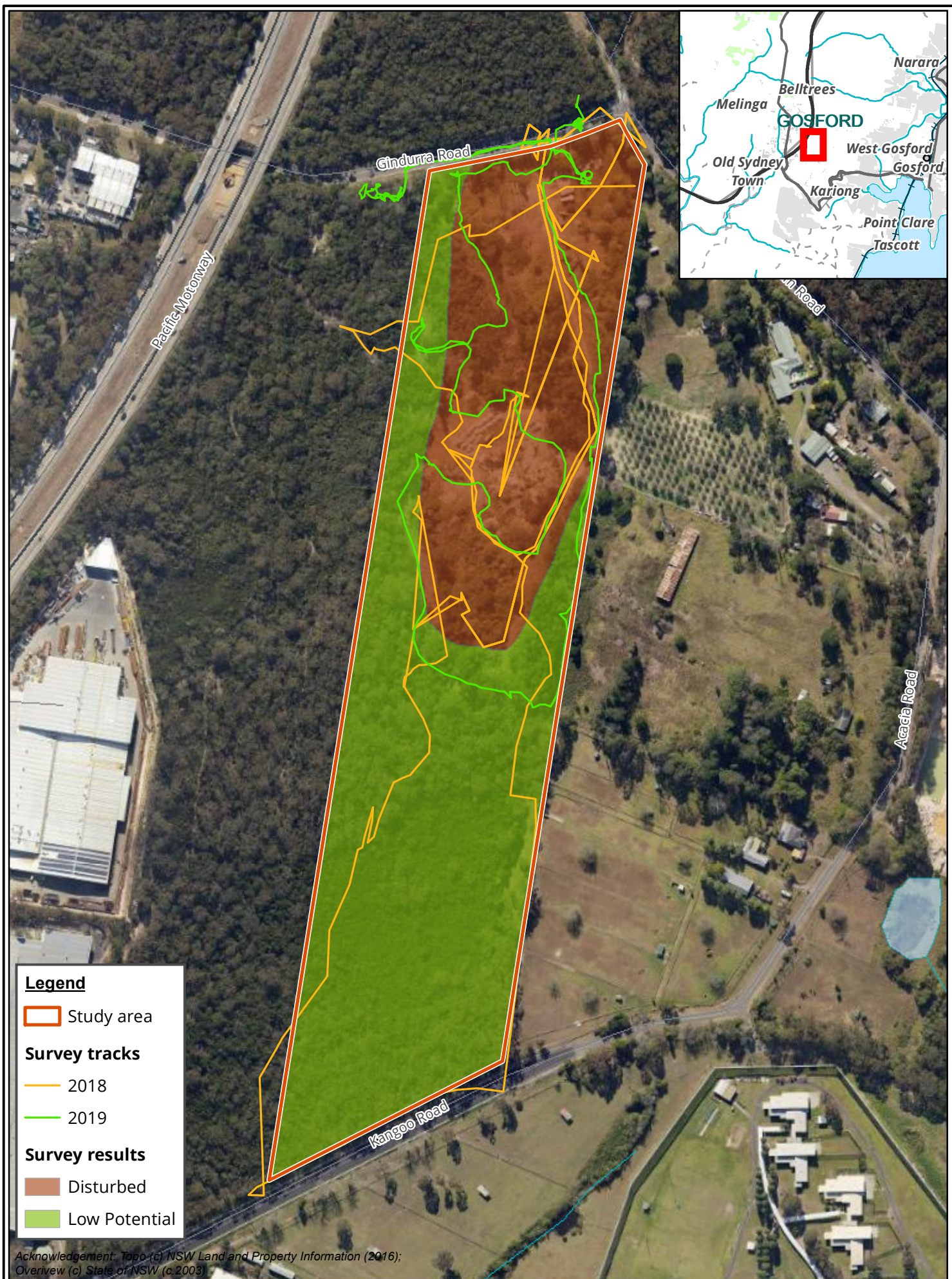


Figure 9 Archaeological assessment

5 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.

5.1 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 the guidelines that have been prepared by the Commonwealth Department of the Environment and Energy, and the 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.

5.2 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, p.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, p.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 (Table 7). Site condition refers to the degree of disturbance to the contents of a site at the time it was recorded (Table 8).

Table 7 Site contents ratings used for archaeological sites

Rating	Description
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.

Rating	Description
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.

Table 8 Site condition ratings used for archaeological sites

Rating	Description
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, p.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 (Table 9).

Table 9 Site representativeness ratings used for archaeological sites

Rating	Description
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 provided in Table 10.

Table 10 Scientific significance ratings used for archaeological sites

Rating	Description
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.

5.2.1 Statements of archaeological significance

No Aboriginal sites or objects were identified during the field investigation. The background research and field investigation confirmed that the study area has been heavily disturbed by previous land uses. This assessment has therefore determined that there is no archaeological significance within the study area.

6 Impact assessment

As previously outlined, an industrial development is proposed for the study area including the installation of security fencing, construction of on-site roads, parking areas, stormwater run-off and drainage/treatment infrastructure, an office and maintenance workshop, hardstand area and storage bays.

6.1 Predicted physical impacts

The study area does not contain any recorded Aboriginal sites and has been assessed as having low archaeological potential due to disturbances observed in the study area, and the distance of the study area to reliable sources of water. The proposed works will therefore not impact on any Aboriginal heritage values.

6.2 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' (Australia ICOMOS 2013). 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 the design of the development is the primary mitigation and management strategy, and should be implemented where practicable. The proposed works have been confined to areas that have been heavily disturbed from the sand and soil recycling centre and will avoid impacts to any known Aboriginal sites. As part of the management and mitigation measures for the proposed works, and Aboriginal cultural heritage assessment including archaeological survey and consultation with the Aboriginal community was undertaken. This was done to determine the presence and nature of any potential Aboriginal sites so that appropriate management could be undertaken. The survey did not identify the presence of any Aboriginal sites and the study area was assessed with low potential due to high levels of disturbances present. As a result of the assessment an unexpected finds protocol has been recommended which will help manage and mitigate potential impacts in the case of unexpected finds.

Appropriate boundary fencing is recommended to be used in order to clearly outline the boundary of the study area and to ensure that the proposed works will not impact upon rock engraving SIE 26.

7 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: No further archaeological investigation required

No further archaeological investigation or works are required to be undertaken for the study area. The study area has been assessed as having low archaeological potential and no further investigations are required in this area. This recommendation is conditional upon Recommendations 2 to 5.

Recommendation 2: Boundary fencing

Appropriate boundary fencing is recommended to be used in order to clearly outline the boundary of the study area and to ensure that the proposed works will not impact upon rock engraving SIE 26.

Recommendation 3: Recording of SIE 26 on AHIMS

The engraving site, SIE26, is to be recorded on AHIMS. Further investigation and conservation efforts are to be conducted by either the landholder or EES.

Recommendation 4: Discovery of unanticipated Aboriginal objects and discovery of Aboriginal ancestral remains

All Aboriginal objects and places are protected under the *National Parks and Wildlife Act 1974* (NPW Act). It is an offence to disturb an Aboriginal site without a consent permit issued by DPIE. Should any Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal site or object the archaeologist will provide further recommendations. These may include notifying EES and Aboriginal stakeholders.

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 you must:

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

Recommendation 5: Continued consultation with the registered Aboriginal parties

As per consultation requirements it is recommended that the proponent provides a soft copy of this report to the Aboriginal stakeholders for comment. 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.

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