Cabramatta Loop:

Aboriginal cultural heritage assessment report

FINAL REPORT

Prepared for ARTC

22 September 2020

NOTE: INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS REPORT

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Biosis staff involved in this project were:

- Anne Murray (GIS)

Contents

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Glossary

ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
ARTC	Australian Rail Track Corporation
AR	Archaeological Report
ASIRF	Aboriginal Site Impact Recording Form
BP	Before present
CBD	Central business district
CEMP	Construction Environment Management Plan
CSSI	Critical State Significant Infrastructure
Consultation requirements	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*
DA	Development Application
DECCW	Department of Environment, Climate Change and Water (now Heritage NSW)
DP	Deposited Plan
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Environmentally Sustainable Development
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
NNTT	National Native Title Tribunal
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
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSFL	Southern Sydney Freight Line
Project site	The project site comprises of parts of Lot 4 DP 1186349, Lot 4, 5 DP 1129945, Lot 1 DP 1053994, Lot 12 DP 1185796, Lot 11 DP 1185775, Lot 1008 DP 591195, Lot 2 DP 250138, Lot 10 DP 1185718, Lot 2 DP 1129315, Lot 1 DP 865075, Lot 2 DP 1128471, Lot 1 DP 171299 and Lot 1 DP 1164164
the Code	*Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Updates to this report

This report has been updated to include the findings and recommendations of the test excavations completed on 12 May 2020 and to satisfy the requirements of the Conditions of Approval E7 to E8 and Revised Environmental Management Measures D4.2.

Table 1 Conditions of Approval relevant to this report

CoA No.	Requirement	How Addressed	Reference
E7	Before the commencement of work within areas of moderate to high archaeological potential as identified in the documents in Condition A1, the Proponent shall: (a) Undertake archaeological investigation of this site using a methodology prepared in consultation with the Aboriginal stakeholders; and	Biosis has undertaken an archaeological investigation which included Aboriginal consultation and archaeological test excavations of the areas of moderate archaeological potential in Jacquie Osmond Reserve which is within the project impact area. This investigation was undertaken using the methodology prepared in consultation with Aboriginal stakeholders.	See Archaeological Report (AR) section 6 See Aboriginal Cultural Heritage Assessment (ACHA) section 4.3.
	(b) Report on the results of the archaeological investigation, including recommendations (such as for further archaeological work), and must include, but not necessarily be limited to:	The AR and ACHA report on the results of archaeological investigations and include recommendations for the management and mitigation of heritage impacts.	See AR section 6 and 10. See ACHA section 7.
	(i) consideration of measures to avoid or minimise disturbance to Aboriginal objects where objects of moderate to high significance are found to be present;	No objects of high or moderate significance were identified. Mitigation measures for unexpected finds have been provided in the recommendations.	See AR section 10. See ACHA section 7.
	(ii) where impacts cannot be avoided, recommendations for any further investigations or salvage under Condition E8 below; and	No further investigations are recommended.	See AR section 10. See ACHA section 7.
	(iii) management and mitigation measures to minimise additional impacts due to pre-construction and construction activities.	Management and mitigation measures to minimise additional impacts due to pre-construction and construction activities have	See AR section 10. See ACHA section 7.

CoA No.	Requirement	How Addressed	Reference
		been included in the recommendations.	
E8	Before the commencement of work where Aboriginal objects of moderate to high significance are found to be present and cannot be avoided (refer to Condition E7 (ii) above), the Proponent must: develop a detailed salvage strategy, prepared in consultation with the Aboriginal stakeholders; and undertake any further archaeological excavation works recommended by the results of the Aboriginal archaeological salvage strategy. Within twelve (12) months of completing the above work, unless otherwise agreed by the Planning Secretary, the Proponent must submit a report containing the findings of the excavations, including artefact analysis and Aboriginal Site Impacts Recording Forms (ASIR), and the identification of final storage location for all Aboriginal objects recovered (testing and salvage), prepared in consultation with the Aboriginal stakeholders and Heritage NSW (previously OEH). A copy of this report shall be provided to the relevant Local Aboriginal Land Council and council.	Condition not triggered as no objects of moderate to high significance were found.	This Report

Table 2 Revised environmental management measures relevant to this report

REMM No.	Requirement	How Addressed	Reference
D4.2	Further assessment will be carried out in Jacquie Osmond Reserve in the form of subsurface investigations (test excavations) prior to construction commencing (refer to methodology provided in Appendix 3 of Technical Report 9- Aboriginal and Cultural Heritage impact assessment). Should any Aboriginal objects be encountered during investigation a long-term care agreement setting out the obligations and methods of long term safekeeping will be developed in consultation with the RAPs.	Biosis has undertaken an archaeological investigation which included Aboriginal consultation and archaeological test excavations of the areas of moderate archaeological potential in Jacquie Osmond Reserve within the project impact area. A long term care agreement with the Gandangara Local Aboriginal Land Council is	See AR section 6 and 10. See ACHA section 4 and 7.

REMM No.	Requirement	How Addressed	Reference
		proposed in the recommendations.	

Summary

Biosis Pty Ltd (Biosis) was commissioned by GHD on behalf of Australian Rail Track Corporation (ARTC) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) of an area of land proposed for the Cabramatta Loop project (the project site). The project site is split into a number of sections located on the rail line through Liverpool, Warwick Farm, Cabramatta and approximately 26 kilometres south west of Sydney central business district (CBD).

The project site, defined by the area of impact of the proposed works, comprises parts of Lot 4 DP 1186349, Lot 4, 5 DP 1129945, Lot 1 DP 1053994, Lot 12 DP 1185796, Lot 11 DP 1185775, Lot 1008 DP 591195, Lot 2 DP 250138, Lot 10 DP 1185718, Lot 2 DP 1129315, Lot 1 DP 865075, Lot 2 DP 1128471, Lot 1 DP 171299 and Lot 1 DP 1164164. This assessment approach has been undertaken to allow for assessment of both the project site as well as any additional areas in the broader study area which are likely to be affected by the project, either directly or indirectly. The proposed works involve:

- Bi-directional signalling with simultaneous entry to the new loop integrated to the existing signalling system of the South Sydney Freight Line (SSFL).
- Construction of 1.65 kilometres of new track and slewing of 550 metres of existing SSFL track.
- Installation of two new rail bridges over Sussex Street and Cabramatta Creek.
- Construction of a retaining wall and noise wall on Broomfield Street.
- Construction of a retaining wall in Jacquie Osmond Reserve and between the two Cabramatta Creek bridges.
- Re-configuration of Broomfield Street road alignment, car parking, pedestrian and cycle routes.
- Relocation and protection of identified third party services.
- Construction compounds (proposed compounds are included in the project site but final selection of compound locations to be decided by the construction contractor).

The project will be assessed as a Critical State Significant Infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP) (SSI 9186). The project will be assessed by the Department of Planning, Industry and Environment and determined by the Minister of Planning and Public Spaces. The Secretary's Environmental Assessment Requirements (SEARs) were issued for this development on 17 May 2018.

The purpose of this report is to assess the potential Aboriginal heritage impacts from the operation and construction of the project; this assessment is supported by an Archaeological Report (AR). This ACHA addresses the relevant SEARs for the Environmental Impact Statement (EIS), and the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *National Parks and Wildlife Act 1974* (NPW Act) and the EP&A Act. This report meets the requirements of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Heritage NSW 2011), *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010a) (consultation requirements), and *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b) (the Code).

Consultation

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 consultation requirements. The appropriate government bodies were notified, and advertisements placed in the *Liverpool City Champion* and *Fairfield City Champion* newspapers (21 November and 28 November 2018), which resulted in the following Aboriginal organisations registering their interest:

Table 3 List of registered Aboriginal parties (RAPs)

No.	Organisation	Contact person
1	A1 Indigenous Services	Carolyn Hickey
2	AAS	Andrew Williams
3	Amanda Hickey Cultural Services	Amanda Hickey
4	B.W Consultants	Ralph Hampton
5	Barking Owl	Jody Kulakowski
6	Barraby Cultural Services	Lee Field
7	Corroboree Aboriginal Corporation	Marilyn Carroll-Johnson
8	Darug Aboriginal Land Care	Des Dyer
9	Darug Boorooberongal Elders Aboriginal Corporation	Uncle Gordon Workman
10	Darug Custodian Aboriginal Corporation	Justine Coplin
11	Darug Land Observations	Anna
12	Goobah Developments	Basil Smith
13	Gulaga	Wendy Smith
14	Guntawang Aboriginal Resources Incorporated	Wendy Morgan
15	Kamilaroi Yankunjatjara Working Group	Phil Khan
16	Liverpool Council Aboriginal Consultative Committee	Norma Burrows
17	Merrigarn	Shaun Carroll
18	Muragadi	Jesse
19	Murra Bidgee Mullangari	Ryan Johnson
20	Widescope	Steven Hickey
21	Yulay Cultural Services	Arika Jalomaki
22	Yurrandaali Cultural Services	Bo Field

A search conducted by the Office of the Registrar, *Aboriginal Land Rights Act 1983* (NSW) listed zero Aboriginal Owners with land within the project site. A search conducted by the National Native Title Tribunal (NNTT) listed zero Registered Native Title Claims, Unregistered Claimant Applications or Registered Indigenous Land Use Agreements within the project site.

Upon registration, the Aboriginal parties were invited to provide their knowledge on the project site and on the proposal provided in Cabramatta Loop methodology. During consultation the following information was provided by RAPs in regards to the cultural values of the project site.

- Wendy Morgan, a member of the South Coast People native title claim identified the area as containing cultural values to her group, noting that her People had walked from Wallaga Lake, south to Lake Ayer, out to Euchar and north to Kempsey.
- Justine Coplin of the Darug Custodian Aboriginal Corporation identified that area is significant to the Darug people due to the evidence of continued occupation and complex of significant sites in the area.

A copy of the draft ACHA report was provided to RAPs on 17 April 2019 for review and comment. RAPs were given 28 days to provide comments and eight responses were received as detailed in Section 4.4. Amanda Hickey Cultural Services, Widescope, Corroboree Aboriginal Corporation, Darug Custodian Aboriginal Corporation, Barking Owl Aboriginal Corporation, and Darug Aboriginal Land Care all responded to the draft report in support of the recommendations and information provided.

Another copy of the second draft ACHA report was provided to RAPs on 14 August 2020 for review and comment. RAPs were given 28 days to provide comments and two responses were received as detailed in section 4.6. Kamilaroi Yankunjatjara Working Group and Murra Bidgee Mullangari both responded with support for the recommendations and information provided in this updated draft.

The outcome of the consultation process was that the project site currently has a high level of cultural significance to the Darug and South Coast People. The results of the consultation process are included in this document.

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

Results

Two previously recorded Aboriginal Heritage Information Management System (AHIMS) sites were identified within 50 metres of the project site (Table 4). AHIMS 45-5-3271/CC1 is recorded as an isolated artefact, and PAD within Warwick Farm Recreation Reserve, adjacent to the project site. The site card and the associated report are not available on the AHIMS database. AHIMS 45-5-3428/CC1 was recorded in 2007 by Michael Therin. A copy of this site card was obtained from the AHIMS database, the report associated with this site card however is not available. The information contained within this site card indicates that Aboriginal archaeological test excavations were undertaken by Therin in 2007 within PAD site AHIMS 45-5-3271, and the surrounding area. The excavations identified 27 subsurface Aboriginal artefacts across four test pits within Warwick Farm Recreation Reserve. Therin therefore registered AHIMS 45-5-3428 as an extension of AHIMS 45-5-3271.

A field investigation of the project site was undertaken on 6 December 2018, attended by Taryn Gooley (Heritage Team Leader/Senior Archaeologist, Biosis). The field investigation was restricted to the portions of the project site located outside of the heavily disturbed rail line. The overall effectiveness of the survey for examining the ground for Aboriginal sites was deemed low due to ground surface visibility (GSV) combined with a low amount of exposures; however, disturbances were identified across much of the project site.

No previously unrecorded Aboriginal cultural heritage sites were identified during the field investigation. The area to the west of the rail line within Warwick Farm Recreation Reserve was assessed as having high archaeological potential due to the presence of previously recorded AHIMS sites with demonstrated archaeological deposits, and low levels of previous ground disturbances observed. The area to the east of the existing rail line within Jacquie Osmond Reserve displayed higher levels of disturbance and was assessed with

moderate archaeological potential. The remainder of the project site was assessed as having low archaeological potential due to the high levels of previous ground disturbances identified.

Test excavations were undertaken in the area of moderate potential identified at Jacquie Osmond Reserve from the 5 May to 12 May 2020. A total of 26 test pits were excavated in line with the Code, with seven of these test pits containing Aboriginal artefacts. The site contained eight artefacts in total. The artefact assemblage was dominated by silcrete raw materials with one mudstone artefact also identified. Assemblage characteristics showed no clear trends in manufacture technique or processes, likely due to the limited sample size. Artefact types were made up of three medial flakes, two proximal flakes, and one each of an angular fragment, complete flake and distal flake. Two of these artefacts also displayed retouch, suggesting some secondary modification following flake removal, however no use wear was observed to indicate they were utilised as tools. The artefact assemblage consisted of a low density deposit sporadically placed throughout the area of potential, and artefacts making up the assemblage were of limited scientific value.

The development activities have been largely confined to areas of existing disturbance, or those areas assessed with low potential to contain Aboriginal heritage. AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, or identified areas of high archaeological potential, will not be impacted by the project which will preserve these sites for future generations in line with the principles of Environmentally Sustainable Development (ESD) and intergenerational equality. However, the proposed works will completely impact on AHIMS 45-5-5333/Jacquie Osmond AS1. There is potential that further artefacts will be present in Jacquie Osmond AS1; however the excavations have indicated that artefacts are likely to be of low scientific significance due to the low density and common nature of the assemblage and no further archaeological assessment is recommended.

The management and mitigation measures recommended for the project site are provided in Table 4.

Table 4 Site details

Site name	Site type	Significance	Type of harm before mitigated	Consequence of unmitigated harm	Consequence of mitigated harm	Site specific recommendations
AHIMS 45-5-3271/CC1	Isolated artefact, PAD	Moderate	None	No loss of value	Impact can be avoided	Should be avoided
AHIMS 45-5-3428/CC1	PAD	Moderate	None	No loss of value	Impact can be avoided	Should be avoided
AHIMS 45-5-5333/ Jacquie Osmond AS1	Subsurface artefact scatter	Low	Direct	Total loss of value	Impact cannot be avoided	Development of a long term care and control agreement for artefacts recovered from test excavations

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: Continued consultation with the registered Aboriginal parties throughout construction of the project

The proponent should continue to inform the RAPs of the status of works and about the management of Aboriginal cultural heritage sites within the study area where there is a change, throughout construction of the project. Updates should be provided at least every six months as per the Heritage NSW guidelines. A copy of the final version of this report will be sent to the RAPs, Heritage NSW and the AHIMS register for information.

Recommendation 2: No further archaeological works required in the project site

This assessment has identified a low density subsurface archaeological deposit within Jacquie Osmond Reserve (Jacquie Osmond AS1). This site is considered to have low archaeological significance. It is not expected that salvage of this site would provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region and therefore further subsurface excavation, in the form of salvage, is not required.

Recommendation 3: AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, and identified areas of high archaeological potential to be identified as exclusions zones

AHIMS 45-5-3271/CC1, AHIMS 45-5-3428/CC1, and the areas of identified high archaeological potential are located outside of the project footprint and no works are proposed in these sites. These areas should be identified as exclusion zones in the Construction Environment Management Plan (CEMP) so no unintentional impacts can occur.

Recommendation 4: Development of a long term care and control agreement

It is recommended that a method of long term care is developed for the artefacts recovered from Jacquie Osmond AS1 and in the event that any unexpected finds are identified as part of the works. A long term care agreement setting out the obligations and methods of long term safekeeping should be developed in consultation with the RAPs. It is recommended that artefacts are handed to Gandangarra Local Aboriginal Land Council under a long term care agreement where they can be freely accessed by interested community members and used for educational purposes.

Recommendation 5: Submission of an ASIRF for any site impacted as part of the works

An Aboriginal Site Impact Recording Form (ASIRF) will be submitted to AHIMS following the impacts to Aboriginal site Jacquie Osmond AS1 as part of the proposed works.

Recommendation 6: Discovery of Unanticipated Aboriginal Objects or Aboriginal Ancestral Remains

An Unexpected Heritage Finds and Human Remains Procedure must be prepared to manage unexpected heritage finds and human remains in accordance with guidelines and standards published by the Heritage Council of NSW or Heritage NSW. This Procedure must be included in the CEMP and implemented for the duration of construction.

The Unexpected Heritage Finds and Human Remains Procedure must specify that 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 object, the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders, and implementing archaeological monitoring.

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. The Unexpected Heritage Finds and Human Remains Procedure must specify that if any suspected human remains are discovered during any activity:

1. Works must immediately cease at that location and not further move or disturb the remains.
2. The NSW Police and Heritage NSW's Environmental Line on 131 555 must be notified as soon as practicable and provide details of the remains and their location.
3. Work at that location must not recommence unless authorised in writing by Heritage NSW.

1 Introduction

1.1 Overview

ARTC proposes to construct and operate a passing loop for up to 1,300 metre length trains on the SSFL between Sydney Trains' Cabramatta and Warwick Farm stations. The Cabramatta Loop Project (the project) would allow freight trains to pass and provide additional rail freight capacity along the SSFL. The project is CSSI in accordance with Division 5.2 of the EP&A Act. As State significant infrastructure, the project needs approval from the NSW Minister for Planning.

This report has been prepared to accompany the EIS to support the application for approval of the project, and to address the environmental assessment requirements of the SEARs, issued on 13 June 2018.

An original assessment of the study area was conducted by Biosis in 2019. This report has been updated to include the results of the test excavations undertaken at the site.

1.2 The project

1.2.1 Location

The project is generally located within the existing rail corridor between the Hume Highway and Cabramatta Road East road overbridges in the suburbs of Warwick Farm and Cabramatta. In addition, the project includes works to Broomfield Street adjacent to the rail corridor in Cabramatta. The location of the project is shown in Figure 1.

The rail corridor is owned by the NSW Government (RailCorp) and leased to ARTC.

1.2.2 Key features

The key features of the project are shown in Figure 2 and include:

- New rail track – providing a 1.65 kilometre long section of new track with connections to the existing track at the northern and southern ends.
- Track realignment – moving about 550 metres of existing track sideways (slewing) to make room for the new track.
- Bridge works – constructing two new bridge structures adjacent to the existing rail bridges over Sussex Street and Cabramatta Creek.
- Road works – reconfiguring Broomfield Street for a distance of about 680 metres between Sussex and Bridge streets.
- Ancillary work would include communication and signalling upgrades, works to existing retaining and noise walls, drainage work and protecting/relocating utilities.

1.2.3 Timing

Subject to approval of the project, construction is planned to start in early 2021, and is expected to take about two years. Construction is expected to be completed in early 2023.

It is anticipated that some features of the project would be constructed while the existing rail line continues to operate. Other features of the project would need to be constructed during programmed weekend rail

possession periods when rail services along the line cease to operate. Possession periods typically occur for 48 hours four times per year.

1.2.4 Operation

The project would operate as part of the SSFL and would continue to be managed by ARTC. Train services are currently, and would continue to be, provided by a variety of operators.

Following the completion of works, the existing functionality of Broomfield Street would be restored, with one travel lane in each direction, kerb-side parking on both sides and a shared path on the western side of the street.

1.3 Purpose and scope of this report

The purpose of this report is to assess the potential Aboriginal heritage impacts from the operation and construction of the project. This ACHA addresses the relevant SEARs for the EIS, as outlined in Table 5, and the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), NPW Act and the EP&A Act. This report meets the requirements of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Heritage NSW 2011), consultation requirements, and the Code. The report:

- Describes the existing environment with respect to the history of the project site.
- Assesses the impacts of constructing and operating the project on Aboriginal cultural values.
- Recommends measures to mitigate the impacts identified.

1.4 Structure of the report

The structure of the report is outlined below.

- Section 1 – provides an introduction to the report and provides a project description.
- Section 2 – outlines the existing environment as relevant to the assessment.
- Section 3 – outlines the results of the archaeological assessment.
- Section 4 – outlines the Aboriginal community consultation process.
- Section 5 – outlines the archaeological values and significance of the project site.
- Section 6 – outlines the results of the impact assessment.
- Section 7 – provides recommendations for the project.

1.5 Project methodology

Biosis undertook a desktop assessment including review of AHIMS data, and existing archaeological studies and reports relevant to the project site. This information was then used to develop Aboriginal site prediction statements for the project site, and to identify known Aboriginal sites and/or places recorded in the project site. The desktop assessment was prepared in accordance with requirements 1 to 4 of the Code.

Biosis undertook an Aboriginal archaeological field investigation conducted in accordance with requirements 5 to 10 of the Code. This archaeological investigation was attended by one archaeologist who focused on the assessment of disturbance and whether there is the potential for Aboriginal archaeological remains to be present beneath the ground surface.

Test excavations within an area of moderate archaeological potential were undertaken in accordance with the Code and the project methodology. Full details of the archaeological investigation and methodology are presented in the archaeological report in .

This assessment was undertaken in accordance with the following legislative framework and guidelines (Table 5):

Table 5 Legislative framework and associated guidelines

Legislation and guidelines relevant to the project	Description
***Environment Protection and Biodiversity Act 1999* (EPBC Act)**	The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the EPBC Act as matters of national environmental significance.
***Environmental Planning and Assessment Act 1979* (EP&A Act)**	The EP&A Act establishes the framework for cultural heritage values to be formally assessed in the land use planning, development consent and environmental impact assessment processes. The EP&A Act requires that environmental impacts are considered prior to land development and the level of significance of the impact assessed; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The EP&A Act also requires that local governments prepare planning instruments (such as Local Environmental Plans (LEP) and Development Control Plans (DCP)) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required. It also establishes the framework for Aboriginal heritage values to be formally assessed in the land-use planning and development consent processes.
***National Parks and Wildlife Act 1974* (NPW Act)**	Currently Aboriginal cultural heritage, as statutorily defined by the NPW Act, consists of objects and places which are protected under Part 6 of the Act. Aboriginal objects are defined as: "any deposit, object or material evidence...relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains" Aboriginal places are defined as a place that is or was of special Aboriginal cultural significance. Places are declared under section 84 of the NPW Act.
State Environmental Planning Policy 2011 (SEPP)	The aims the SEPP are as follows: (a) to identify development that is State significant development, (b) to identify development that is State significant infrastructure and critical State significant infrastructure, (c) to identify development that is regionally significant development.
Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (Heritage NSW 2011)	This document provides a framework on assessing and reporting on Aboriginal cultural heritage in NSW. This report has been prepared in accordance with this document as required by the project SEARS.
Aboriginal Cultural Heritage Consultation requirements for proponents (DECCW 2010)	This document provides a framework for the Aboriginal community consultation process in accordance with 90N of the NPW Act. This assessment has been prepared in accordance with this document as required by the project SEARS.

Legislation and guidelines relevant to the project	Description
Code of practice for archaeological investigation of Aboriginal objects in NSW (DECCW 2010)	The Code establishes the requirements that must be followed when carrying out archaeological investigation in NSW. This assessment has been prepared in accordance with the code as required by the project SEARS.
***NSW Native Title Act 1994* (NNT Act)**	The NNT Act was introduced to ensure consistency between NSW and Commonwealth legislation. It validates past and intermediate acts that may have been invalidated because of the existence of native title. The NNTT has a number of functions under the NTA, including maintaining the Register of Native Title Claims, the National Native Title Register and the Register of Indigenous Land Use Agreements and mediating native title claims.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (ATSIHP Act)	The ATSIHP Act can protect areas and objects that are of particular significance to Aboriginal people. The ATSIHP Act allows the Environment Minister, on the application of an Aboriginal person or group of persons, to make a declaration to protect an area, object or class of objects from a threat of injury or desecration.

This assessment was undertaken to address requirements of the SEARS addressing heritage issues (Table 6):

Table 6 SEARS for heritage

Key issue and desired outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report	Current guidelines
3 (2) Assessment of Key issues **For each key issue the Proponent must:**	(a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue	• Section 2 and 3	
	(b) describe the legislative and policy context, as far as it is relevant to the issue	• Section 1.5	
	(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts	• Section 6	
	(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	• Section 6.3 and 7	
	(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant)	• Section 6.3 and 7	
10. Heritage **The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and**	1. The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of: (a) Aboriginal places and objects, as defined under the National Parks and Wildlife Act 1974 and in accordance with the principles and methods of assessment identified in the current guidelines;	• Section 6 in AR	• Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (Heritage NSW, 2011) • Aboriginal Cultural Heritage Consultation requirements for proponents (DECCW, 2010)

Key issue and desired outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report	Current guidelines
management of the heritage significance of items of environmental heritage. **The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage.**	(b) Aboriginal places of heritage significance, as defined in the Standard Instrument – Principal Local Environmental Plan; 2. Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the Code. 3. Where impacts to Aboriginal objects and/or place are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.	• Section 6 in AR • Appendix 1 - Aboriginal Cultural Heritage Assessment (ACHA)	• Code of practice for archaeological investigation of Aboriginal objects in NSW (DECCW, 2010) • NSW Skeletal Remains: Guidelines for Management of Human Remains (Heritage Office, 1998)

Table 7 Agency requirements for heritage

Agency	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report
Liverpool City Council	There is potential for Indigenous archaeology, especially along Cabramatta Creek where new pylons will be required for two new bridges.	Section 5 and section 6 of AR
Liverpool City Council	An indigenous Heritage Assessment should be undertaken, focusing mainly on the Cabramatta Creek area and including unexpected finds protocol.	Section 5 and 6 of AR, and Recommendation 6 and 7
Heritage NSW	Identify and describe Aboriginal cultural heritage values that will be affected by the development and document these in an ACHA.	Section 6 of ACHA
Heritage NSW	Consultation with Aboriginal people must be undertaken and documented in accordance with the Consultation Requirements.	Appendix 1 of ACHA
Heritage NSW	Impacts on Aboriginal cultural heritage values are to be assessed and documented in an ACHA, including mitigation measures.	Section 6 of ACHA Section 8 of Archaeological Report
Heritage NSW	The ACHA must outline procedure to be followed if Aboriginal objects are found.	Recommendation 6 and 7

1.6 Restricted and confidential information

Appendix 1 in the AR contains AHIMS information which is confidential and not to be made public. This is clearly marked on the title page for the Attachment.

1.7 Aboriginal cultural heritage

According to Allen and O'Connell (2003), Aboriginal people have inhabited the Australian continent for the last 50,000 years. Dates of the earliest occupation of the continent by Aboriginal people are subject to continued revision as more research is undertaken. The timing for the human occupation of the Sydney Basin is still uncertain. While there is some possible evidence for occupation of the region around 40,000 years ago, the earliest known radiocarbon date for the Aboriginal occupation of the Sydney Basin is associated with an archaeological deposit at Parramatta, which was dated to 30,735 ± 407 BP (Jo McDonald Cultural Heritage Management Pty Ltd 2005a, Jo McDonald Cultural Heritage Management Pty Ltd 2005b). Archaeological evidence of Aboriginal occupation of the Cumberland Plains indicates that the area was intensively occupied from approximately 4000 years BP (Dallas 1982).

Without being part of the Aboriginal culture and the productions of this culture, it is not possible for non-Aboriginal people to fully understand the meaning of site, objects and places to Aboriginal people – only to move closer towards understanding this meaning with the help of the Aboriginal community. Similarly, definitions of Aboriginal culture and cultural heritage without this involvement constitute outsider interpretations.

With this preface Aboriginal cultural heritage broadly refers to things that relate to Aboriginal culture and hold cultural meaning and significance to Aboriginal people (DECCW 2010a, p.3). There is an understanding in Aboriginal culture that everything is interconnected. In essence Aboriginal cultural heritage can be viewed as potentially encompassing any part of the physical and/or mental landscape, that is, 'Country' (DECCW 2010a, p.iii).

Aboriginal people's interpretation of cultural value is based on their 'traditions, observance, lore, customs, beliefs and history' (DECCW 2010a, p.3). The things associated with Aboriginal cultural heritage are continually and actively being defined by Aboriginal people (DECCW 2010a, p.3). These things can be associated with traditional, historical or contemporary Aboriginal culture (DECCW 2010a, p.3).

1.7.1 Tangible Aboriginal cultural heritage

Three categories of tangible Aboriginal cultural heritage may be defined:

- Things that have been observably modified by Aboriginal people.
- Things that may have been modified by Aboriginal people but no discernible traces of that activity remain.
- Things never physically modified by Aboriginal people (but associated with Dreamtime Ancestors who shaped those things).

1.7.2 Intangible Aboriginal cultural heritage

Examples of intangible Aboriginal cultural heritage would include memories of stories and 'ways of doing', which would include language and ceremonies (DECCW 2010a, p.3).

1.7.3 Statutory

Currently Aboriginal cultural heritage, as statutorily defined by the NPW Act, consists of objects and places which are protected under Part 6 of the Act.

Aboriginal objects are defined as:

> *any deposit, object or material evidence…relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.*

Aboriginal places are defined as a place that is or was of special Aboriginal cultural significance. Places are declared under section 84 of the NPW Act.

1.7.4 Values

Aboriginal cultural heritage is valued by Aboriginal people as it is used to define their identity as both individuals and as part of a group (DECCW 2010a, p.iii). More specifically it is used:

- To provide a:
  - *'connection and sense of belonging to Country'* (DECCW 2010a, p.iii)
  - link between the present and the past (DECCW 2010a, p.iii)
- As a learning tool to teach Aboriginal culture to younger Aboriginal generations and the general public (DECCW 2010a, p.3)
- as further evidence of Aboriginal occupation prior to European settlement for people who do not understand the magnitude to which Aboriginal people occupied the continent (DECCW 2010a, p.3).

Figure 1: Location of the project

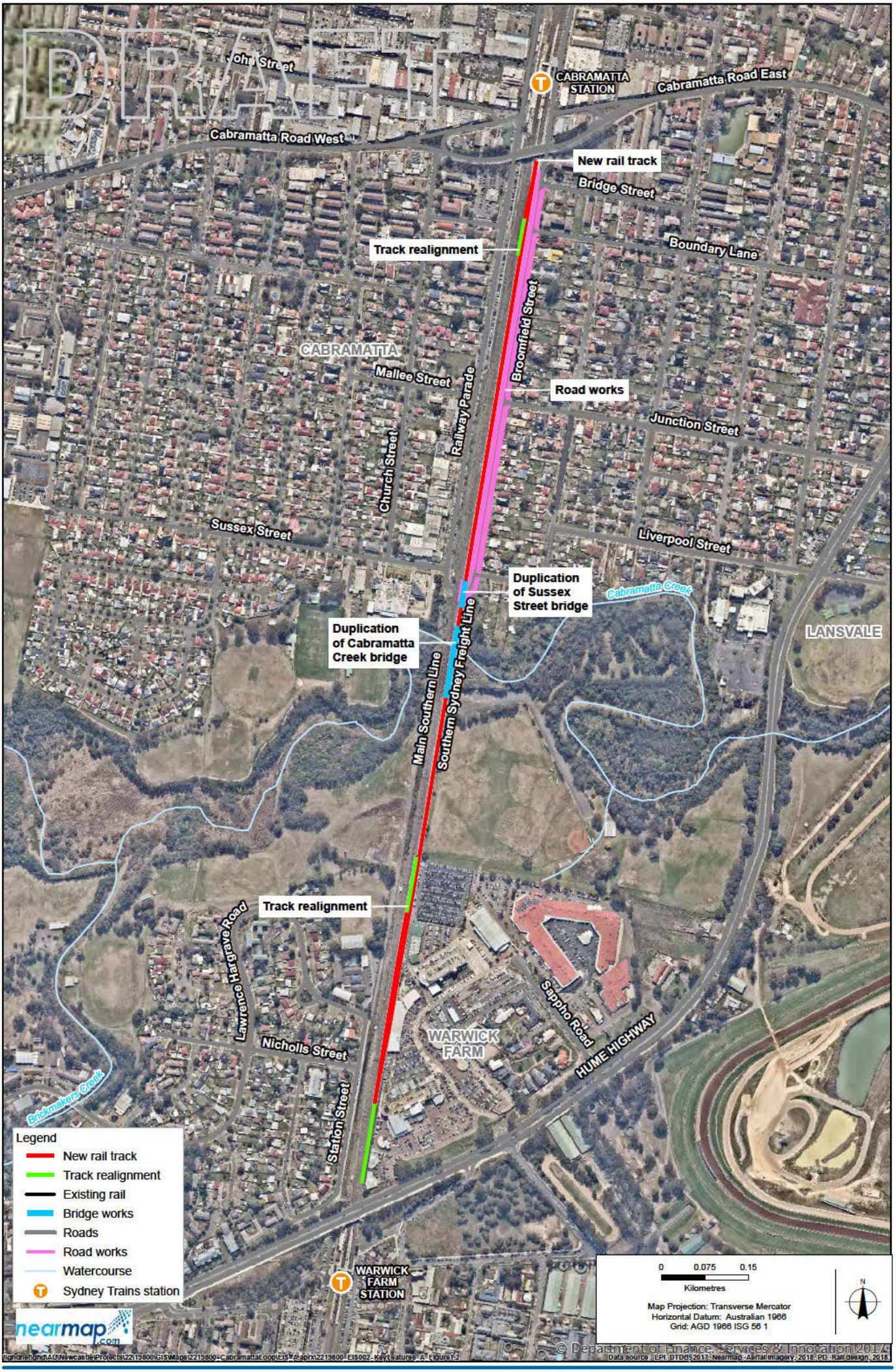


Figure 2 Key Features of the Project

2 Environmental context

This section discusses the project site in regards to its landscape, and environmental context including topography, hydrology, geology, soil landscapes, climate and rainfall, landscape resources and European land use. This section should be read in conjunction with the AR attached in Appendix 6. Some of the information in the AR is repeated in this section as these factors relate to the understanding of the Aboriginal cultural heritage values of the study area. The background research has been undertaken in accordance with the Code.

2.1 Topography and hydrology

The project site consists of gently undulating slopes forming in the north that flow from two crest landforms south towards Cabramatta Creek to form flood plains on either side of the creek line. These flood plains are gently inclined and feature low lying crests which range in elevation from 6 - 10 metres. Areas along Cabramatta creek range from steeply incised to gently inclined flood plains. Artefact, and PAD sites have been previously recorded with the region upon well drained topographies within the vicinity of permanent sources of fresh water, and therefore have the potential to occur upon low lying crests within the lower floodplains.

Stream order is recognised as a factor which helps the development of predictive modelling in Aboriginal archaeology in the Cumberland Plain. Predictive models are models which predict the potential locations of Aboriginal sites. Models which have been developed for the region have a tendency to favour permanent water courses as the locations of complex sites that have been continuously occupied, 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 (Jo McDonald Cultural Heritage Management 2000, p.19).

The stream order system used for this assessment was originally developed by Strahler (1964). It functions by adding two streams of equal order at their confluence to form a higher order stream. As stream order increases, so does the likelihood that the stream would be a perennial source of water.

The project site is traversed by Cabramatta Creek, a 5th order perennial water source, that was likely a tributary of Georges River, a 7th order perennial water source, before Chipping Norton Lake was formed through human intervention. It is likely the floodplain and creek terrace landforms associated with Cabramatta Creek were occupied by Aboriginal people who exploited the abundant resources that would have been easily available.

2.2 Soil landscapes

The project site is situated within the Middle Triassic Wianamatta group of the Cumberland Lowlands upon the Bringelly Shale formation group in the northern portion of the project site. The Bringelly Shale formation consists of shale, claystone, siltstone, carbonaceous claystone, laminite and fine to medium-grained lithic sandstone (Bannerman & Hazelton 1990, pp.2–3). Within the southern portion of the project site, in the areas surrounding Cabramatta Creek, alluvial terrace, flood plain and alluvium deposits overlay the Bringelly shale formation. According to Bannerman and Hazelton (1990, p.3), the composition of alluvium formations varies, in that it depends on the lithology of the source material and its distance from where it has been deposited.

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 project site is located within two soil landscapes; the Blacktown soil landscape, and South Creek soil landscape. The Blacktown soil landscape is a residual landscape and consists of gently undulating rises, broad rounded crests and gently inclined slopes with a gradient of less than 5 per cent. Local relief within the Blacktown soil landscape is up to 30 metres and rocky outcropping is absent. Dominant soils consist of shallow to moderately deep (<100 centimetres) red and brown podzols on crests and in well drained topographies, and deep (150-300 centimetres) yellow podzolic soils and soloths on lower slopes and drainage lines (Bannerman & Hazelton 1990, p.28). Due to their age and slow accumulation, residual soil landscapes have reasonable potential to contain archaeological deposits in an open context, such as stone artefacts derived from occupation sites. Other occupational evidence might include scarred trees where remnant vegetation occurs. However, the slow accumulation and high impact of extensive land clearing (usually associated with pastoral and civic development) often results in poor preservation of archaeological material.

Table 8 Blacktown (*bt*) soil landscape characteristics (Bannerman & Hazelton 1990, pp.29–30)

Soil material	Description
Blacktown 1 (*bt1*) - Friable brownish-black loam	Friable brown loam to clay loam with a moderately pedal sub angular block structure and rough-faced porous fabric ped fabric. This soil material generally occurs as a topsoil (A horizon). Peds are well defined and range from 2-20 millimetres. Rounded iron indurated fine gravel-sized shale fragments and charcoal fragments sometimes occur as inclusions. Soil colour is very dark brown (10YR 2/2),* and can also range from dark reddish brown (5YR 3/2) to dark yellowish brown (10YR 3/4). Soil varies from moderately acidic to neutral.
Blacktown 2 (*bt2*) - Hardsetting brown clay loam	Hard setting brown clay loam to silty clay loam, with an apedal massive to weakly pedal structure and porous earthy fabric. Occurs as an A^2 Horizon soil deposit. Peds range from 20-50 millimetres. Platy, iron indurated gravel sized shale fragments are common, with rare inclusions of charcoal and roots. Soil colour is predominately brown (7.5YR 4/3), but can range from dark reddish brown (2.5YR 3/3) to dark brown (10YR 3/3). Soil acidity varies from moderately acidic to slightly acidic.
Blacktown 3 (bt3) - Strongly pedal, mottled brown light clay	Brown light to medium clay with strong pedal polyhedral or sub angular-blocky structure and smooth faced dense ped fabric that occurs as a subsoil (B horizon). The soil texture increases with depth and peds range from 5-20 millimetres. Fine to coarse gravel sized shale fragments are a common inclusion and often occur within stratified bands, with roots and charcoal rarely being present. Soil colour is a strong brown (7.5YR 4/6), and can range from reddish brown (2.5YR 2/6) to dark yellowish brown (10YR 4/6). The pH of this soil material varies from strongly acidic to slightly acidic.
Blacktown 4 (*bt4*) - Light grey plastic mottled clay	Plastic light grey silty clay to heavy clay with moderately pedal polyhedral to sub angular blocky structure, and smooth-faced dense ped fabric, that occurs as a deep subsoil deposit overlying shale bedrock (B^3 or C Horizon). Peds range between 2-20 millimetres. Inclusion consists of weathered ironstone concretions

* Munsell Soil Colour Chart

Soil material	Description
	and rock fragments. Gravel sized shale fragments and roots occur occasionally, but charcoal is rare within this soil deposit. Red, yellow and brown mottles are present and soil colour is usually light grey (10YR 7/1) or sometimes pale red (2.5YR 6/2). Soil acidity ranges from strongly acidic to moderately acidic.

The South Creek soil Landscape dominates the areas surrounding Cabramatta Creek. It is characterised as a fluvial soil landscape situated on flat to gently sloping alluvial plains of less than 5 per cent and local relief of 10 metres, with intermittent terraces or levees. Soils are generally very deep (135-190 centimetres) layered sediments over bedrock or relief soils, with red and yellow podzoilic soils being predominant upon terraces, with some structured grey clays, leached clay and yellow solodic soils also occurring. In areas adjacent to drainage lines where soil evolution has occurred structured plastic clays and structured loams can also be present. This soil landscape varies in many areas from erosion to deposition and has the potential to disturb soil sequencing and potentially archaeological deposits (Bannerman & Hazelton 1990, pp.68–69). Characteristics of dominant soil materials within the South Creek soil landscape are summarised in Table 9.

Table 9 South Creek (*sc*) soil landscape characteristics (Bannerman & Hazelton 1990, p.69)

Soil Material	Description
South Creek 1 (*sc1*) – Brown apedal single-grained loam	Brown sandy loam to sandy clay loam with a porous and earthy fabric, and a single-grained apedal structure, usually occurring as a topsoil (A horizon). Roots are abundant in surface layers, while small angular or rounded gravels of 2-6 millimetres may occur; other inclusions, such as charcoal, do not occur. Colours range from a reddish brown (5YR 4/3) to brown (10YR 4/3), and are generally moderately acidic but can vary between strongly to slightly acidic.
South Creek 2 (*sc2*) – Dull brown clay loam	A hard setting dull brown clay loam to sandy clay loam, usually featuring an apedal massive structure and porous, earthy fabric, occurring as a topsoil (A horizon). There may be occasional areas of weak structure which contain small (2-5 mm) rough-faced sub angular blocky peds. Roots are rare and stone and other inclusions do not occur. Colour is generally a dull brown (7.5YR 5/4), but can vary from dark reddish grey (5YR 4/2) to yellowish brown (10YR 5/6). Ranges from moderately acidic to neutral acidity.
South Creek 3 (*sc3*) – Bright brown clay	A bright brown light to medium clay with a strong pedal structure and dense smooth-faced angular blocky or polyhedral ped fabric (20-50mm in size), usually presenting as a subsoil (B horizon). Occasionally contains enough levels of sand to be classified as a sandy clay. Usually whole coloured, ranging from reddish brown (3YR 4/8) to gray (10YR 5/1), with highly variable pH levels from extremely acidic to neutral. Yellow or grey mottling can occur, and may occupy up to 15per cent of material volume. Where this madeira presents as a topsoil there may be roots. Small sub rounded or sub angular gravel (2-20mm) can make up to 50per cent of the volume, and no charcoal is present.

2.3 Climate and rainfall

The closest weather station to the project site is located at Bankstown Airport (weather station number 066137) approximately 11 kilometres south east of the project site. In summer the mean average temperature reaches 28.4ºC, with an average low of 16.7ºC, and in winter the mean average temperature reaches 17.8ºC, with a low of 5.1ºC (BOM 2018). During summer the mean average rainfall is 102.1 millimetres, and in winter a mean average rainfall of 43.1 millimetres (BOM 2018). While environmental

conditions are subject to fluctuation over time, this data suggests that the study area experienced warm and wet summers, and cold and dry winters.

2.4 Landscape resources

The project site would have provided an abundance of natural resources able to be utilised in a variety of ways by Aboriginal people. Plant 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, pp.113–114).

The Blacktown soil landscape would have typically supported open-forest and open-woodland that has been extensively cleared since European contact. Originally the Blacktown soil landscape would have featured woodland and open-forest of Forest Red Gum *Eucalyptus tereticornic,* narrow-leaved Ironbark *Eucalyptus crebra,* Grey Box *Eucalyptus molucanna,* and Spotted Gum *Corymbia maculata* (Bannerman & Hazelton 1990, p.29).

Vegetation within the South Creek soil landscape reflects the soil landscapes frequent inundation, which supports common tree species such as the broad-leaved apple *Angophora subvelutina,* Cabbage Gum *Eucalyptus amplifolia,* and Swamp Oak *Casuraina glauca*. Tall spike rushes (such as *Eleocharis sphacelata, Juncus usilatus* and *Polygonum*), have the potential to occur where channels are silted. Upon elevated streambanks tall shrubland consisting of paperbarks *Melaleuca,* and tea trees *Leptospernum* may also occur. However, the South Creek soil landscape has been extensively cleared and as a direct result is now dominated by noxious weeds, such as Blackberry *Rubus vugalris* (Bannerman & Hazelton 1990, pp.68–69).

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. Brush-tailed Possums were highly prized for their fur and could be fashioned into a cloak (Attenbrow 2002, p.117). Native Fauna that could have been present in the area include, but are not limited to: Australian Brush Tail Possum Trichosurus vulpecula, Short-beaked Echidna Tachyglossus aculeatus, Swamp Wallaby Wallabia bicolor, Rainbow Lorikeet Trichoglossus moluccanus, Kookaburra Dacelo novaeguineae, Australian Magpie Cracticus tibicen, Water Dragon Intellagama lesueurii, Eastern Blue-Tongue Tiliqua scincoides.

2.5 European land use history

The study area contains portions of the railway corridor in the late 1880s, and as such the area surrounding area has been heavily disturbed. Development in the Liverpool area centred on the construction of the railway line, which began construction in the early 1850s. In 1857, the single-track railway line from Granville to Liverpool, which formed part of the Main South railway line to Goulburn, was completed, with the Liverpool station opening in 1856.

From as early as 1893, it can be seen that the southern portion of the project site intersects Cabramatta Creek, crossing over the creek, via the bridge and through land grants purchased by Mitch Dwyer and Arthur Devlin. Two smaller areas further south of the southern alignment are located below the Hume highway, directly adjacent to the main southern railway. The areas to the west and east of the rail line within Warwick Farm Recreation Reserve and Jacquie Osmond Reserve were primarily used for agricultural purposes. A plan of the railway line shows that both areas are located within the Liverpool town subdivision, however does not record any structures immediately adjacent to or within the alignments (Photo 1).

Over time, traffic along the rail network increased resulting in upgrades to the system, which included duplication of rail lines. The initial plans to replace existing bridges using imported iron bridges on the Main South line were cancelled due to the period of economic depression in the 1890s. As a result, the existing bridges were replaced with brick arch bridges in 1891, using locally made bricks; these bridges were the first instances of the major use of brick arch bridges by the Railways network. With 17 spans, the Cabramatta Creek viaduct was the longest of these brick arch bridges. Around 2012, an additional bridge was constructed adjacent to the brick arch bridge to support a new track and associated infrastructure built for the South Sydney Freight Line.

Photo 1 **Plan of the Main South Railway Line, focusing on the project site (Source: NSW Land Regsitry Services, Crown plan 1954.3000)**

3 Aboriginal cultural heritage context

This section discusses the project site in regards to its Aboriginal cultural heritage context. This section should be read in conjunction with the AR attached in Appendix 6. The background research has been undertaken in accordance with the Code.

3.1 Ethnohistory

The project site is in the vicinity of three language groups, Dharawal, Gundungurra and the hinterland Darug. Attenbrow (2002, p.34) suggests:

- The Gundungurra covered "the southern rim of the Cumberland Plain west of the Georges River, as well as the southern Blue Mountains".
- The Dharawal covered "the south side of Botany Bay, extending as far as the Shoalhaven River; from the coast to the Georges River and Appin, possibly as far west as Camden".
- The hinterland Darug covered the area "from Appin in the south to the Hawkesbury River in the north; west of the Georges River, Parramatta, the Lane Cove River and Berowra Creek".

These areas are considered to be indicative only and would have changed through time. These language groups were then divided into smaller clans, groups of 60 people or less. The clan groups around Liverpool were named the Cabrogal after the cohbra grubs which they harvested from the banks of the Georges River (Liverpool City Council 2008, p.10).

After the arrival of European settlers the movement of Aboriginal people became increasingly restricted. European expansion along the Cumberland Plain was swift and soon there had been considerable loss of land to agriculture. This led to violence and conflict between Europeans and Aboriginal people as both groups sought to compete for the same resources (Brookes & Associates et al. 2003, p.16). At the same time diseases such as small pox were having a devastating effect on the Aboriginal population. Death, starvation and disease were some of the disrupting factors that led to a reorganisation of the social practices of Aboriginal communities after European contact. The formation of new social groups and alliances were made as Aboriginal people sought to retain some semblance of their previous lifestyle.

Information provided during consultation by Justine Coplin of Darug Custodian Aboriginal Corporation indicates that the Cabramatta area as part of the Cumberland Plain is highly significant to the Darug people as it shows evidence of continued occupation by the Darug people, through the presence of numerous archaeological sites located within the region and in the immediate vicinity of the study area. Justine provided the following statement regarding the Darug people:

> *"Darug people had a complex lifestyle that was based on respect and belonging to the land, all aspects of life and survival did not impact on the land but helped to care for and conserve land and the sustenance that the land provided. As Darug people moved through the land there were no impacts left, although there was evidence of movement and lifestyle, the people moved through areas with knowledge of their areas and followed signs that were left in the landscape. Darug people knew which areas were not to be entered and respected the areas that were sacred. Knowledge of culture, lifestyle and lore have been part of Darug people's lives for thousands of years, this was passed down to the next generations and this started with birth and continued for a lifetime. Darug people spent a lifetime learning and as people grew older they passed through stages of knowledge, elders*

became elders with the learning of stages of knowledge not by their age, being an elder is part of the kinship system this was a very complicated system based on respect. Darug sites are all connected, our country has a complex of sites that hold our heritage and past history, evidence of the Darug lifestyle and occupation are all across our country, due to the rapid development of Sydney many of our sites have been destroyed, our sites are thousands of years old and within the short period of time that Australia has been developed pre contact our sites have disappeared."

3.2 Aboriginal heritage located in the project site

The archaeological assessment of the project site identified the following Aboriginal sites within 50 metres of the project site:

- 45-5-3271/ CC1.
- 45-5-3428/ CC1.
- AHIMS 45-5-5333/ Jacquie Osmond AS1.

The archaeological report attached in Appendix 6 provides details for Aboriginal sites identified during the archaeological assessment and shown on Figure 3. A brief description of each site is provided below.

AHIMS 45-5-3271/CC1

AHIMS 45-5-3271/CC1 was recorded by Australian Museum Consulting (AMBS) in 2004. The site is recorded as an isolated artefact, and a PAD. The site card was not able to be obtained from AHIMS. The site is located within Warwick Farm Recreation Reserve adjacent to Cabramatta Creek, with Photo 2 showing a portion of the previously recorded PAD, facing north-west.

AHIMS 45-5-3428/CC1

AHIMS 45-5-3428/CC1 was recorded in 2007 by Michael Therin. A copy of this site card was obtained from the AHIMS database, however the archaeological report was not available. The information contained within this site card indicates that Aboriginal archaeological test excavations were undertaken by Therin in 2007 within PAD site AHIMS 45-5-3271, and the surrounding area. Excavations at the site identified 27 subsurface Aboriginal artefacts across four test pits. Therin therefore registered AHIMS 45-5-3428 as an extension of AHIMS 45-5-3271. Photo 3 shows the location of the AHIMS site and extent of the PAD, facing east.

AHIMS 45-5-5333/ Jacquie Osmond AS1

AHIMS 45-5-5333/Jacquie Osmond AS1 consisted of eight artefacts identified across an alluvial flat landform within 250 metres of Cabramatta Creek (Photo 4). The artefacts were identified from seven of 26 excavated test pits, suggesting an average site density of 1.23 artefact per square metre excavated. It appeared that the artefacts were relatively in-situ, however, glass and modern materials were identified during the test excavations suggesting some disturbance. The artefact assemblage was primarily made up of silcrete, with one mudstone artefact identified at 900 millimetres. Two of these artefacts displayed evidence of retouch, however no diagnostic tool types were identified.

Photo 2 AHIMS 45-5-3271/CC1 facing north west

Photo 3 AHIMS 45-5-3428/CC1 facing east

Photo 4 South facing view of AHIMS 45-5-5333/Jacquie Osmond AS1

3.2.1 Field investigation results

A field investigation was undertaken on 6 December 2018 by Taryn Gooley (Heritage Team Leader/Senior Archaeologist, Biosis). Due to the high levels of previous ground disturbance and the level of urban development within the remainder of the project site, the field investigation focused on Warwick Farm Recreation Reserve and Jacquie Osmond Reserve. Background research identified these areas as most likely to contain potential Aboriginal sites. One random meander transect targeting areas of exposure within Warwick Farm Recreation Reserve and Jacquie Osmond Reserve was undertaken. AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 were inspected during the field investigation (Photo 2 and Photo 3).

Generally the survey was hampered by poor GSV and exposures due to grass cover and disturbances. Overall GSV and exposure across the project site was approximately 10 per cent, with isolated areas of high visibility present in areas of exposure.

No Aboriginal objects or scarred trees were identified during the survey. The previously recorded AHIMS sites identified in the background research could not be relocated during the survey due to low surface visibility across the project site. The area to the west of the rail line within Warwick Farm Recreation Reserve falls within an alluvial flats landform pattern. This area was assessed as having high archaeological potential due to the presence of previously recorded AHIMS sites with demonstrated archaeological deposits, and low levels of previous ground disturbances observed. It is likely that further subsurface archaeological deposits exist within the undisturbed areas of Warwick Farm Recreation Reserve.

The area to the east of the existing rail line within Jacquie Osmond Reserve also falls within an alluvial flats landform pattern. This area displayed higher levels of disturbance and was assessed as having moderate archaeological potential (Figure 4). The Jacquie Osmond Reserve displayed evidence of superficial ground disturbance associated with the establishment of baseball playing fields that may have caused some disturbance to topsoils. The field investigation and the background research conducted for the project site

does not suggest that activities such as bulk earth works have occurred in this area and previous archaeological investigations in the area demonstrate that alluvial flats within close proximity to higher order waterways have high potential to contain subsurface archaeological deposits. It is therefore likely that Aboriginal objects exist within this area, however, they may be in a disturbed context.

Disturbances identified within the project site included a previously cleared laydown area, a modified drainage line, access tracks adjacent to the rail line, the rail line and bridge crossing, and a large asphalted area on the eastern side of the rail line. The creek line immediately around the bridge crossing is highly disturbed from bridge and rail construction. These areas of disturbance have been assessed as having low archaeological potential (Figure 4).

Test excavations were undertaken in the area of moderate potential identified at Jacquie Osmond Park from the 5 May to the 12 May 2020. A total of 26 test pits were excavated in line with the Code, with seven of these test pits containing Aboriginal artefacts. The site (AHIMS 45-5-5333/Jacquie Osmond AS1) contained eight artefacts in total. The artefact assemblage was dominated by silcrete raw materials with one mudstone artefact also identified. Assemblage characteristics showed no clear trends, likely due to the limited sample size. Artefact types were made up of three medial flakes, two proximal flakes, and one each of an angular fragment, complete flake and distal flake. Two of these artefacts also displayed retouch, suggesting some secondary modification following flake removal, however no use wear was observed to indicate they were utilised as tools.

3.3 Interpretation of past land use

The project site crosses Cabramatta Creek, most likely a previous tributary of the Georges River. Parklands and creek lines have the potential to contain evidence of Aboriginal occupation (Australian Museum Business Services 2008). Predictive modelling conducted for the region indicates that artefact scatters were likely to occur along creek lines within the Cumberland Plains, however it was argued that these sites are likely to have been disturbed or destroyed by recent human and natural activity in the area (Byrne & du Cros 1985). Central West Archaeological & Heritage Services (2002) identified that undisturbed areas within alluvial floodplains were areas of high archaeological sensitivity.

The vast majority of the project site has been subject to high levels of previous ground disturbance due to the construction and ongoing maintenance of the rail line, along with residential development and the construction of roads and various infrastructure services. Aboriginal objects or sites are therefore unlikely to occur within the rail corridor, and other areas of previous disturbance within the project site.

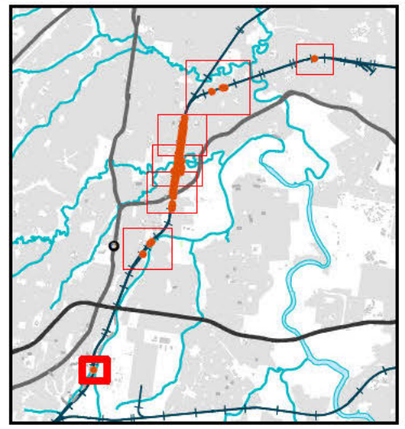
Areas located outside of the rail corridor, within Warwick Farm Recreation Reserve have demonstrated evidence of subsurface archaeological deposits as evidenced by the archaeological excavations conducted by Therin in 2007. Background research conducted for the project site indicates that Warwick Farm Recreation Reserve and Jacquie Osmond reserve have been subject to low and moderate levels of previous disturbance respectively indicating that further subsurface archaeological deposits are likely to be present within these areas (refer to section 4.2 of the AR in Appendix 6 for further detail).

It is likely the flood plains and creek terraces associated with Cabramatta creek were utilised by Aboriginal people as camping and occupation areas. The area would have been favourable for Aboriginal occupation, due to the reliable nature of the water source, along with the associated flora and fauna resources reliable water bring (Artefact Heritage Services 2011).

Test excavations within the area of moderate archaeological potential identified eight artefacts on an alluvial flat landform within 250 metres of Cabramatta Creek. This site is similar to the site features of AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, both of which contained low densities of artefacts on the alluvial flats within 250 metres of Cabramatta Creek, suggesting the occupation of the site was similar to what has been

found previously across the local area. The low density of artefacts and lack of a complete reduction sequence, including cores and retouch debitage suggests the study area was not being used to create artefacts and was therefore not likely to have been an area of long term or intensive occupation. It is most likely that the area was used for resource exploitation and represents sporadic or low intensity occupation which has resulted in the opportunistic discard of artefacts.

Figure 3 AHIMS Search Results & Figure 5 Test Excavation Results
THESE FIGURES HAVE BEEN REMOVED AS THEY CONTAIN RESTRICTED OR SENSITIVE INFORMATION



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.1 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,000 @ A3

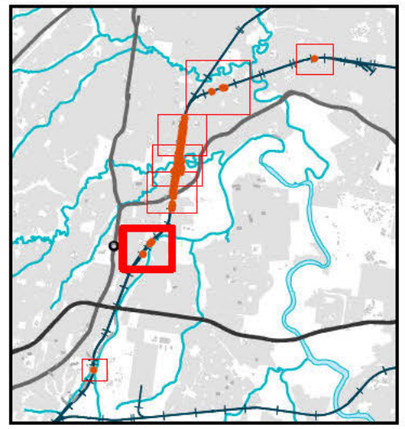
Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

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

Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.2 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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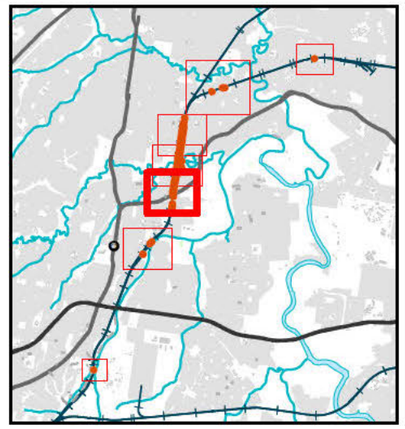
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation

Acknowledgements: Basemap © Land and Property Information 2016



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.3 Field investigation results

0 30 60 90 120 150

Metres

Scale: 1:4,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Date: 28 March 2019,
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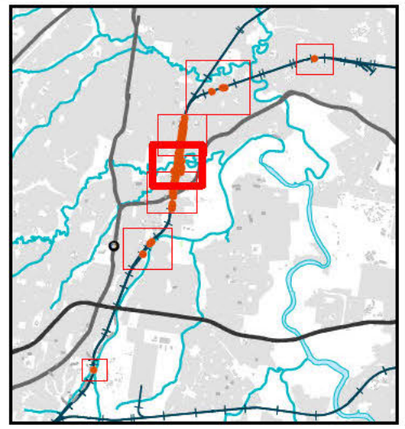
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.4 Field investigation results

0 25 50 75 100 125

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
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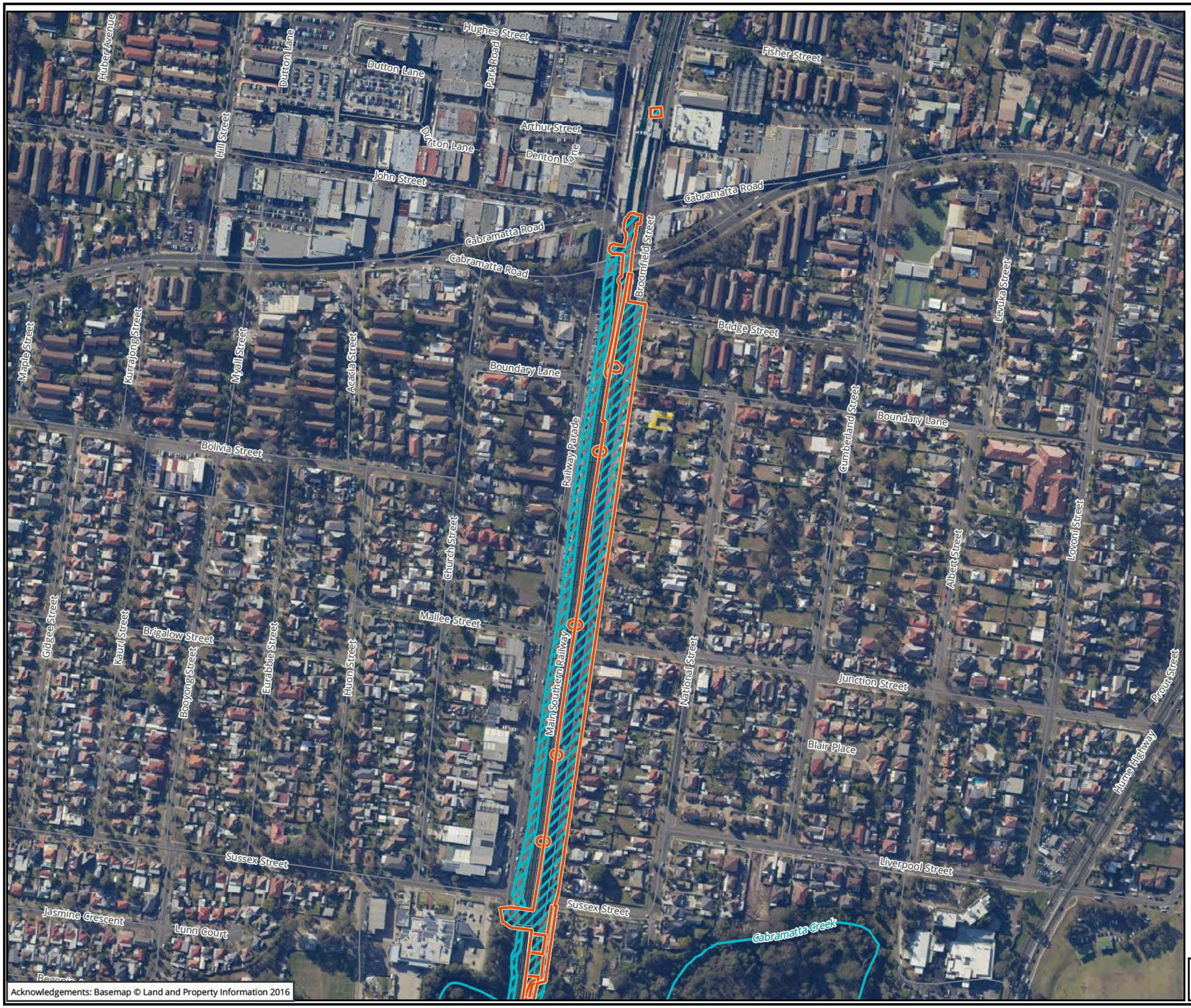

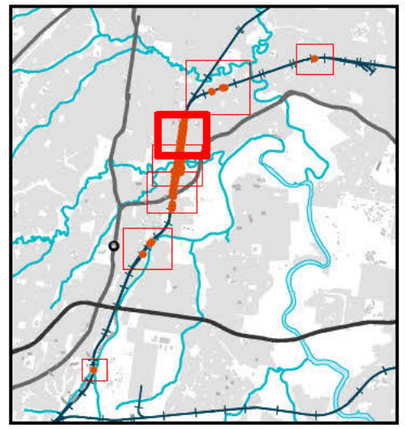

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.5 Field investigation results

0 30 60 90 120 150

Metres

Scale: 1:4,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Albury, Ballarat, Melbourne,
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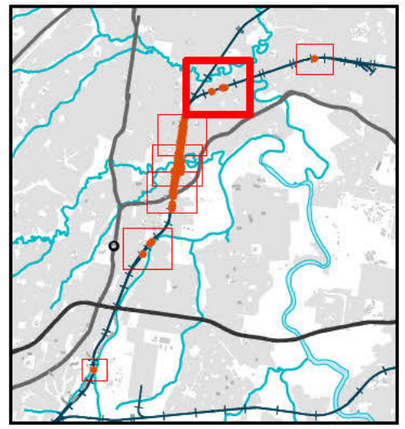
Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.6 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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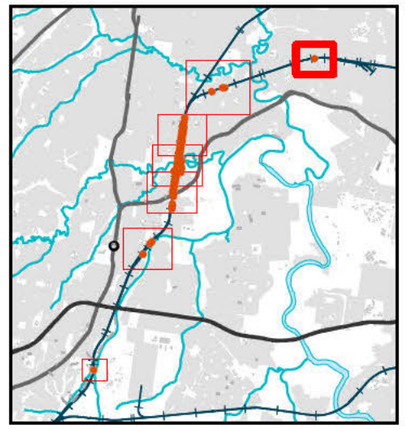
Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 4.7 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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

Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
Location:P:\27800s\27833\Mapping
27833_AR_F7_FieldInvestigation

4 Aboriginal community consultation

Consultation with the Aboriginal community has been undertaken in accordance with the Consultation Requirements as detailed below (DECCW 2010a). A consultation log of all communications with RAPs is provided in Appendix 1.

4.1 Stage 1: Notification of project proposal and registration of interest

4.1.1 Identification of relevant Aboriginal stakeholders

In accordance with the consultation guidelines, Biosis notified the following bodies in writing (via email) on 7 November 2018 and 10 December 2018, regarding the proposal and subsequent invitation to provide a list of known Aboriginal stakeholders to Biosis:

- Fairfield City Council (07/11/2018).
- Gandangara Local Aboriginal Land Council (GLALC) (07/11/2018).
- Greater Sydney Local Land Services (07/11/2018).
- Liverpool City Council (10/11/2018).
- NNTT (07/11/2018).
- NSW Native Title Services Corporation Limited (NTSCORP Limited) (07/11/2018).
- Heritage NSW (07/11/2018, and 09/11/2018).
- Office of the Registrar, Aboriginal Land Rights Act 1983 of Aboriginal Owners (07/11/2018).

A copy of this correspondence is provided in Appendix 1 and Appendix 2. A list of known Aboriginal stakeholders in the Fairfield and Liverpool areas was provided by Heritage NSW, Office of the Registrar, Liverpool Council, and NNTT. A copy of these responses are provided in Appendix 2. The Gandangara LALC, NTSCORP Limited and Greater Sydney Local Land Services did not provide a response.

A search conducted by the Office of the Registrar, *Aboriginal Land Rights Act 1983* (NSW), as part of the response above, listed no Aboriginal Owners with land within the project site. A search conducted by the NNTT, as part of the response above, listed zero Registered Native Title Claims, Unregistered Claimant Applications or Registered Indigenous Land Use Agreements within the project site.

4.1.2 Public notice

In accordance with the consultation guidelines, a public notification was placed in the following newspapers:

- Liverpool City Champion (21 November 2018).
- Fairfield City Champion (28 November 2018).

The advertisement invited Aboriginal people who hold cultural knowledge to register their interest in a process of community consultation to provide assistance in determining the significance of Aboriginal object(s) and/or places in the vicinity of the project site. A copy of the public notice is provided in Appendix 2. Details of the Aboriginal stakeholders who registered an interest in the project are provided in section 4.1.3 below, and Appendix 3.

4.1.3 Registration of Aboriginal parties

Aboriginal stakeholders identified in section 4.1.1 were sent a letter inviting them to register their interest in a process of community consultation to provide assistance in determining the significance of Aboriginal object(s) and/or places in the vicinity of the project site. In response to the letters and public notice, a total of 22 groups registered their interest in the project. Responses to registration from Aboriginal stakeholders are provided in Appendix 3. A full list of Aboriginal stakeholders who registered for consultation is provided below. The Aboriginal stakeholders who registered an interest in the project are classified as RAPs for the project:

- A1 Indigenous Services
- AAS
- Amanda Hickey Cultural Services
- B.W Consultants
- Barking Owl
- Barraby Cultural Services
- Corroboree Aboriginal Corporation
- Darug Aboriginal Land Care
- Darug Boorooberongal Elders Aboriginal Corporation
- Darug Custodian Aboriginal Corporation
- Darug Land Observations
- Goobah Developments
- Gulaga
- Guntawang Aboriginal Resources Incorporated
- Kamilaroi Yankunjatjara Working Group
- Liverpool Council Aboriginal Consultative Committee
- Merrigarn
- Muragadi
- Murra Bidgee Mullangari
- Widescope
- Yulay Cultural Services
- Yurrandaali Cultural Services.

4.2 Stage 2: Presentation of information about the proposed project

On 22 January 2019 Biosis provided RAPs with details about the proposed development works (project information pack). This was provided at the same time as the methodology, which is discussed in Section 4.3. A copy of the project information pack is provided in Appendix 3.

4.3 Stage 3: Gathering information about cultural significance

4.3.1 Archaeological assessment methodology information pack

On 22 January 2019, Biosis provided each RAP with a copy of the project methodology pack outlining the proposed Aboriginal cultural heritage assessment process, and methodology for undertaking this assessment including test excavations. RAPs were given 28 days to review and provide feedback on the proposed methodology. All responses have been collated and used to inform the conclusions drawn in this assessment. A copy of the project methodology pack is provided in Appendix 3.

Eleven responses were received regarding the stage 2 and 3 consultation documents:

- A1, Barraby, Corroboree, Darug Land Care, Murra Bidgee Mullangari, Kamilaroi Yankuntjatjara Working Group, Widescope, Yulay Cultural Services, Yurrandaali Cultural Services all responded that they support the methodology.

- Wendy Morgan from Guntawang Aboriginal Resources Incorporated provided the following information:
  - The area where this loop covers is an area where native medical plants where grown in the past.
  - *"I Wendy Morgan of Guntawang Aboriginal Resources Incorporated agree with the proposed test excavation sampling strategy for the Camden Town Farm Aboriginal Cultural Heritage Assessment and I would like to make the following comments about the proposed methodology and provide the documentation attached regarding the significance of the heritage values of the sturdy area. As a Native Title Claimant of the South Coast People Claim NC2017/003 I would like to ensure that you use the knowledge of our Cultural and Heritage Office as a cultural guide in the initial assessment, the site walk over also for the site digs of this area. (Please note that only Native Title Claimants who can identify to the people listed can claim to be Native title Claimants).* [redacted] *I would like to ensure that the artefacts are keep in a safe place until completion of the project, upon relocation of the artefacts I would also like to ensure that they will not be dug up in the future and disregarded. I would like to see that there is information provided to Heritage NSW if there are significance pieces found and these pieces be securely stored."*
- Biosis responded to Wendy on 6 March 2019 with the following:
  - *Hi Wendy, Thank you for responding to the project methodology for the Cabramatta Loop project. I have documented your response and we will incorporate it into the ACHA reporting. I note that the attachment you sent was for the Camden Town Farm Aboriginal Cultural Heritage Assessment not the Cabramatta Loop assessment. I will include the information provided but I just wanted to check to see if you would like to amend the letter for the Cabramatta Loop project?*
- Wendy Morgan responded on 6 March 2019 that she would update her response on Monday and send it through. No follow up response has been received prior to writing this report.
- Justine Coplin from Darug Custodian Aboriginal Corporation provided the following information:
  - *Dear Taryn,* [redacted] *It has been discussed by our group and with many consultants and researches that our history is generic and is usually from an early colonists perspective or solely based on archaeology and sites. These histories are adequate but they lack the people's stories and parts of important events and connections of the Darug people and also other Aboriginal people that now call this area home and have done so for numerous generations. This area is significant to the Darug people due to the evidence of continued occupation, within close proximity to this project site there is a complex of significant sites. Landscapes and landforms are significant to us for the information that they hold and the connection to Darug people. Aboriginal people (Darug) had a complex lifestyle that was based on respect and belonging to the land, all aspects of life and survival did not impact on the land but helped to care for and conserve land and the sustenance that the land provided. As Darug people moved through the land there were no impacts left, although there was*

evidence of movement and lifestyle, the people moved through areas with knowledge of their areas and followed signs that were left in the landscape. Darug people knew which areas were not to be entered and respected the areas that were sacred. Knowledge of culture, lifestyle and lore have been part of Darug people's lives for thousands of years, this was passed down to the next generations and this started with birth and continued for a lifetime. Darug people spent a lifetime learning and as people grew older they passed through stages of knowledge, elders became elders with the learning of stages of knowledge not by their age, being an elder is part of the kinship system this was a very complicated system based on respect. Darug sites are all connected, our country has a complex of sites that hold our heritage and past history, evidence of the Darug lifestyle and occupation are all across our country, due to the rapid development of Sydney many of our sites have been destroyed, our sites are thousands of years old and within the short period of time that Australia has been developed pre contact our sites have disappeared. [redacted] *Darug Custodian Aboriginal Corporation have received and reviewed the report for Stage 2 and 3 Aboriginal Community Consultation - Aboriginal Cultural Heritage Assessment for Cabramatta Loop Environmental Impact Statement. We support the recommendations set out in this report. Please contact us with all further enquiries on the above contacts.*

4.3.2 Information gathered during field investigation

Biosis invited Gandangara LALC to attend a field investigation of the study area on 27/11/2019, 29/11/2019, 4/12/2018, and 5/12/2018. Gandangara LALC indicated that a representative would be able to attend the site inspection on 6/12/2018, however the representative for LALC was unable to attend the morning of the inspection. A copy of test excavation invitations are provided in Appendix 4.

4.4 Stage 4: Review of draft Aboriginal cultural heritage assessment report

Following completion of the draft ACHA report, it was provided to RAPs on 17/04/2019 for review and comment. RAPs were given 28 days to provide comments and eight responses were received as detailed below. A copy of comments on the draft report are provided in Appendix 5..

Kamilaroi Yankunjatjara Working Group responded to the draft ACHA on 19/04/2019 requesting a hard copy of the report. Biosis responded by sending the requested hard copy on 23/04/2019. No further comments were received from Kamilaroi Yankunjatjara Working Group.

Responses to the draft ACHA were received from Amanda Hickey Cultural Services, Widescope, Corroboree Aboriginal Corporation, Darug Custodian Aboriginal Corporation, Barking Owl Aboriginal Corporation, and Darug Aboriginal Land Care by email between the 19/4/2019 and 15/05/2019. These responses stated that they agreed with the recommendations and had no issues with the information provided within the draft ACHA and AR.

Barraby Cultural Services also responded to the draft ACHA, stating that the report was received on 23/04/2019. However, no further comments were received.

The details for each response has been provided in Appendix 5.

4.4.1 Information gathered during test excavations

Representatives from Gandangara LALC, Murra Bidgee Mullangari, Darug Custodian Aboriginal Corporation and Kamilaroi Yankunjatjara Working Group attended test excavations from the 5 May to 12 May 2020. During this period they generally noted that all Aboriginal objects contained cultural significance to them for the connection to past peoples and Country. A copy of test excavation invitations are provided in Appendix 4.

A phone call with Gandangara LALC representative Darren Duncan on the 15 July 2020 was undertaken to determine if they would be willing to accept care of the recovered artefacts under a long term care agreement. Duncan noted they would be happy to receive the artefacts. Duncan also noted that the Gandangara LALC would like to have an Aboriginal representative monitor ground disturbance works in the extent of AHIMS 45-5-5333/Jacquie Osmond AS1 if possible.

4.5 Project update

A project update informing RAPs of the projects progress was provided on 8 April 2020. A copy if this consultation is provided in Appendix 4.

4.6 Stage 4: Review of second Aboriginal cultural heritage assessment report

Following completion of the draft ACHA report, it was provided to RAPs on 14/08/2020 for review and comment. RAPs were given 28 days to provide comments and eight responses were received as detailed below. A copy of comments on the draft report are provided in Appendix 6. Murra Bidgee Mullangari responded on 7/09/2020 by email and stated agreement and support for the recommendations made in this second draft ACHA and AR.

Comments were also received by Kamilaroi Yankunjatjara Working Group on 9/09/2020 regarding the general progress of the project and of the reports. Kamilaroi Yankunjatjara Working Group also contacted Biosis by email on 9/09/2020 stating agreement and support for the recommendations made in the second draft ACHA and AR.

The details of these responses are presented in Appendix 6.

5 Aboriginal cultural 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 the cultural values of Aboriginal sites in the project site. Details of the scientific significance assessment of Aboriginal sites in the project site are provided in Appendix 6.

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: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS 2013) (the Burra Charter). 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, a 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 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 Australian

Government, Heritage NSW and the Heritage Branch, and the NSW Department of Premier and Cabinet 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 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 Heritage NSW *Guidelines to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Heritage NSW 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 consideration of Aboriginal sites and places are the cultural/social significance to Aboriginal people and their archaeological or scientific significance to archaeologists and the Aboriginal community. 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 Cultural (social significance) values

Cultural or social significance refers to the spiritual, traditional, historical and/or contemporary associations and values attached to a place or objects by Aboriginal people. Aboriginal cultural heritage is broadly valued by Aboriginal people as it is used to define their identity as both individuals and as part of a group (DECCW 2010a, p.iii). More specifically it provides:

- A '*connection and sense of belonging to Country*' (DECCW 2010a, p.iii).
- A link between the present and the past (DECCW 2010a, p.3).
- A learning tool to teach Aboriginal culture to younger Aboriginal generations and the general public (DECCW 2010a, p.3).
- Further evidence of Aboriginal occupation prior to European settlement for people who do not understand the magnitude to which Aboriginal people occupied the continent (DECCW 2010a, p.3).

It is acknowledged that Aboriginal people are the primary determiners of the cultural significance of Aboriginal cultural heritage. During consultation the following information was provided by RAPs in regards to the cultural values of the project site.

- Wendy Morgan a member of the South Coast People native title claim identified the area as containing cultural values to her group, [redacted]
- Justine Coplin of the Darug Custodian Aboriginal Corporation identified the area as significant to the Darug people due to the evidence of continued occupation and complex of significant sites in the

area. She also noted that a large amount of Aboriginal sites in the greater Sydney area have been destroyed by historical and recent development activities.

- Des Dyer of Darug Aboriginal Land Care identified that the area was important to the Darug community.

5.3 Historic values

Historic significance refers to associations a place or object may have with a historically important person, event, phase or activity to the Aboriginal and other communities.

The history of the project site indicates that it has been utilised for different uses which range from agriculture and animal husbandry to more modern uses such as rail tracks and large areas of vacant public spaces.

The only item within the project site that has been recorded to have historical heritage significance at both a local and state level is the Cabramatta (Cabramatta Creek), Railway Parade & Sussex Street Underbridge which have local historical significance as they were built to serve the upgrading and duplication of the Granville to Liverpool railway line in the 1890s. The two viaducts represent the earliest examples of brick arched viaducts built by NSW Railways from the 1890s. With their original structure and fabric intact they are significant as fine examples of their type constructed by the NSW Railways. The viaducts are aesthetically distinctive and have landmark qualities because of their size, especially the structure over Cabramatta Creek which has 17 spans, the natural setting over the watercourse enhancing the setting.

5.4 Archaeological (scientific significance) values

An archaeological assessment was undertaken for the project site and is presented in detail as part of the attached AR (Appendix 6). The survey and background research undertaken as part of this assessment identified that a large portion of the project site had been subject to high levels of disturbance associated with its use a rail corridor, and urban development within the local area.

The project site displays evidence of disturbances such as a previously cleared laydown area, a modified drainage line, access tracks adjacent to the rail line, and bridge crossing. A large portion of the project site also contains road reserves adjacent to residential properties.

Previous disturbances identified within Jacquie Osmond Reserve include a large asphalted area adjacent to the rail line and Cabramatta Creek. Background research also indicates that there has been a moderate level of ground disturbance within this area associated with the establishment of softball playing fields, and the installation of water services.

AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 were inspected as part of the field investigation, and it was confirmed that these sites had undergone low levels of disturbance. No artefacts could be relocated during the field investigation, but it was determined that sub-surface deposits would likely still be present. These sites are located outside the area of proposed impact.

AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 were assessed as having moderate archaeological significance based on the confirmed presence of Aboriginal archaeological deposits within the sites, along with the low levels of disturbances noted. This site type occurs frequently within the local area.

Test excavations within the area of moderate archaeological potential identified during the field investigation identified an area of subsurface archaeological deposit. AHIMS 45-5-5333/Jacquie Osmond AS1 consisted of eight artefacts identified across an alluvial flat landform within 250 metres of Cabramatta Creek. The

assemblage composition and density are both commonly found throughout the region and are of low scientific value. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as low.

5.5 Aesthetic values

The project site is relatively disturbed. A large portion of the project site is currently a located within a rail corridor or is directly adjacent to the rail corridor. The areas surrounding the project site has been heavily built up from residential development and indicated low aesthetic values as a result. Warwick Farm Recreation Reserve and Jacquie Osmond Reserve are located to the west and the east of the central portion of the project site respectively, while Cabramatta Creek transects the central portion of the project site. The portion of Cabramatta Creek located within the project site has been heavily modified by the construction of the rail line, the rail bridge, a bike path, and the construction of an asphalt laydown area/ car park. The development in and surrounding the project site has resulted in a loss of aesthetic value. The site therefore has low aesthetic values.

5.6 Statement of significance

The significance of sites was assessed in accordance with the following criteria:

- Requirements of the code.
- The Burra Charter.
- *Guide to investigating and reporting on Aboriginal heritage* (Heritage NSW 2011).

The combined use of these guidelines is widely considered to represent the best practice for assessments of Aboriginal cultural heritage. The identification and assessment of cultural heritage values includes the four values of the Burra Charter: social, historical, scientific and aesthetic values. The resultant statement of significance has been constructed for the AHIMS sites located within 50 metres of the project site based on the significance ranking criteria assessed in Table 10.

5.6.1 Statement of significance for AHIMS 45-5-3271/CC1

AHIMS 45-5-3271/CC1 is recorded as an isolated artefact, and PAD. No further information about this site is available but review of the AHIMS 45-5-3428 site card suggests it has been tested as part of an assessment undertaken by Therin in 2007. An inspection of the site during this assessment found that the site is in good condition. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as moderate. The Aboriginal community has indicated during consultation that the project site has a high significance to the community, particularly to the Darug and South Coast Peoples. The site does not have any direct historical or aesthetic associations, but the wider area possesses historical values associated with pastoral use and transport.

5.6.2 Statement of significance for AHIMS 45-5-3428/CC1

AHIMS 45-5-3428 /CC1 was recorded in 2007 by Michael Therin. A copy of this site card was obtained from the AHIMS database. The information contained within this site card indicates that Aboriginal archaeological test excavations were undertaken by Therin in 2007 within PAD site AHIMS 45-5-3271, and the surrounding area. Excavations within the area identified 27 subsurface Aboriginal artefacts across four test pits. Therin therefore registered AHIMS 45-5-3428 as an extension of AHIMS 45-5-3271. An inspection of the site during this assessment found that the site is in good condition. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as

moderate. The Aboriginal community has indicated during consultation that the project site has a high significance to the community, particularly to the Darug and South Coast Peoples. The site does not have any direct historical or aesthetic associations but the wider area possesses historical values associated with pastoral use and transport.

5.6.3 Statement of significance for AHIMS 45-5-5333/Jacquie Osmond AS1

AHIMS 45-5-5333/Jacquie Osmond AS1 consisted of eight artefacts identified across an alluvial flat landform within 250 metres of Cabramatta Creek. The artefacts were identified from seven of 26 excavated test pits, suggesting an average site density of 1.23 artefact per square metre excavated. I It appeared that the artefact assemblage may have undergone some disturbance, which was limited to upper soil deposits where glass and modern materials were identified during the test excavations, with the potential for deeper deposits (below 300 millimetres) to be intact. The artefact assemblage was primarily made up of silcrete, with one mudstone artefact identified between 800 and 900 millimetres. Two of these artefacts displayed evidence of retouch, however no diagnostic tool types were identified. The assemblage composition and density are both commonly found throughout the region and are of low scientific value. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as low.

Table 10 Significance assessment criteria

Site name	Criteria	Ranking
AHIMS 45-5-3271/CC1	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value to the Darug and South Coast Peoples.	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses some archaeological values.	Moderate
	Aesthetic – the site is surrounded by disturbances from a railway and residential development. It has low aesthetic values.	Low
AHIMS 45-5-3428/CC1	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value to the Darug and South Coast Peoples.	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – the site possesses some archaeological values.	Moderate
	Aesthetic – the site is surrounded by disturbances from a railway and residential development. It has low aesthetic values.	Low
AHIMS 45-5-5333/Jacquie Osmond AS1	Cultural – discussions with the local Aboriginal communities reflect that the site is high in value to the Darug and South Coast Peoples.	High
	Historical – the site is not connected to any historical event or personage.	Low
	Scientific – The site was found to contain a low density artefacts scatter consisting of eight stone artefacts. The characteristics of	Low

Site name	Criteria	Ranking
	these artefacts and the assemblage in general were common throughout sites across the local and regional area and some disturbance of the artefacts was likely. The site is of low scientific significance as it contributes little to our understanding of Aboriginal occupation beyond site patterning.	
	Aesthetic – the site is surrounded by disturbances from a railway and residential development. It has low aesthetic values.	Low

6 Impact Assessment

As previously outlined, the project proposes the following works:

- New rail track – providing a 1.65 kilometre long section of new track with connections to the existing track at the northern and southern ends.
- Track realignment – moving about 550 metres of existing track sideways (slewing) to make room for the new track.
- Bridge works – constructing two new bridge structures adjacent to the existing rail bridges over Sussex Street and Cabramatta Creek.
- Road works – reconfiguring Broomfield Street for a distance of about 680 metres between Sussex and Bridge streets.
- Ancillary work would include communication and signalling upgrades, works to existing retaining and noise walls, drainage work and protecting/relocating utilities.
- Construction compounds and work sites – Construction of compounds involves using areas as a base of construction activities including storage of plant, equipment and site offices and facilities.

6.1 Potential risks to Aboriginal cultural heritage

The proposed works will involve a range of ground disturbances, however they have largely been confined to areas of existing disturbance or areas of low archaeological potential where possible. The works will not result in impacts to Aboriginal values, AHIMS 45-5-3428, AHIMS 45-5-3271, or the area of high archaeological potential associated with these sites. A summary of the potential impacts of the proposed works on known Aboriginal sites within the study area is provided in Table 11 below.

Table 11 Summary of potential archaeological impacts

AHIMS site no.	Site name	Significance	Type of harm	Degree of harm	Consequence of harm
AHIMS 45-5-3271	CC1	Moderate	No harm	None	No loss of value
AHIMS 45-5-3428	CC1	Moderate	No harm	None	No loss of value
AHIMS 45-5-5333	Jacquie Osmond AS1	Low	Direct	Total	Total loss of value

The construction of a site compound is proposed within Jacquie Osmond Reserve (Compound C4) and will contain site offices and associated facilities such as showers and meal rooms, areas for plant, equipment and materials to be stored, fencing, security facilities and parking for between 60 to 80 cars. It has been assumed that these works will result in direct impacts to the entire area of moderate potential within Jacquie Osmond Reserve. Possible impacts will include:

- Impacts to the ground surface as a result of repeated use of vehicles and plant equipment on the area.

- Impacts as a result of compaction due to material and equipment storage, laydown of site offices and associated amenities and fencing.
- Relocation of the Sydney Water sewer main to an area parallel to the rail corridor.

6.2 Avoiding harm to Aboriginal heritage

Based on the results of the field investigations and background research, the location of compounds was modified in order to avoid impacts to AHIMS sites and the area of high archaeological potential within Warwick Farm Recreation Reserve (AHIMS 45-5-3428 and AHIMS 45-5-3271). GHD and ARTC have advised that the proposed works cannot avoid impacts to the area of moderate potential (AHIMS 45-5-5333/Jacquie Osmond AS1) consisted within Jacquie Osmond Reserve through complete or partial redesign; therefore, the following management and mitigation measures are recommended.

6.3 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, p.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 has been implemented in this project. Based on the results of the field investigations and background research, the location of compounds was modified in order to avoid impacts to AHIMS sites and the area of high archaeological potential within Warwick Farm Recreation Reserve. This ensures the preservation of these Aboriginal heritage values within proximity to the project site for future generations to enjoy in line with the principles of ESD and intergenerational equity. This avoidance strategy also ensures cumulative impacts within the Cumberland Plains are mitigated.

As the project is CSSI, impacts could not be avoided to AHIMS 45-5-5333/Jacquie Osmond Reserve AS 1. Test excavations were therefore undertaken in the extent of AHIMS 45-5-5333/Jacquie Osmond Reserve AS 1 to determine the nature and extent of archaeological deposits within Jacquie Osmond Reserve (Compound C4) and to retrieve as much data as possible about Aboriginal occupation of the study area. The test excavations revealed a low density subsurface artefact scatter. The artefacts recovered during the test excavations have been catalogued and analysed which has contributed to our current knowledge of Aboriginal archaeological site type and distribution throughout the Cumberland Plains region. An ASIRF will be submitted following completion of works so the site information is accessible for educational purposes. The test excavations have increased our current understanding of Aboriginal occupation in the region ensuring that any scientific and cultural information obtained can be accessed and used by future generations. Further testing and salvage of this site is not recommended as the sporadic, low density nature of the deposit and the limited scientific value of the additional artefact assemblage would not provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region

In addition, a long term care agreement in consultation with RAPs should be implemented for artefacts recovered during the test excavations and community consultation with the Aboriginal community will be maintained throughout the construction phase. It is recommended that artefacts recovered from the excavations be given back to the Aboriginal community through a long term care agreement with the Gandangara LALC, where they can then be used to teach subsequent generations about Aboriginal culture or can be reburied in a culturally appropriate place at a later date. We believe this considers the principles of

ESD and intergenerational equity and more importantly ensures that recovered artefacts are managed according to the wishes of RAPs.

During the consultation process Gandangara LALC requested that an Aboriginal representative be present to monitor ground disturbance works in the site extent of AHIMS 45-5-5333/Jacquie Osmond AS1. Biosis has not recommended monitoring as the site consisted of a low density subsurface archaeological deposit of low archaeological significance. It was not expected that further assessment of this site would provide additional scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region.

If ARTC wishes to engage the LALC for monitoring it is recommended that this form part of the unexpected finds procedure and may occur if undisturbed artefact bearing soils below a depth of 100 milimetres were expected to be disturbed within the site extent of AHIMS 45-5-5333/Jacquie Osmond AS1 only.

7 Recommendations

The recommendations below respond specifically to the wishes of the RAPs. Recommendations regarding the archaeological value of the site, and the subsequent management of Aboriginal cultural heritage is provided in the archaeological report (Appendix 6).

7.1 Management 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: Continued consultation with the registered Aboriginal parties throughout construction of the project

The proponent should continue to inform the RAPs of the status of works and about the management of Aboriginal cultural heritage sites within the study area where there is a change, throughout construction of the project. Updates should be provided at least every six months as per the Heritage NSW guidelines. A copy of the final version of this report will be sent to the RAPs, Heritage NSW and the AHIMS register for information.

Recommendation 2: No further archaeological works required in the project site

This assessment has identified a low density subsurface archaeological deposit within Jacquie Osmond Reserve (Jacquie Osmond AS1). This site is considered to have low archaeological significance. It is not expected that salvage of this site would provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region and therefore further subsurface excavation, in the form of salvage, is not required.

Recommendation 3: AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, and identified areas of high archaeological potential to be identified as exclusions zones

AHIMS 45-5-3271/CC1, AHIMS 45-5-3428/CC1, and the areas of identified high archaeological potential are located outside of the project footprint and no works are proposed in these sites. These areas should be identified as exclusion zones in the CEMP so no unintentional impacts can occur.

Recommendation 4: Development of a long term care and control agreement

It is recommended that a method of long term care is developed for the artefacts recovered from Jacquie Osmond AS1 and in the event that any unexpected finds are identified as part of the works. A long term care agreement setting out the obligations and methods of long term safekeeping should be developed in consultation with the RAPs. It is recommended that artefacts are handed to Gandangarra Local Aboriginal

Land Council under a long term care agreement where they can be freely accessed by interested community members and used for educational purposes.

Recommendation 5: Submission of an ASIRF for any site impacted as part of the works

An ASIRF will be submitted to AHIMS following the impacts to Aboriginal site Jacquie Osmond AS1 as part of the proposed works.

Recommendation 6: Discovery of Unanticipated Aboriginal Objects and Aboriginal Ancestral Remains

An Unexpected Heritage Finds and Human Remains Procedure must be prepared to manage unexpected heritage finds and human remains in accordance with guidelines and standards published by the Heritage Council of NSW or Heritage NSW. This Procedure must be included in the CEMP and implemented for the duration of construction.

The Unexpected Heritage Finds and Human Remains Procedure must specify that 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 object, the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders, and implementing archaeological monitoring.

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. The Unexpected Heritage Finds and Human Remains Procedure must specify that if any suspected human remains are discovered during any activity:

1. Works must immediately cease at that location and not further move or disturb the remains.
2. The NSW Police and Heritage NSW's Environmental Line on 131 555 must be notified as soon as practicable and provide details of the remains and their location.
3. Work at that location must not recommence unless authorised in writing by Heritage NSW.

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Appendices

Appendix 1 Consultation log

Stage 1 – Notification of project proposal and registration of interest

Step 1: Identification of Aboriginal people/parties with an interest in the proposed project site

Organisation contacted	Date and type of contact	Date and type of response	Response details
Fairfield City Council	7 November 2018 - email	7 November 2018 - email	Confirmation of email, request passed on.
Gandangara Local Aboriginal Land Council	7 November 2018 - email	N/A	N/A
Greater Sydney Local Land Services	7 November 2018 - email	N/A	N/A
Office of Environment and Heritage	7 November 2018 - email	14 November 2018 - email	Barry Gunther from Heritage NSW provided a list of RAPs.
National Native Title Tribunal	7 November 2018 - email	8 November 2018 - email	Returned search request, no Native Title over the project site and no relevant entries in NNTT databases
Native Title Services Corporation Limited	7 November 2018 - email	N/A	N/A
Office of the Registrar, Aboriginal Land Rights Act 1983	7 November 2018 - email	8 November 2018 - email	Jodie Rikiti returned search request. No Registered Aboriginal Owners for project site. Suggested that Biosis contact Gandangara Local Aboriginal Land Council.
Liverpool City Council	10 December 2018 - email	19 December 2018 – Email 15 February 2019 - email	Norma Burrows responded on 19/12/208 that she forwarded the invitation on to key Aboriginal groups known to council Norma also requested the Liverpool Council Consultative Committee be registered as an Aboriginal party for the project. Jimmy Gokten Community Planning Policy Officer – social planner, for Liverpool city council contacted ARTC on 15/02/2019 with a list of potentially interested Aboriginal parties. All parties provide in the list had been previously contacted during the stage 1 consultation process and provided an invitation to register for the project.

Step 2: Public advertisement

The public notice was published in the *Liverpool City Champion* and *Fairfield City Champion* on 21 November 2018 and 28 November 2018 respectively. A copy of the advertisement is provided in Appendix 2.

Step 3: Registration of interest

The registration period ran from 20 November 2018 to 4 December 2018. Leeway was given to Aboriginal parties/groups who provided responses shortly after the close of this period and they have been registered as Aboriginal parties for consultation.

Organisation contacted	Date and type of contact	Date and type of response	Response details
A1 Indigenous Services	20 November 2018 – email	25 November 2018 - email	Emailed registering interest for project
Amanda Hickey Cultural Services	20 November 2018 - email	21 November 2018 - email	Emailed registering interest for project
Anthony Williams	20 November 2018 - email	26 November 2018 - email	Emailed registering interest for project
B.W Consultants	20 November 2018 - email	21 November 2018 – email	Emailed registering interest for project
B.W Consultants	20 November 2018 - email	N/A	N/A
Badu	20 November 2018 - email	N/A	N/A
Barking Owl Aboriginal Corporation	20 November 2018 - email	22 November 2018 - email	Emailed registering interest for project
Barraby Cultural Services	20 November 2018 - email	26 November 2018 - email	Emailed registering interest for project
Biamanga	20 November 2018 - email	N/A	N/A
Bidjawong Aboriginal Corporation	20 November 2018 - email	N/A	N/A
Bilinga	20 November 2018 - email	N/A	N/A
Bilinga Cultural Heritage Technical Services	20 November 2018 - email	N/A	N/A
Butucarbin Aboriginal Corporation	20 November 2018 - email	N/A	N/A
Callendulla	20 November 2018 - email	N/A	N/A
Corroboree Aboriginal Corporation	20 November 2018 - email	21 November 2018 - email	Emailed registering interest for project

Organisation contacted	Date and type of contact	Date and type of response	Response details
Cubbitch Barta	20 November 2018 - email	N/A	N/A
Darug Aboriginal Cultural Heritage Assessments	20 November 2018 - email	N/A	N/A
Darug Boorooberongal Elders	20 November 2018 - email	20 November 2018 - email	Emailed registering interest for project
Darug Custodian Aboriginal Corporation	20 November 2018 - email	21 November 2018 - email	Emailed registering interest for project
Darug Land Observations	20 November 2018 - email	23 November 2018 - email	Emailed registering interest for project
Darug Tribal Aboriginal Corporation	20 November 2018 - email	N/A	N/A
Deerubbin Local Aboriginal Land Council	20 November 2018 - email	N/A	N/A
Darug Aboriginal Land Care	20 November 2018 - email	20 November 2018 - email	Emailed registering interest for project
Dharug	20 November 2018 - email	N/A	N/A
Dhinawan-Dhigaraa Culture & Heritage Pty Ltd	20 November 2018 - email	N/A	N/A
Dhinawan-Dhigaraa Culture & Heritage Pty Ltd	20 November 2018 - email	N/A	N/A
Didge Ngunawal Clan	20 November 2018 - email	N/A	N/A
DJMD Consultancy	20 November 2018 - email	N/A	N/A
Gandangara Local Aboriginal Land Council	20 November 2018 - email	N/A	N/A
Garrara Aboriginal Corporation	20 November 2018 - email	N/A	N/A
Goobah Developments	20 November 2018 - email	1 December 2018 - email	Emailed registering interest for project
Gulaga	20 November 2018 - email	25 November 2018 - email	Emailed registering interest for project
Gunjeewong Cultural Heritage Aboriginal Corporation	20 November 2018 - email	N/A	N/A
Guntawang Aboriginal	20 November	29 November 2018 -	Emailed registering interest for project

Organisation contacted	Date and type of contact	Date and type of response	Response details
Resources Incorporated	2018 - email	email	
Gunyuu	20 November 2018 - email	N/A	N/A
Gunyuu Cultural Heritage Technical Services	20 November 2018 - email	N/A	N/A
HSB Consultants	20 November 2018 - email	N/A	N/A
Jerringong	20 November 2018 - email	N/A	N/A
Kamilaroi Yankunjatjara Working Group	20 November 2018 - email	21 November 2018 - email	Emailed registering interest for project
Kawul Cultural Services	20 November 2018 - email	N/A	N/A
Liverpool Council	10 December 2018 - email	19 December 2018 - email	Emailed registering interest for project
Merrigarn Indigenous Corporation	20 November 2018 - email	21 November 2018 – email	Emailed registering interest for project
Minnamunnung	20 November 2018 - email	N/A	N/A
Munyunga	20 November 2018 - email	N/A	N/A
Munyunga Cultural Heritage Technical Services	20 November 2018 - email	N/A	N/A
Muragadi Heritage Indigenous Corporation	20 November 2018 - email	21 November 2018 – email	Emailed registering interest for project
Murra Bidgee Mullangari Aboriginal Corporation	20 November 2018 - email	21 November 2018 – email	Emailed registering interest for project
Murramarang	20 November 2018 - email	N/A	N/A
Murrumbul	20 November 2018 - email	N/A	N/A
Murrumbul Cultural Heritage Technical Services	20 November 2018 - email	N/A	N/A
Nerrigundah	20 November 2018 - email	N/A	N/A
Nundagurri	20 November	N/A	N/A

Organisation contacted	Date and type of contact	Date and type of response	Response details
	2018 - email		
Pemulwuy CHTS	20 November 2018 - email	N/A	N/A
Rane Consulting	20 November 2018 - email	N/A	N/A
Steven Johnson and Krystle Carroll	20 November 2018 - email	N/A	N/A
Tharawal Local Aboriginal Land Council	20 November 2018 - email	N/A	N/A
Thauaira	20 November 2018 - email	N/A	N/A
Thoorga Nura	20 November 2018 - email	N/A	N/A
Tocomwall	20 November 2018 - email	N/A	N/A
Wailwan Aboriginal Digging Group	20 November 2018 - email	N/A	N/A
Walbunja	20 November 2018 - email	N/A	N/A
Walgalu	20 November 2018 - email	N/A	N/A
Warragil Cultural Services	20 November 2018 - email	N/A	N/A
Widescope Indigenous Group	20 November 2018 - email	29 November 2018 - email	Emailed registering interest for project
Wingikara	20 November 2018 - email	N/A	N/A
Wingikara Cultural Heritage Technical Services	20 November 2018 - email	N/A	N/A
Wullung	20 November 2018 - email	N/A	N/A
Wurrumay Consultancy	20 November 2018 - email	N/A	N/A
Yerramurra	20 November 2018 - email	N/A	N/A
Yulay Cultural Services	20 November 2018 - email	26 November 2018 - email	Emailed registering interest for project

Organisation contacted	Date and type of contact	Date and type of response	Response details
Yurrandaali Cultural Services	20 November 2018 - email	26 November 2018 - email	Emailed registering interest for project

Stage 2 – Presentation of information about the proposed project

Step 1: Provision of project information pack

A copy of the information pack is provided in Appendix 3 and a copy of the covering email is provided following.

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	A1 Indigenous Services	22 January 2019 - email	28 January 2019 - email	A1 supports the methodology and ACHA [redacted]
2	AAS	22 January 2019 - email	N/A	N/A
3	Amanda Hickey Cultural Services	22 January 2019 - email	N/A	N/A
4	B.W Consultants	22 January 2019 - email	22 January 2019 – email	Wrong email! [redacted]
5	B.W Consultants	23 January 2019 –email Stage 2 and 3 document sent to alternate address supplied as the primary address supplied was incorrect.	N/A	N/A
6	Barking Owl	22 January 2019 - email	N/A	N/A
7	Barraby Cultural Services	22 January 2019 - email	28 January 2019 - email	Barraby Cultural Services supports the methodology for this project.
8	Corroboree Aboriginal Corporation	22 January 2019 - email	31 January 2019 - email	Corroboree Aboriginal Corp. see no problems with the project plans. [redacted]
9	Darug Aboriginal Land Care	22 January 2019 - email	26 January 2019 - email	Darug Aboriginal Land agrees with the methodology.

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
10	Darug Boorooberongal Elders Aboriginal Corporation	22 January 2019 - email	N/A	N/A
11	Darug Custodian Aboriginal Corporation	22 January 2019 - email	6 February 2019 - email	Darug Custodian Aboriginal Corporation supports the methodology for this project.
12	Darug Land Observations	22 January 2019 - email	N/A	N/A
13	Goobah Developments	22 January 2019 - email	N/A	N/A
14	Gulaga	22 January 2019 - email	N/A	N/A
15	Guntawang Aboriginal Resources Incorporated	22 January 2019 - email	14 February 2019 - email	The area where this loop covers is an area where native medical plants where grown in the past. Can you please ensure you read the attached documentation regarding Aboriginal feedback. (A copy of the attachment is included in Appendix 4)
16	Kamilaroi Yankunjatjara Working Group	22 January 2019 - email	31 January 2019 – email	Thank you for your report regarding the Cabramatta Loop, I have read your report and agree and support all your recommendations. [redacted]
17	Liverpool Council Aboriginal Consultative Committee	22 January 2019 - email	N/A	N/A
18	Merrigarn	22 January 2019 - email	N/A	N/A
19	Muragadi	22 January 2019 - email	N/A	N/A
20	Murra Bidgee Mullangari	22 January 2019 - email	25 January 2019 - email	I have read the project information and ACHA for the above project, I endorse the recommendations made by Biosis. Please feel free to contact me if you require further details via mobile.

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
21	Widescope	22 January 2019 - email	24 January 2019 – email	I have reviewed and support the Cabramatta Loop Environmental Impact Statement and survey methodology.
22	Yulay Cultural Services	22 January 2019 - email	28 January 2019 – email	Yulay Cultural Services supports the methodology for this project.
1	Yurrandaali Cultural Services	23 January 2019 - email	28 January 2019 – email	Yurrandaali Cultural Services supports the methodology for this project.

Stage 3 – Gathering information about cultural significance

Step 1: Provision of project methodology pack and consultation meeting

A copy of the methodology pack is provided in Appendix 3 and a copy of the covering email is provided following.

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	A1 Indigenous Services	22 January 2019 - email	28 January 2019 - email	A1 supports the methodology and ACHA [redacted]
2	AAS	22 January 2019 - email	N/A	N/A
3	Amanda Hickey Cultural Services	22 January 2019 - email	N/A	N/A
4	B.W Consultants	22 January 2019 - email	22 January 2019 – email	Responded "Wrong email! [redacted]
	B.W Consultants	23 January 2019 – email Stage 2 and 3 document sent to alternate address supplied as the primary address supplied was incorrect.	N/A	N/A
5	Barking Owl	22 January 2019 - email	N/A	N/A
6	Barraby Cultural Services	22 January 2019 - email	28 January 2019 -	Barraby Cultural Services

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
			email	supports the methodology for this project.
7	Corroboree Aboriginal Corporation	22 January 2019 - email	31 January 2019 - email	Corroboree Aboriginal Corp. see no problems with the project plans. [redacted]
8	Darug Aboriginal Land Care	22 January 2019 - email	26 January 2019 - email	Darug Aboriginal Land agrees with the methodology.
9	Darug Boorooberongal Elders Aboriginal Corporation	22 January 2019 - email	N/A	N/A
10	Darug Custodian Aboriginal Corporation	22 January 2019 - email	6 February 2019 - email	Darug Custodian Aboriginal Corporation supports the methodology for this project.
11	Darug Land Observations	22 January 2019 - email	N/A	N/A
12	Goobah Developments	22 January 2019 - email	N/A	N/A
13	Gulaga	22 January 2019 - email	N/A	N/A
14	Guntawang Aboriginal Resources Incorporated	22 January 2019 - email	14 February 2019 - email	The area where this loop covers is an area where native medical plants where grown in the past. Can you please ensure you read the attached documentation regarding Aboriginal feedback.
15	Kamilaroi Yankunjatjara Working Group	22 January 2019 - email	31 January 2019 – email	Thank you for your report regarding the Cabramatta Loop, I have read your report and agree and support all your recommendations. [redacted]
16	Liverpool Council Aboriginal Consultative Committee	22 January 2019 - email	N/A	N/A
17	Merrigarn	22 January 2019 - email	N/A	N/A

No.	Organisation contacted	Date and type of contact	Date and type of response	Response details
18	Muragadi	22 January 2019 - email	N/A	N/A
19	Murra Bidgee Mullangari	22 January 2019 - email	25 January 2019 - email	I have read the project information and ACHA for the above project, I endorse the recommendations made by Biosis. Please feel free to contact me if you require further details via mobile.
20	Widescope	22 January 2019 - email	24 January 2019 – email	I have reviewed and support the Cabramatta Loop Environmental Impact Statement and survey methodology.
21	Yulay Cultural Services	22 January 2019 - email	28 January 2019 – email	Yulay Cultural Services supports the methodology for this project.
22	Yurrandaali Cultural Services	23 January 2019 - email	28 January 2019 – email	Yurrandaali Cultural Services supports the methodology for this project.

Test excavation invitations

A series of test excavation invitations and updates were sent to RAPs. A copy of this consultation is provided in Appendix 4.

Invitations for test excavations were sent on 30 September 2020.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	OEH	25 September 2019 - email	N/A	N/A
2	Darug Custodian Aboriginal Corporation	30 September 2019 - email	1 October 2019 – email	Acceptance and relevant documents
3	Kamilaroi Yankunjatjara Working Group	30 September 2019 - email	1 October 2019 – email	Acceptance and relevant documents
4	Murra Bidgee Mullangari	30 September 2019 - email	1 October 2019 – email	Acceptance and relevant documents
5	Gandangara Local Aboriginal Land Council	30 September t 2019	N/A	N/A

Test excavation updates were sent on 30 September 2019 as fieldwork was placed on hold

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	Darug Custodian Aboriginal Corporation	30 September 2019 - email	N/A	N/A
2	Kamilaroi Yankunjatjara Working Group	30 September 2019 - email	1 October 2019 – email	N/A
3	Murra Bidgee Mullangari	30 September 2019 - email	1 October 2019 – email	N/A
4	Gandangara Local Aboriginal Land Council	30 September 2019 - email	1 October 2019 – email	N/A

A second round of test excavation invitations were sent on 13 November 2019.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	Darug Custodian Aboriginal Corporation	13 November 2019 - email	N/A	N/A
2	Kamilaroi Yankunjatjara Working Group	13 November 2019 - email	N/A	N/A
3	Murra Bidgee Mullangari	13 November 2019 - email	N/A	N/A
4	Gandangara Local Aboriginal Land Council	13 November 2019 - email	N/A	N/A

Test excavation updates were provided on 28 November 2019 as fieldwork was placed on hold.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	Darug Custodian Aboriginal Corporation	28 November 2019 - email	N/A	N/A
2	Kamilaroi Yankunjatjara Working Group	28 November 2019 - email	N/A	N/A
3	Murra Bidgee Mullangari	28 November 2019 - email	N/A	N/A
4	Gandangara Local Aboriginal Land Council	28 November 2019 - email	N/A	N/A

Invitations to participate in fieldwork were provided on 21 April 2020.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	Darug Custodian Aboriginal Corporation	21 April 2020 – email/phone	N/A	N/A
2	Kamilaroi Yankunjatjara Working Group	21 April 2020 – email/phone	22 April 2020 - email	Availability for fieldwork
3	Murra Bidgee Mullangari	21 April 2020 - email	23 April 2020 - phone	Availability for fieldwork
4	Gandangara Local Aboriginal Land Council	21 April 2020 – email/phone	N/A	N/A

Project update

A project update was provided to RAPS on 8 April 2020 regarding the progress of the project.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	A1 Indigenous Services	8 April 2019 - email	N/A	N/A
2	AAS	8 April 2019 - email	N/A	N/A
3	Amanda Hickey Cultural Services	8 April 2019 - email	N/A	N/A
4	B.W Consultants	8 April 2019 - email	N/A	N/A
5	Barking Owl	8 April 2019 - email	N/A	N/A
6	Barraby Cultural Services	8 April 2019 - email	N/A	N/A
7	Corroboree Aboriginal Corporation	8 April 2019 - email	N/A	N/A
8	Darug Aboriginal Land Care	8 April 2019 - email	N/A	N/A
9	Darug Boorooberongal Elders Aboriginal Corporation	8 April 2019 - email	N/A	N/A
10	Darug Custodian Aboriginal Corporation	8 April 2019 - email	N/A	N/A
11	Darug Land Observations	8 April 2019 - email	N/A	N/A
12	Goobah Developments	8 April 2019 - email	N/A	N/A
13	Gulaga	8 April 2019 - email	N/A	N/A
14	Guntawang Aboriginal Resources Incorporated	8 April 2019 - email	N/A	N/A
15	Kamilaroi Yankunjatjara Working Group	8 April 2019 - email	N/A	N/A
	Kamilaroi Yankunjatjara	8 April 2019 - email	N/A	N/A

	Organisation contacted	Date and type of contact	Date and type of response	Response details
	Working Group			
16	Liverpool Council Aboriginal Consultative Committee	8 April 2019 - email	N/A	N/A
17	Merrigarn	8 April 2019 - email	N/A	N/A
18	Muragadi	8 April 2019 - email	N/A	N/A
19	Murra Bidgee Mullangari	8 April 2019 - email	N/A	N/A
20	Widescope	8 April 2019 - email	N/A	N/A
21	Yulay Cultural Services	8 April 2019 - email	N/A	N/A
22	Yurrandaali Cultural Services	8 April 2019 - email	N/A	N/A

Stage 4 – Review of draft report

Step 1: Provision of draft report for review

A copy of the draft report was provided to RAPs on 17/04/2019 for review and comment. RAPs were given 28 days to provide comments. A copy of the draft report and invitation to provide feedback have been provided in Appendix 5.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	A1 Indigenous Services	17 April 2019 - email	N/A	N/A
2	AAS	17 April 2019 - email	N/A	N/A
3	Amanda Hickey Cultural Services	17 April 2019 - email	22 April 2019 - email	Provided comment stating that they were happy with the draft ACHA and AR.
4	B.W Consultants	17 April 2019 - email	N/A	N/A
5	Barking Owl	17 April 2019 - email	1 May 2019 - email	Responded stating that Barking Owl Aboriginal Corporation have agreed and are satisfied with the ACHA report, and have no further comments.
6	Barraby Cultural Services	17 April 2019 - email	23 April 2019 - email	Responded confirming that the draft ACHA was received
7	Corroboree Aboriginal Corporation	17 April 2019 - email	26 April 2019 - email	Responded stating that there were no issues with the information provided.
8	Darug Aboriginal Land Care	17 April 2019 - email	15 May 2019 - email	Agreed with the

	Organisation contacted	Date and type of contact	Date and type of response	Response details
				recommendations and methodology.
9	Darug Boorooberongal Elders Aboriginal Corporation	17 April 2019 - email	N/A	N/A
10	Darug Custodian Aboriginal Corporation	17 April 2019 - email	29 April 2019 - email	Responded stating that the report had been received and reviewed. Darug Custodian Aboriginal Corporation support the recommendations.
11	Darug Land Observations	17 April 2019 - email	N/A	N/A
12	Goobah Developments	17 April 2019 - email	N/A	N/A
13	Gulaga	17 April 2019 - email	N/A	N/A
14	Guntawang Aboriginal Resources Incorporated	17 April 2019 - email	N/A	N/A
15	Kamilaroi Yankunjatjara Working Group	17 April 2019 - email	19 April 2019 - email	Requested a hard copy of the report
	Kamilaroi Yankunjatjara Working Group	23 April 2019 - mail	N/A	Sent out a hard copy of the report but received no further comments.
16	Liverpool Council Aboriginal Consultative Committee	17 April 2019 - email	N/A	N/A
17	Merrigarn	17 April 2019 - email	N/A	N/A
18	Muragadi	17 April 2019 - email	N/A	N/A
19	Murra Bidgee Mullangari	17 April 2019 - email	N/A	N/A
20	Widescope	17 April 2019 - email	19 April 2019 - email	Responded stating the report has been received and they support the ACHA.
21	Yulay Cultural Services	17 April 2019 - email	N/A	N/A
22	Yurrandaali Cultural Services	17 April 2019 - email	N/A	N/A

Stage 4 – Review of second draft report

Step 1: Provision of second draft report for review

A copy of the second draft report was provided to RAPs on 14/08/2020 for review and comment. RAPs were given 28 days to provide comments. A copy of the draft report and invitation to provide feedback have been provided in Appendix 5.

	Organisation contacted	Date and type of contact	Date and type of response	Response details
1	A1 Indigenous Services	14 August 2020 - email	N/A	N/A
2	AAS	14 August 2020 - email	N/A	N/A
3	Amanda Hickey Cultural Services	14 August 2020 - email	N/A	N/A
4	B.W Consultants	14 August 2020 - email	N/A	N/A
5	Barking Owl	14 August 2020 - email	N/A	N/A
6	Barraby Cultural Services	14 August 2020 - email	N/A	N/A
7	Corroboree Aboriginal Corporation	14 August 2020 - email	N/A	N/A
8	Darug Aboriginal Land Care	14 August 2020 - email	N/A	N/A
9	Darug Boorooberongal Elders Aboriginal Corporation	14 August 2020 - email	N/A	N/A
10	Darug Custodian Aboriginal Corporation	14 August 2020 - email	N/A	N/A
11	Darug Land Observations	14 August 2020 - email	N/A	N/A
12	Goobah Developments	14 August 2020 - email	N/A	N/A
13	Gulaga	14 August 2020 - email	N/A	N/A
14	Guntawang Aboriginal Resources Incorporated	14 August 2020 - email	N/A	N/A
15	Kamilaroi Yankunjatjara Working Group	14 August 2020 - phone	9 September 2020 - phone	Called regarding progress of project
16	Kamilaroi Yankunjatjara Working Group	14 August 2020 - email	9 September 2020 - email	Has read the updated draft and supports the recommendations made.
17	Liverpool Council Aboriginal Consultative Committee	14 August 2020 - email	N/A	N/A
18	Merrigarn	14 August 2020 -	N/A	N/A

	Organisation contacted	Date and type of contact	Date and type of response	Response details
		email		
19	Muragadi	14 August 2020 - email	N/A	N/A
20	Murra Bidgee Mullangari	14 August 2020 - email	7 September 2020 - email	Has read the updated draft and supports the recommendations made.
21	Widescope	14 August 2020 - email	N/A	N/A
22	Yulay Cultural Services	14 August 2020 - email	N/A	N/A
23	Yurrandaali Cultural Services	14 August 2020 - email	N/A	N/A

Appendix 2 Stage 1: Notification of project proposal and registration of interest

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

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Positions Vacant

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Motor Vehicles

Public Notices

NOTIFICATION AND REGISTRATION OF ABORIGINAL INTERESTS

Australian Rail Track Corporation (ARTC) is proposing to construct a new simultaneous entry loop between Cabramatta and Warwick Farm on the eastern side of the South Sydney Freight Line. GHD have been engaged as the Technical Advisor to lead the works design and develop an Environmental Impact Statement (EIS) for the proposed development. Biosis will be undertaking an Aboriginal cultural heritage assessment (ACHA) to inform the EIS for the proposed development. The proposed development will be assessed as State Significant Infrastructure (SSI) under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) (SSI 18_9186).

Biosis is assisting GHD with consultation with the Aboriginal community to inform the ACHA. Consultation with the Aboriginal community for this assessment will be undertaken in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010). The purpose of the Aboriginal community consultation is to provide sufficient information for the assessment of Aboriginal cultural heritage values to assist the Secretary of the Department of Planning and Environment in their determination of the application.

Biosis therefore wish to invite Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal object(s)/and or Places in the vicinity of the study area, to register their interest in the project outlined above.

For more information or to register in writing, please contact:
Taryn Gooley
Biosis Pty Ltd
8/27 Annie Street
Wickham NSW 2293
tgooley@biosis.com.au

In accordance with the consultation requirements, the details of registered Aboriginal parties for this project will be forwarded through to the OEH and Gandangarra LALC. If you do not want your details forwarded on please notify Biosis at the time of your registration.

The relevant contact for the proponent is:
Project Manager, Cabramatta Loop Project
Tel: 1300 550 402 enviroline@artc.com.au

REGISTRATION MUST BE RECEIVED BEFORE 5pm, 12 DECEMBER 2018

Public Notices

NOTICE OF SALE

National Storage (Operations) Pty Ltd, 144 Forrester Rd, St Marys (9673 1948) wishes to advise **Adam Hoete,** 77 Manilla Rd, Lethbridge Parks NSW 2770 that it intends to sell a Holden V6 Commodore Sedan, red in colour, BDP92P, VIN (6G1EP55H68L104432) by public auction via Grays online by 28/12/2018 unless all storage rentals, charges and other fees was paid in full.

NSW GOVERNMENT

The Department of Education

Information booth

Westfields Sports High School

An upgrade is underway for Westfields Sports High School to deliver new innovative permanent teaching spaces.

If you would like more information about this project or would like to provide feedback, please visit the upcoming information booth.

When: Thursday 6 December 2018 3:30pm to 4:30pm

Where: Wetherill Park Library, 561-583 Polding Street, Wetherill Park 2164

BLZ155767

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Email: schoolinfrastructure@det.nsw.edu.au
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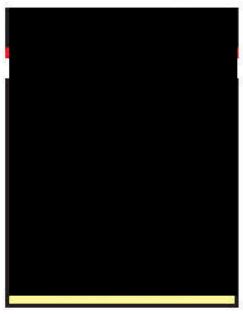

Public Notices

NOTIFICATION AND REGISTRATION OF ABORIGINAL INTERESTS

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Biosis is assisting GHD with consultation with the Aboriginal community to inform the ACHA. Consultation with the Aboriginal community for this assessment will be undertaken in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW 2010). The purpose of the Aboriginal community consultation is to provide sufficient information for the assessment of Aboriginal cultural heritage values to assist the Secretary of the Department of Planning and Environment in their determination of the application.

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For more information please contact:
Taryn Gooley
Biosis Pty Ltd
8/27 Annie Street
Wickham NSW 2293
tgooley@biosis.com.au

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The relevant contact for the proponent is:
Project Manager, Cabramatta Loop Project
Tel: 1300 550 402 enviroline@artc.com.au

REGISTRATIONS MUST BE RECEIVED BEFORE 5pm, 5 DECEMBER 2018

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Appendix 3 Stage 2 and 3: Presentation of information about the proposed project and gathering information about cultural significance

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

Appendix 4 Test excavation invitations and project updates

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

24 September 2019

Greater Sydney
Office of Environment and Heritage
Greater Sydney Planning Team
PO Box 64
Parramatta NSW 2124

To whom it may concern,

RE: Aboriginal Cultural Heritage Assessment for Cabramatta Loop Environmental Impact Statement (EIS) – test excavations

Our Ref: Matter 27833

Biosis will be undertaking test excavations for the Cabramatta Loop EIS, as part of the Aboriginal cultural heritage assessment to be assessed as State Significant Infrastructure (SSI 18_9186). As a courtesy please find the details of the test excavations below:

Location: Jacquie Osmond Reserve, 1 Hume Highway, Warwick Farm, NSW 2170
Legal entity: Australian Rail Track Corporation (ARTC)
Project manager: Taryn Gooley, Heritage Team Leader, Biosis Pty Ltd. [redacted]
Dates: 8 October to 18 October 2019
Location of Aboriginal objects: [redacted]
People undertaking test excavations: James Cole and Mathew Smith, Anthea Vella

Sampling Strategy

The principle objectives of the test excavations are to identify and understand the nature, extent and significance of any areas of potential archaeological deposit within the study area. This will further our knowledge of Aboriginal archaeological site patterning within the study area and enable the predictive model to be further tested and refined.

The aims of the testing program are to:

- Determine the nature and extent of the sub-surface archaeological deposits identified by Therin (2007) in the study area.
- Identify if the archaeological material occurs in an intact, undisturbed context, by examining the soil profile and stratigraphy.
- Analyse and interpret any archaeological finds (such as stone artefacts, hearths, etc.) recovered during the testing program.
- Inform current knowledge of Aboriginal occupation and land use models of the region.
- Provide management and mitigation measures for Aboriginal archaeological objects located during the subsurface testing program.

Biosis Pty Ltd
Newcastle Resource Group

Suite 8, 27 Annie Street
Wickham NSW 2293

Phone: 02 4911 4040

ACN 006 175 097
ABN 65 006 175 097

Email: newcastle@biosis.com.au

biosis.com.au

- Test the predictive model and answer the research questions developed as part of this assessment.

Test excavation will be undertaken in accordance with the Code, in order to determine the nature, extent and significance of the deposit or site. Excavation will be conducted by hand in accordance with the Code. Test excavation within the study area will conform to the following methodology:

- Test excavations will be conducted in 50 by 50 centimetre units.
- The test pits will be 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 a site or PAD area will be excavated in five centimetre spits; the subsequent test pits conducted within the site or PAD area can then be excavated in either 10 centimetre spits or stratigraphic units (whichever is smaller) to the base of Aboriginal object-bearing units being the removal of the A-horizon soil deposit down to the sterile clay or bedrock layer (B-horizon).
- If the depth of deposit prevents reaching sterile deposits within the 50 by 50 centimetre test pit, additional 50 by 50 centimetre test pits may be excavated adjacent to the original test pit (for example expanding the test pit to 50 by 100 centimetres) to reach the sterile deposits.
- 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 (three m^2).
- The code dictates 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 will be sieved in five millimetre sieves. Dry sieving will be attempted in the first instance, however wet sieving may be used if deposits cannot be dry sieved.
- All cultural material will be collected, bagged and clearly labelled. They will be temporarily stored in the Biosis office for analysis [redacted]
- For each test pit that is excavated, the following documentation will be 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 will be 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 will immediately cease and the NSW Police and OEH will be notified.

- Test excavations will cease when enough information* has been recovered to adequately characterise the objects present with regard to their nature and significance.

  **Enough information is defined by OEH as meaning "the sample of excavated material clearly and self-evidently demonstrates the deposit's nature and significance. This may include things like locally or regionally high object density: presence of rare or representative objects: presence of archaeological features: or locally or regionally significant deposits stratified or not." (DECCW 2010b).*

Storage of cultural material

Any cultural material identified during test excavations will be temporarily stored in the Biosis, Sydney office for analysis [redacted]

Once the cultural material has been analysed, the cultural material can be managed in the following manners:

- Cultural material can be held by the Aboriginal community under a care and control agreement.
- Cultural material can be returned to country and reburied as soon as practicable in a secure location in accordance with Requirements 16b and 26 of the code.

Biosis requests any comments regarding the care and control of any cultural material be included as part of the review of this assessment methodology.

Appendix 5 Stage 4: Review of draft cultural heritage assessment report

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

Appendix 6 Stage 4: Second round comments

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

Appendix 7 Archaeological report

Cabramatta Loop:
Archaeological Report

FINAL REPORT

Prepared for ARTC

22 September 2020

NOTE: INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS REPORT.

Biosis offices

NEW SOUTH WALES

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

Document information

Report to:	ARTC
Prepared by:	Mathew Smith Anthea Vella Matthew Tetlaw Samantha Keats
Biosis project no.:	27833/31990

File name: 31990.CabramattaLoopAR.FIN02.20200922

Citation: Biosis (2020). Cabramatta Loop Archaeological Report. Report for ARTC. Authors: M. Smith, A. Vella, M. Tetlaw, S. Keats. Biosis Pty Ltd, Newcastle. Project no. 27833/31990

LGA: Fairfield and Liverpool

Document control

Version	Internal reviewer	Date issued
Draft 01	Taryn Gooley	05/02/2019
Draft 02	James Cole	15/03/2019
Draft 03	Taryn Gooley	16/04/2019
Final 01	James Cole	29/05/2019
Draft 04	Taryn Gooley	19/06/2020
Draft 04	Amanda Markham	16/07/2020
Draft 05	Maggie Butcher	04/08/2020
Final 02	Amanda Markham	21/09/2020

Contents

Tables

Figures

Photos

Glossary

ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
ARTC	Australian Rail Track Corporation
AR	Archaeological Report
ASIRF	Aboriginal Site Impact Recording Form
BP	Before present
CBD	Central business district
Consultation requirements	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*
CSSI	Critical State Significant Infrastructure
DA	Development Application
DECCW	Department of Environment, Climate Change and Water (now Heritage NSW)
DP	Deposited Plan
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Environmentally Sustainable Development
GPS	Global Positioning System
GSV	Ground Surface Visibility
Heritage NSW	Heritage New South Wales Department of Premier and Cabinet
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

SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSFL	Southern Sydney Freight Line
Project site	The project site comprises of parts of Lot 4 DP 1186349, Lot 4, 5 DP 1129945, Lot 1 DP 1053994, Lot 12 DP 1185796, Lot 11 DP 1185775, Lot 1008 DP 591195, Lot 2 DP 250138, Lot 10 DP 1185718, Lot 2 DP 1129315, Lot 1 DP 865075, Lot 2 DP 1128471, Lot 1 DP 171299 and Lot 1 DP 1164164
the Code	*Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*

Updates to this report

This report has been updated to include the findings and recommendations of the test excavations completed on 12 May 2020 in the area of moderate archaeological potential identified in Jacquie Osmond Reserve undertaken to satisfy the requirements of the Conditions of Approval E7 to E8 and Revised Environmental Management Measures D4.2.

Table 1 Conditions of Approval relevant to this report

CoA No.	Requirement	How Addressed	Reference
E7	Before the commencement of work within areas of moderate to high archaeological potential as identified in the documents in Condition A1, the Proponent shall: (a) Undertake archaeological investigation of this site using a methodology prepared in consultation with the Aboriginal stakeholders; and	Biosis has undertaken an archaeological investigation which included Aboriginal consultation and archaeological test excavations of the areas of moderate archaeological potential in Jacquie Osmond Reserve which is within the project impact area. This investigation was undertaken using the methodology prepared in consultation with Aboriginal stakeholders.	See Archaeological Report (AR) section 6. See Aboriginal Cultural Heritage Assessment (ACHA) section 4.3.
	(b) Report on the results of the archaeological investigation, including recommendations (such as for further archaeological work), and must include, but not necessarily be limited to:	The AR and ACHA report on the results of archaeological investigations and include recommendations for the management and mitigation of heritage impacts.	See AR section 6 and 10. See ACHA section 7.
	(i) consideration of measures to avoid or minimise disturbance to Aboriginal objects where objects of moderate to high significance are found to be present;	No objects of high or moderate significance were identified. Mitigation measures for unexpected finds have been provided in the recommendations.	See AR section 10. See ACHA section 7.
	(ii) where impacts cannot be avoided, recommendations for any further investigations or salvage under Condition E8 below; and	No further investigations are recommended.	See AR section 10. See ACHA section 7.
	(iii) management and mitigation measures to minimise additional impacts due to pre-construction and construction activities.	Management and mitigation measures to minimise additional impacts due to pre-construction and	See AR section 10. See ACHA section 7.

CoA No.	Requirement	How Addressed	Reference
		construction activities have been included in the recommendations.	
E8	Before the commencement of work where Aboriginal objects of moderate to high significance are found to be present and cannot be avoided (refer to ConditionE7 (ii) above), the Proponent must: develop a detailed salvage strategy, prepared in consultation with the Aboriginal stakeholders; and undertake any further archaeological excavation works recommended by the results of the Aboriginal archaeological salvage strategy. Within twelve (12) months of completing the above work, unless otherwise agreed by the Planning Secretary, the Proponent must submit a report containing the findings of the excavations, including artefact analysis and Aboriginal Site Impacts Recording Forms (ASIR), and the identification of final storage location for all Aboriginal objects recovered (testing and salvage), prepared in consultation with the Aboriginal stakeholders and Heritage NSW. A copy of this report shall be provided to the relevant Local Aboriginal Land Council and council.	Condition not triggered as no objects of moderate to high significance were found.	This Report

Table 2 Revised environmental management measures relevant to this report

REMM No.	Requirement	How Addressed	Reference
D4.2	Further assessment will be carried out in Jacquie Osmond Reserve in the form of subsurface investigations (test excavations) prior to construction commencing (refer to methodology provided in Appendix 3 of Technical Report 9- Aboriginal and Cultural Heritage impact assessment). Should any Aboriginal objects be encountered during investigation a long-term care agreement setting out the obligations and methods of long term safekeeping will be developed in consultation with the RAPs.	Biosis has undertaken an archaeological investigation which included Aboriginal consultation and archaeological test excavations of the areas of moderate archaeological potential in Jacquie Osmond Reserve within the project impact area. A long term care agreement with the Gandangara Local Aboriginal Land Council is	See AR section 6 and 10. See ACHA section 4 and 7.

REMM No.	Requirement	How Addressed	Reference
		proposed in the recommendations.	

Summary

Biosis Pty Ltd (Biosis) was commissioned by GHD on behalf of Australian Rail Track Corporation (ARTC) to undertake an Archaeological Report (AR) to support an Aboriginal Cultural Heritage Assessment (ACHA) of an area of land proposed for the Cabramatta Loop project (the project site) as per the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a) (the Code) and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011). The project site is split into a number of sections located on the rail line through Liverpool, Warwick Farm, Cabramatta, New South Wales (NSW) and approximately 26 kilometres south west of Sydney central business district (CBD).

The project site, defined by the area of impact of the proposed works, comprises parts of Lot 4 DP 1186349, Lot 4, 5 DP 1129945, Lot 1 DP 1053994, Lot 12 DP 1185796, Lot 11 DP 1185775, Lot 1008 DP 591195, Lot 2 DP 250138, Lot 10 DP 1185718, Lot 2 DP 1129315, Lot 1 DP 865075, Lot 2 DP 1128471, Lot 1 DP 171299 and Lot 1 DP 1164164. This assessment approach has been undertaken to allow for assessment of both the project site as well as any additional areas in the broader study area which are likely to be affected by the project, either directly or indirectly. The proposed works involve:

- Bi-directional signalling with simultaneous entry to the new loop integrated to the existing signalling system of the South Sydney Freight Line (SSFL).
- Construction of 1.65 kilometres of new track and slewing of 550 metres of existing SSFL track.
- Installation of two new rail bridges over Sussex Street and Cabramatta Creek.
- Construction of a retaining wall and noise wall on Broomfield Street.
- Construction of a retaining wall and embankment in Jacquie Osmond Reserve and between the two Cabramatta Creek bridges.
- Re-configuration of Broomfield Street road alignment, car parking, pedestrian and cycle routes.
- Relocation and protection of identified third party services.
- Construction compounds (proposed compounds are included in the project site but the final selection of compound locations to be decided by the construction contractor).

The project will be assessed as a Critical State Significant Infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP) (SSI 9186). The project will be assessed by the Department of Planning, Industry and Environment and determined by the Minister of Planning and Public Spaces. The Secretary's Environmental Assessment Requirements (SEARs) were issued for this development on 17 May 2018.

Two previously recorded Aboriginal Heritage Information Management System (AHIMS) sites were identified within 50 metres of the project site. AHIMS 45-5-3271(CC1) is recorded as an isolated artefact and PAD within Warwick Farm Recreation Reserve. The site card and the associated report are not available on the AHIMS database. AHIMS 45-5-3428 (CC1) was recorded in 2007 by Michael Therin. A copy of this site card was obtained from the AHIMS database, the report associated with this site card however is not available. The information contained within this site card indicates that Aboriginal archaeological test excavations were undertaken by Therin in 2007 within PAD site AHIMS 45-5-3271, and the surrounding area. The excavations identified 27 subsurface Aboriginal artefacts across four test pits within Warwick Farm Recreation Reserve. Therin therefore registered AHIMS 45-5-3428 as an extension of AHIMS 45-5-3271.

A field investigation of the project site was undertaken on 6 December 2018, attended by Taryn Gooley (Heritage Team Leader/Senior Archaeologist, Biosis). The field investigation was restricted to the portions of the project site located outside of the heavily disturbed rail line. The overall effectiveness of the survey for examining the ground for Aboriginal sites was deemed low due to ground surface visibility (GSV) combined with a low amount of exposures; however, disturbances were identified across much of the project site.

No previously unrecorded Aboriginal cultural heritage sites were identified during the field investigation. The area to the west of the rail line within Warwick Farm Recreation Reserve was assessed as having high archaeological potential due to the presence of previously recorded AHIMS sites with demonstrated archaeological deposits, and low levels of previous ground disturbances observed. The area to the east of the existing rail line within Jacquie Osmond Reserve displayed higher levels of disturbance and was assessed with moderate archaeological potential.

Test excavations were undertaken in the area of moderate potential identified at Jacquie Osmond Reserve from 5 May to 12 May 2020. A total of 26 test pits were excavated in line with the Code, with seven of these test pits containing Aboriginal artefacts. The site (AHIMS 45-5-5333/Jacquie Osmond Archaeological Site AS1) contained eight artefacts in total. The artefact assemblage was dominated by silcrete raw materials with one mudstone artefact also identified. Assemblage characteristics showed no clear trends in manufacture technique or processes, likely due to the limited sample size. Artefact types were made up of three medial flakes, two proximal flakes, and one each of an angular fragment, complete flake and distal flake. Two of these artefacts also displayed retouch, suggesting some secondary modification following flake removal, however no use wear was observed to indicate they were utilised as tools. The artefact assemblage consisted of a low density deposit sporadically placed throughout the area of potential, and artefacts making up the assemblage were of limited scientific value.

The development activities have been largely confined to areas of existing disturbance, or those areas assessed with low potential to contain Aboriginal heritage. AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, or identified areas of high archaeological potential, will not be impacted by the project which will preserve these sites for future generations in line with the principles of Environmentally Sustainable Development (ESD) and intergenerational equality. However, the proposed works will completely impact on AHIMS 45-5-5333/Jacquie Osmond AS1 through the construction of a site compound. There is potential that further artefacts will be present in Jacquie Osmond AS1. However, the excavations have indicated that artefacts are likely to be of low scientific significance due to the low density and common nature of the assemblage and no further archaeological assessment is recommended.

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: Continued consultation with the registered Aboriginal parties throughout construction of the project

The proponent should continue to inform the RAPs of the status of works and about the management of Aboriginal cultural heritage sites within the study area where there is a change, throughout construction of the project. Updates should be provided at least every six months as per the Heritage NSW guidelines. A copy of the final version of this report will be sent to the RAPs, Heritage NSW and the AHIMS register for information.

Recommendation 2: No further archaeological works required in the project site

This assessment has identified a low density subsurface archaeological deposit within Jacquie Osmond Reserve (Jacquie Osmond AS1). This site is considered to have low archaeological significance. It is not expected that salvage of this site would provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region and therefore further subsurface excavation, in the form of salvage, is not required.

Recommendation 3: AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, and identified areas of high archaeological potential to be identified as exclusions zones

AHIMS 45-5-3271/CC1, AHIMS 45-5-3428/CC1, and the areas of identified high archaeological potential are located outside of the project footprint and no works are proposed in these sites. These areas should be identified as exclusion zones in the Construction Environment Management Plan (CEMP) so no unintentional impacts can occur.

Recommendation 4: Development of a long term care and control agreement

It is recommended that a method of long term care is developed for the artefacts recovered from Jacquie Osmond AS1 and in the event that any unexpected finds are identified as part of the works. A long term care agreement setting out the obligations and methods of long term safekeeping should be developed in consultation with the RAPs. It is recommended that artefacts are handed to Gandangarra Local Aboriginal Land Council under a long term care agreement where they can freely accessed by interested community members and used for educational purposes.

Recommendation 5: Submission of an ASIRF for any site impacted as part of the works

An Aboriginal Site Impact Recording Form (ASIRF) will be submitted to AHIMS following the impacts to Aboriginal site Jacquie Osmond AS1 as part of the proposed works.

Recommendation 6: Discovery of Unanticipated Aboriginal Objects and Aboriginal Ancestral Remains

An Unexpected Heritage Finds and Human Remains Procedure must be prepared to manage unexpected heritage finds and human remains in accordance with guidelines and standards published by the Heritage Council of NSW or Heritage NSW. This Procedure must be included in the CEMP and implemented for the duration of construction.

The Unexpected Heritage Finds and Human Remains Procedure must specify that 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 object, the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders, and implementing archaeological monitoring.

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. The Unexpected Heritage Finds and Human Remains Procedure must specify that if any suspected human remains are discovered during any activity:

1. Works must immediately cease at that location and not further move or disturb the remains.
2. The NSW Police and Heritage NSW's Environmental Line on 131 555 must be notified as soon as practicable and provide details of the remains and their location.
3. Work at that location must not recommence unless authorised in writing by Heritage NSW.

1 Introduction

1.1 Overview

ARTC proposes to construct and operate a passing loop for 1300 metre length trains on the SSFL between Sydney Trains' Cabramatta and Warwick Farm stations. The Cabramatta Loop Project ('the project') would allow freight trains to pass and provide additional rail freight capacity along the SSFL. The project is Critical State significant infrastructure in accordance with Division 5.2 of the EP&A Act. As CSSI, the project needs approval from the NSW Minister for Planning.

This report has been prepared to accompany the Environmental Impact Statement (EIS) to support the application for approval of the project, and address the environmental assessment requirements of the SEARs, issued on 17 May 2018.

An original assessment of the study area was conducted by Biosis in 2019. This report has been updated to include the results of the test excavations undertaken at the site from 5 May to 12 May 2020.

1.2 The project

1.2.1 Location

The project is generally located within the existing rail corridor between the Hume Highway and Cabramatta Road East road overbridges in the suburbs of Warwick Farm and Cabramatta. In addition, the project includes works to Broomfield Street and Jacquie Osmond Reserve adjacent to the rail corridor in Cabramatta and Warwick Farm.

The rail corridor is owned by the NSW Government (RailCorp) and leased to ARTC. The location of the project is shown in Figure 1.

1.2.2 Key features

The key features of the project include:

- New rail track–providing a 1.65 kilometre long section of new track with connections to the existing track at the northern and southern ends.
- Track realignment–moving about 550 metres of existing track sideways (slewing) to make room for the new track.
- Bridge works–constructing two new bridge structures adjacent to the existing rail bridges over Sussex Street and Cabramatta Creek.
- Road works–reconfiguring Broomfield Street for a distance of about 680 metres between Sussex and Bridge streets.
- Construction compounds and work sites with site offices, amenities, areas for plant, equipment and material storage, fencing and security facilities and worker parking.

Ancillary work would include communication upgrades, works to existing retaining and noise walls, drainage work and protecting/relocating utilities. In addition, minor works in the form of new signalling would be installed at a number of locations within the rail corridor (indicative locations provided in the EIS).

The key features of the project are shown in Figure 2. Further information on the project is provided in the EIS.

1.2.3 Timing

Subject to approval of the project, construction is planned to start in early 2021, and is expected to take about two years. Construction is expected to be completed in early 2023.

It is anticipated that some features of the project would be constructed while the existing rail line continues to operate. Other features of the project would need to be constructed during programmed weekend rail possession periods when rail services along the line cease to operate. Possession periods typically occur for 48 hours four times per year.

1.2.4 Operation

The project would operate as part of the SSFL and would continue to be managed by ARTC. ARTC is not responsible for the operation of rolling stock. Train services are currently, and would continue to be, provided by a variety of operators.

1.3 Purpose and scope of this report

The project is subject to assessment by the Department of Planning, Industry and Environment and approval by the Minister for Planning under Part 5.1 of the EP&A Act, which requires preparation of an Environmental Impact Statement (EIS).

This Archaeological Report (AR) is one of a number of technical papers that forms part of the EIS. The purpose of this report is to assess the potential Aboriginal heritage impacts from the operation and construction of the project. This archaeological report addresses the relevant SEARs for the EIS, as outlined in Table 4, and the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), NPW Act and the EP&A Act. This report meets the requirements of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011), *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010b) (consultation requirements) and the Code. The report:

- Describes the existing environment with respect to the history of the project site.
- Assesses the impacts of constructing and operating the project on Aboriginal cultural values.
- Recommends measures to mitigate the impacts identified.

1.4 Structure of the report

The structure of the report is outlined below.

- Section 1–provides an introduction to the report.
- Section 2–describes the proposed development.
- Section 3– outlines the investigators and contributors.
- Section 4–outlines the existing environment as relevant to the assessment.
- Section 5 and Section 6–outlines the results of the field investigation.
- Section 9.2– outlines the archaeological values and significance of the project site.
- Section 9.3–outlines the results of the impact assessment.

- Section 9.4–provides mitigation recommendations for the project.

1.5 Project methodology

Biosis undertook a desktop assessment including review of AHIMS data, and existing archaeological studies and reports relevant to the project site. This information was then used to develop Aboriginal site prediction statements for the project site, and to identify known Aboriginal sites and/or places recorded in the project site. The desktop assessment was prepared in accordance with requirements 1 to 4 of the Code.

Biosis undertook an Aboriginal archaeological field investigation conducted in accordance with requirements 5 to 10 of the Code. This archaeological investigation was attended by one archaeologist who focused on the assessment of disturbance and whether there is the potential for Aboriginal archaeological remains to be present beneath the ground surface.

Test excavations were undertaken in the area of moderate potential identified at Jacquie Osmond Reserve. A total of 26 test pits were excavated in line with the Code, with seven of these test pits containing Aboriginal artefacts. The site (AHIMS 45-5-5333/Jacquie Osmond AS1) contained eight artefacts in total.

Biosis then assessed the scientific significance of Aboriginal sites identified during the desktop assessment and field investigation using the ICOMOS Burra Charter and the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW. This was done to help determine the level of impact the proposed works would have on Aboriginal heritage.

An impact assessment was conducted using the results of the archaeological significance assessment. This impact assessment identified the proposed works within the project site and determined the types and levels of impacts these works would have on the identified Aboriginal values of the project area. Using the impacts and significance of sites, management and mitigation measures were developed and recommendations for the project were made.

This assessment was undertaken in accordance with the following legislative framework and guidelines (Table 3):

Table 3 Legislative framework and associated guidelines

Legislation and guidelines relevant to the project	Description
Environment Protection and Biodiversity Act 1999 (EPBC Act).	The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the EPBC Act as matters of national environmental significance.
Environmental Planning and Assessment Act 1979 **(EP&A Act)**	The EP&A Act establishes the framework for cultural heritage values to be formally assessed in the land use planning, development consent and environmental impact assessment processes. The EP&A Act requires that environmental impacts are considered prior to land development and the level of significance of the impact assessed; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits. The EP&A Act also requires that local governments prepare planning instruments (such as Local Environmental Plans

Legislation and guidelines relevant to the project	Description
	(LEP) and Development Control Plans (DCP)) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required.
National Parks and Wildlife Act 1974 **(NPW Act)**	Currently Aboriginal cultural heritage, as statutorily defined by the NPW Act, consists of objects and places which are protected under Part 6 of the Act. Aboriginal objects are defined as: "any deposit, object or material evidence...relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains" Aboriginal places are defined as a place that is or was of special Aboriginal cultural significance. Places are declared under section 84 of the NPW Act.
State Environmental Planning Policy 2011 **(SEPP)**	The aims the SEPP are as follows: (a) to identify development that is State significant development, (b) to identify development that is State significant infrastructure and critical State significant infrastructure, (c) to identify development that is regionally significant development.
Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (OEH 2011)	This document provides a framework on assessing and reporting on Aboriginal cultural heritage in NSW. This report has been prepared in accordance with this document as required by the project SEARS
Aboriginal Cultural Heritage Consultation requirements for proponents (DECCW 2010)	This document provides a framework for the Aboriginal community consultation process in accordance with 90N of the NPW Act. This assessment has been prepared in accordance with this document as required by the project SEARS.
Code of practice for archaeological investigation of Aboriginal objects in NSW (DECCW 2010)	The Code establishes the requirements that must be followed when carrying out archaeological investigation in NSW. This assessment has been prepared in accordance with the code as required by the project SEARS.
NSW Skeletal Remains: Guidelines for Management of Human Remains (Heritage Office, 1998)	This document provides a framework for the management of human remains. No human remains were identified as part of this assessment.

This assessment was undertaken to address requirements of the SEARS addressing heritage issues (Table 4):

Table 4 SEARS for heritage

Key issue and desired outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report	Current guidelines
3 (2) Assessment of Key issues **For each key issue the Proponent must:**	(a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue		
	(b) describe the legislative and policy context, as far as it is relevant to the issue		
	(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts		
	(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	• Section 9.3	
	(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant)		
10. Heritage **The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of**	1. The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of: (a) Aboriginal places and objects, as defined under the National Parks and Wildlife Act 1974 and in accordance with the principles and methods of assessment identified in the current guidelines; (b) Aboriginal places of heritage significance, as defined in the Standard Instrument–Principal Local Environmental Plan;	• Section 9.3	• Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011) • Aboriginal Cultural Heritage Consultation requirements for proponents (DECCW, 2010) • Code of practice for archaeological investigation

Key issue and desired outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report	Current guidelines
items of environmental heritage. **The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage.**	2. Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the Code. 3. Where impacts to Aboriginal objects and/or place are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.	• Section 3 • Appendix 1–Aboriginal Cultural Heritage Assessment (ACHA)	of Aboriginal objects in NSW (DECCW, 2010) • NSW Skeletal Remains: Guidelines for Management of Human Remains (Heritage Office, 1998)

Table 5 Agency requirements for heritage

Agency	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the report
Liverpool City Council	There is potential for Indigenous archaeology, especially along Cabramatta Creek where new pylons will be required for two new bridges.	Section 5 and section 6
Liverpool City Council	An indigenous Heritage Assessment should be undertaken, focusing mainly on the Cabramatta Creek area and including unexpected finds protocol.	Section 5 and 6, and Recommendation 6 and 7
Heritage NSW	Identify and describe Aboriginal cultural heritage values that will be affected by the development and document these in an ACHA.	Section 6 of ACHA
Heritage NSW	Consultation with Aboriginal people must be undertaken and documented in accordance with the Consultation Requirements.	Appendix 1 of ACHA
Heritage NSW	Impacts on Aboriginal cultural heritage values are to be assessed and documented in an ACHA, including mitigation measures.	Section 8, Section 6 of ACHA
Heritage NSW	The ACHA must outline procedure to be followed if Aboriginal objects are found.	Recommendation 6 and 7

Figure 1: Location of the project

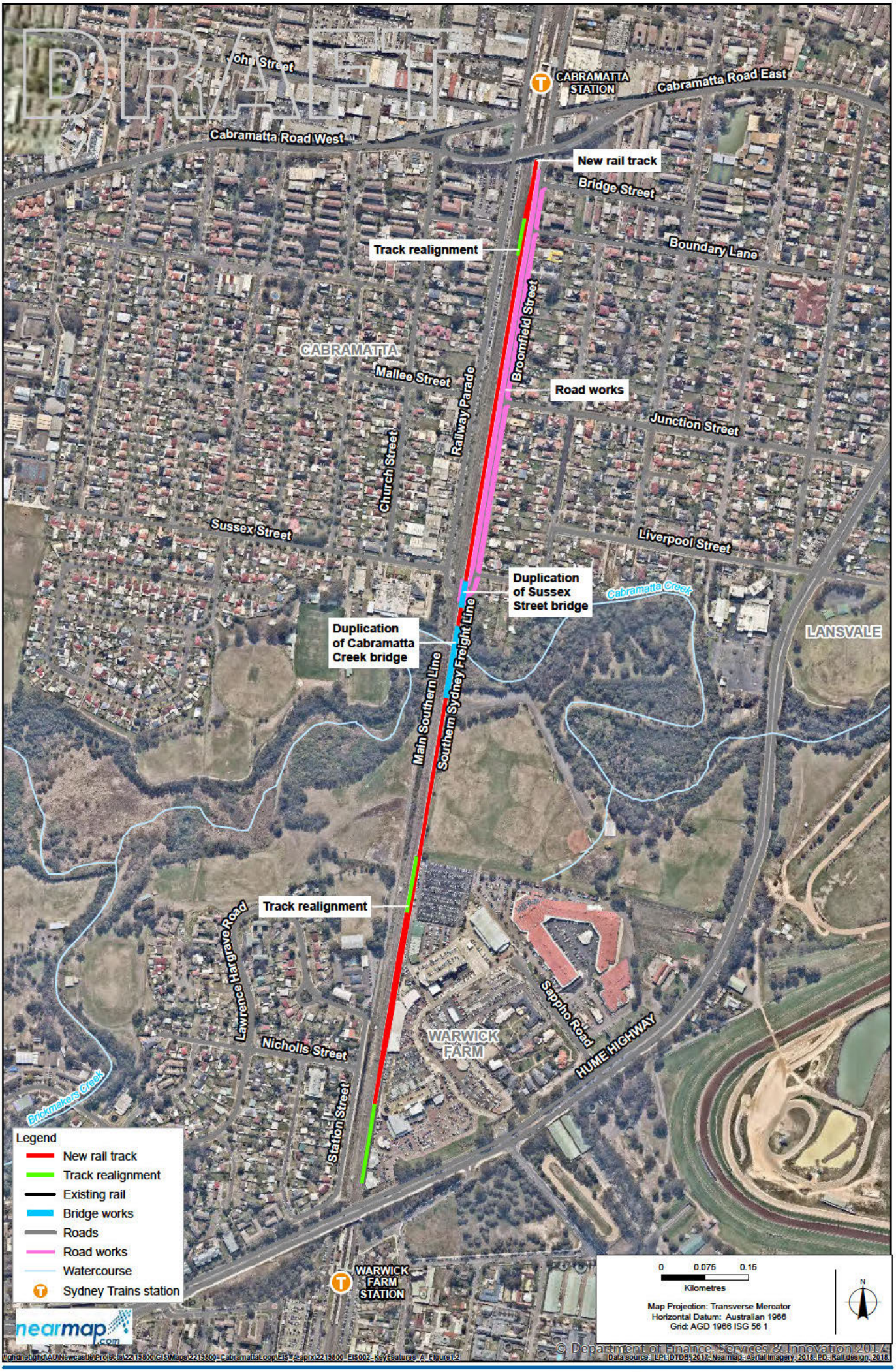


Figure 2 Key Features of the Project

2 Proposed development

The proposed development includes the following (refer to Figure 2):

- Enabling works.
- Main construction works.
- Testing and commissioning works.

2.1.1 Enabling works

Enabling works for major infrastructure are typically carried out prior the start of substantial construction to establish key construction sites and provide protection to the public and environment as required. This phase involves site establishment and relocation of utilities. Principle activities resulting in ground disturbance and potential ground compaction:

- Heavy vehicles and plant compacting the ground surface.
- Vegetation clearance.
- Compound establishment including temporary drainage, placement of site offices, stockpiles and laydown areas.
- Underground utility works comprising new or moving existing underground infrastructure such as the sewer and stormwater pipes within Jacquie Osmond Reserve.

2.1.2 Main construction works

The main construction works involves building new track for the passing loop (to be installed within the new wider rail corridor area), realigning the existing SSFL track, construction of new bridges over Sussex Street and Cabramatta Creek, road works, ancillary infrastructure and works, and finishing and rehabilitation of surrounding area. Principle activities resulting in ground disturbance and potential ground compaction:

- Piling.
- Heavy vehicles and plant, such as cranes, compacting the ground surface.
- Groundworks for the bridges, retaining walls and noise wall.

2.1.3 Testing and commissioning

Testing and commissioning (checking) of the rail line and communication/signalling systems would be undertaken to ensure that all systems and infrastructure are designed, installed, and operating according to ARTC's operational requirements.

3 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 6.

Table 6 Investigators and contributors

Name and qualifications	Experience summary	Project role
Taryn Gooley BASc (Hons–Archaeology)	Taryn joined Biosis in 2017 and has over 10 years' experience as an archaeologist. She is currently the Heritage team leader for NSW. In this role Taryn has successfully completed numerous projects throughout the Newcastle, Port Stephens, Lake Macquarie, Hunter Valley, and North Western NSW regions. These projects have been for a diverse client base including Local Government, Roads and Maritime Services, the Australian Rail Track Corporation, Sydney Water, National Parks and Wildlife Service, Department of Primary Industry and Water, resource companies, architectural firms, engineering firms, and private developers. 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. Taryn holds a Bachelor Arts and Science (Honours) and is a member of the Australian Archaeology Association and the Australian Institute for Maritime Archaeology.	• Site inspection • Quality assurance • Aboriginal consultation
Mathew Smith BA, BSc (Hons)	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, Hunter, Greater Sydney, and Far West regions of NSW, where he has developed his skills in Aboriginal archaeology. 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. Mathew is a member of the Australian Archaeology Association and the Australian Association of Consulting Archaeologists Inc.	• Report writing • Test excavations
Anthea Vella	Anthea graduated from Flinders University with a Bachelor of	• Background research

Name and qualifications	Experience summary	Project role
BArch, MAHM	Archaeology and has also recently graduated from Flinders University with a Master of Archaeology and Heritage Management. She has experience with desktop assessments, project administration, collating internal and external research, and reporting. Anthea also has experience in Aboriginal test excavations, and Historical excavations. She also has geophysical skills in GPR data collection, processing and interpretation.	• Artefact analyisis
Ashley Bridge BA MAS (Adv, Hons)	Ashley joined Biosis at the Sydney Office as a Research Assistant–Heritage in 2018. She completed her Masters in Archaeological Science in 2016. Ashley has undertaken field work in Australia and Europe over the past five years, spending 2017 in Transylvania, Romania, Menorca, and Spain, as a volunteer. In 2018 and 2019, Ashley has undertaken fieldwork for Biosis throughout Sydney, Wollongong and Western New South Wales, with a focus in both Aboriginal and historical archaeology. She also has experience with desktop research and Aboriginal consultation practices in an Australian context.	• Aboriginal consultation
Ashleigh Keevers-Eastman BA(hons)	Ashleigh is a project archaeologist at Biosis who has worked on numerous project across the NSW coast particularly in the Newcastle and Sydney areas. Ashleigh started with Biosis in 2017 as a research assistant where she completed desktop background research, report writing as well as salvage, test excavation and survey fieldwork. Ashleigh also has extensive project management experience in particular in the Medowie signalised intersection upgrade project.	• Report writing • Test excavations
Anne Murray BEnv, MGIS-RS	Anne is a recent graduate with a year of professional experience in GIS in the environmental consulting sector. Prior to joining Biosis in 2018, Anne has worked as a Graduate GIS Specialist for an environmental consultancy. Anne was responsible for preparing maps, analysing data and managing databases for consultants and a variety of public and private proponents. Anne has completed a Masters of GIS and Remote Sensing including studies in cartography, spatial analysis, image analysis and integrated GIS and Remote Sensing. She graduated with distinction and was awarded the Executive Dean's Award for Academic Excellence.	• GIS
Matthew Tetlaw BA(hons)	Matthew is a heritage research assistant currently working from the Wollongong office. Matthew started at Biosis in 2019 after graduating with a bachelor of arts (honours) in 2018. Since starting at Biosis, Matthew has obtained extensive	• Report writing • Test excavations

Name and qualifications	Experience summary	Project role
	experience in background research, report writing, excavation and field surveys.	

4 Desktop assessment

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

4.1 Landscape context

It is important to consider the local environment of the project site in 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.

4.1.1 Topography and hydrology

The project site consists of gently undulating slopes forming in the north that flow south from two crest landforms towards Cabramatta Creek, forming flood plains on either side of the creek line. These flood plains are gently inclined and feature low lying crests which range in elevation from 6 -10 metres. Areas along Cabramatta creek range from steeply incised to gently inclined flood plains. Artefact, and PAD sites have been previously recorded with the region upon well drained topographies within the vicinity of permanent sources of fresh water, and therefore have the potential to occur upon low lying crests within the lower floodplains.

Stream order is recognised as a factor which helps the development of predictive modelling in Aboriginal archaeology in the Cumberland Plain. Predictive models are models which predict the potential locations of Aboriginal sites. Models which have been developed for the region have a tendency to favour permanent water courses as the locations of complex sites that have been continuously occupied, 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 (Jo McDonald Cultural Heritage Management 2000, p.19).

The stream order system used for this assessment was originally developed by Strahler (1964). It functions by adding two streams of equal order at their confluence to form a higher order stream, as shown in Photo 1. As stream order increases, so does the likelihood that the stream would be a perennial source of water. The project site is traversed by Cabramatta Creek, a fifth order perennial water source, that was likely a tributary of Georges River, a seventh order perennial water source, before Chipping Norton Lake was formed through human intervention. This creek would have provided an abundance of resources for Aboriginal people utilising the area.

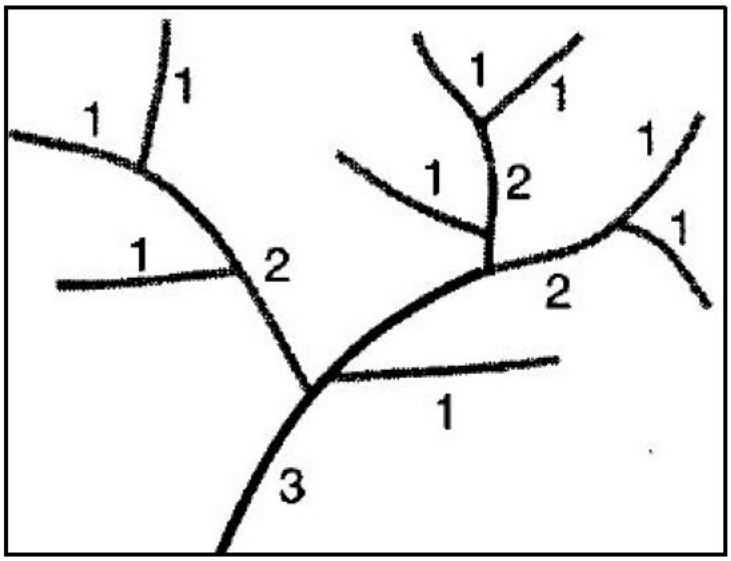


Photo 1 Diagram showing Strahler stream order (Ritter et al. 1995, P.151)

4.1.2 Geology and soil landscapes

The project site is situated within the Middle Triassic Wianamatta group of the Cumberland Lowlands upon the Bringelly Shale formation group in the northern portion of the project site. The Bringelly Shale formation consists of shale, claystone, siltstone, carbonaceous claystone, laminite and fine to medium-grained lithic sandstone. (Bannerman & Hazelton 1990, pp.2–3). Within the southern portion of the project site, in the areas surrounding Cabramatta Creek, alluvial terrace, flood plain and alluvium deposits overlay the Bringelly shale formation. According to Bannerman and Hazelton (1990, p.3), the composition of alluvium formations varies, in that it depends on the lithology of the source material and its distance from where it has been deposited.

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 project site is located within two soil landscapes; the Blacktown soil landscape, and South Creek soil landscape (Figure 5). The Blacktown soil landscape is a residual landscape and consists of gently undulating rises, broad rounded crests and gently inclined slopes with a gradient of less than 5 per cent. Local relief within the Blacktown soil landscape is up to 30 metres and rocky outcropping is absent. Dominant soils consist of shallow to moderately deep (<100 centimetres) red and brown podzols on crests and in well drained topographies, and deep (150–300 centimetres) yellow podzolic soils and soloths on lower slopes and drainage lines (Bannerman & Hazelton 1990, p.28) (Table 7). Due to their age and slow accumulation, residual soil landscapes have reasonable potential to contain archaeological deposits in an open context, such as stone artefacts derived from occupation sites. Other occupational evidence might include scarred trees where remnant vegetation occurs. However, the slow accumulation and high impact of extensive land clearing (usually associated with pastoral and civic development) often results in poor preservation of archaeological material.

Table 7 Blacktown (*bt*) soil landscape characteristics (Bannerman & Hazelton 1990, pp.29–30)

Soil material	Description
Blacktown 1 (*bt1*)–Friable brownish-black loam	Friable brown loam to clay loam with a moderately pedal sub angular block structure and rough-faced porous fabric ped fabric. This soil material generally

Soil material	Description
	occurs as a topsoil (A horizon). Peds are well defined and range from 2-20 millimetres. Rounded iron indurated fine gravel-sized shale fragments and charcoal fragments sometimes occur as inclusions. Soil colour is very dark brown (10YR 2/2), and can also range from dark reddish brown (5YR 3/2) to dark yellowish brown (10YR 3/4). Soil varies from moderately acidic to neutral.
Blacktown 2 (*bt2*)–Hard setting brown clay loam	Hard setting brown clay loam to silty clay loam, with an apedal massive to weakly pedal structure and porous earthy fabric. Occurs as an A^2 Horizon soil deposit. Peds range from 20-50 millimetres. Platy, iron indurated gravel sized shale fragments are common, with rare inclusions of charcoal and roots. Soil colour is predominately brown (7.5YR 4/3), but can range from dark reddish brown (2.5YR 3/3) to dark brown (10YR 3/3). Soil acidity varies from moderately acidic to slightly acidic.
Blacktown 3 (*bt3*)–Strongly pedal, mottled brown light clay	Brown light to medium clay with strong pedal polyhedral or sub angular-blocky structure and smooth faced dense ped fabric that occurs as a subsoil (B horizon). The soil texture increases with depth and peds range from 5-20 millimetres. Fine to coarse gravel sized shale fragments are a common inclusion and often occur within stratified bands, with roots and charcoal rarely being present. Soil colour is a strong brown (7.5YR 4/6), and can range from reddish brown (2.5YR 2/6) to dark yellowish brown (10YR 4/6). The pH of this soil material varies from strongly acidic to slightly acidic.
Blacktown 4 (*bt4*)–Light grey plastic mottled clay	Plastic light grey silty clay to heavy clay with moderately pedal polyhedral to sub angular blocky structure, and smooth-faced dense ped fabric, that occurs as a deep subsoil deposit overlying shale bedrock (B^3 or C Horizon). Peds range between 2-20 millimetres. Inclusion consists of weathered ironstone concretions and rock fragments. Gravel sized shale fragments and roots occur occasionally, but charcoal is rare within this soil deposit. Red, yellow and brown mottles are present and soil colour is usually light grey (10YR 7/1) or sometimes pale red (2.5YR 6/2). Soil acidity ranges from strongly acidic to moderately acidic.

The South Creek soil landscape dominates the areas surrounding Cabramatta Creek. It is characterised as a fluvial soil landscape situated on flat to gently sloping alluvial plains of less than 5 per cent and local relief of 10 metres, with intermittent terraces or lev. Soils are generally very deep (135-190 centimetres) layered sediments over bedrock or relief soils, with red and yellow podzolic soils being predominant upon terraces, with some structured grey clays, leached clay and yellow solodic soils also occurring. In areas adjacent to drainage lines where soil evolution has occurred structured plastic clays and structured loams can also be present. This soil landscape varies in many areas from erosion to deposition and has the potential to disturb soil sequencing and potentially archaeological deposits (Bannerman & Hazelton 1990, pp.68–69).

Characteristics of dominant soil materials within the South Creek soil landscape are summarised in Table 8.

Table 8 South Creek (*sc*) soil landscape characteristics (Bannerman & Hazelton 1990, p.69)

Soil Material	Description
South Creek 1 (*sc1*)–Brown apedal single-grained loam	Brown sandy loam to sandy clay loam with a porous and earthy fabric, and a single-grained apedal structure, usually occurring as a topsoil (A horizon). Roots are abundant in surface layers, while small angular or rounded gravels of 2-6 millimetres may occur; other inclusions, such as charcoal, do not occur. Colours range from a reddish brown (5YR 4/3) to brown (10YR 4/3), and are generally moderately acidic but can vary between strongly to slightly acidic.
South Creek 2 (*sc2*)–Dull brown clay loam	A hard setting dull brown clay loam to sandy clay loam, usually featuring an apedal massive structure and porous, earthy fabric, occurring as a topsoil (A horizon). There may be occasional areas of weak structure which contain small (2-5 millimetres) rough-faced sub angular blocky peds. Roots are rare and stone and other inclusions do not occur. Colour is generally a dull brown (7.5YR 5/4), but can vary from dark reddish grey (5YR 4/2) to yellowish brown (10YR 5/6). Ranges from moderately acidic to neutral acidity.
South Creek 3 (*sc3*)–Bright brown clay	A bright brown light to medium clay with a strong pedal structure and dense smooth-faced angular blocky or polyhedral ped fabric (20-50 millimetres in size), usually presenting as a subsoil (B horizon). Occasionally contains enough levels of sand to be classified as a sandy clay. Usually whole coloured, ranging from reddish brown (3YR 4/8) to gray (10YR 5/1), with highly variable pH levels from extremely acidic to neutral. Yellow or grey mottling can occur, and may occupy up to 15per cent of material volume. Where this madeira presents as a topsoil there may be roots. Small sub rounded or sub angular gravel (2-20 millimetres) can make up to 50per cent of the volume, and no charcoal is present.

4.1.3 Landscape resources

The Blacktown soil landscape would have typically supported open-forest and open-woodland that has been extensively cleared since European contact. Originally the Blacktown soil landscape would have featured woodland and open-forest of Forest Red Gum *Eucalyptus tereticornic,* narrow-leaved Ironbark *Eucalyptus crebra,* Grey Box *Eucalyptus molucanna,* and Spotted Gum *Corymbia maculata* (Bannerman & Hazelton 1990, p.29).

Vegetation within the South Creek soil landscape reflects the soil landscapes frequent inundation, which supports common tree species such as the broad-leaved apple *Angophora subvelutina,* Cabbage Gum *Eucalyptus amplifolia,* and Swamp Oak *Casuraina glauca*. Tall spike rushes (such as *Eleocharis sphacelata, Juncus usilatus* and *Polygonum*), have the potential to occur where channels are silted. Upon elevated streambanks tall shrubland consisting of paperbarks *Melaleuca,* and tea trees *Leptospernum sp*. may also occur. However, the South Creek soil landscape has been extensively cleared, and as a direct result is now dominated by noxious weeds, such as Blackberry *Rubus vugalris* (Bannerman & Hazelton 1990, pp.68–69).

The project site likely would have provided an abundance of natural resources able to be utilised in a variety of ways by Aboriginal people. Plant 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, pp.113–114).

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. Brush-tailed Possums were highly prized for their fur and could be fashioned into a cloak (Attenbrow 2002, p.117). Native Fauna that could have been present in the area include, but are not limited to: Australian Brush Tail Possum *Trichosurus vulpecula*, Short-beaked Echidna *Tachyglossus aculeatus*, Swamp Wallaby *Wallabia bicolor*, Rainbow Lorikeet *Trichoglossus moluccanus*, Kookaburra *Dacelo novaeguineae*, Australian Magpie *Cracticus tibicen*, Water Dragon *Intellagama lesueurii*, and Eastern Blue-Tongue *Tiliqua scincoides*.

4.1.4 Land use history

The study area contains portions of the railway corridor installed in the late 1880s, and as such the surrounding areas have likely been heavily disturbed by the construction and maintenance of the rail line. Development in the Liverpool area centred on the construction of the railway line, which began construction in the early 1850s. In 1857, the single-track railway line from Granville to Liverpool, which formed part of the Main South railway line to Goulburn, was completed, with the Liverpool station opening in 1856.

From as early as 1893, it can be seen that the southern portion of the project site intersects Cabramatta Creek, crossing over the creek, via the bridge and through land grants purchased by Mitch Dwyer and Arthur Devlin. Two smaller areas further south of the southern alignment are located below the Hume highway, directly adjacent to the main southern railway. The areas to the west and east of the rail line within Warwick Farm Recreation Reserve and Jacquie Osmond Reserve were primarily used for agricultural purposes. A plan of the railway line shows that both areas are located within the Liverpool town subdivision, however does not record any structures immediately adjacent to or within the alignments (Photo 2). During the 1960s and 1990s sewer and water pipes were also constructed within the reserve. These pipes were located next to the rail corridor.

Review of geotechnical investigations undertaken approximately 10 metres from the railway line has identified silty sand fill to a depth of 30 centimetres overlying alluvial clayey sand within one geotechnical pit (TP_PB136) and silty sand/ clayey sand fill to depth of 70 centimetres overlying alluvial sandy silty clays. Geotechnical boreholes placed closer to the railway line exhibited deeper levels of disturbances due to railway construction (ABH60, ABH61 and ABH62). Conversations with the Softball association regarding drainage treatments at Jacquie Osmond Reserve (pers comms, Karen Yale GHD 2/04/2019) indicated 6 inch deep and 6 inch wide excavations had been undertaken in 20 foot long strips across the reserve, but the number and locations of these excavations could not be specified.

Over time, traffic along the rail network increased resulting in upgrades to the system, which included duplication of rail lines. The initial plans to replace existing bridges using imported iron bridges on the Main South line were cancelled due to the period of economic depression in the 1890s. As a result, the existing bridges were replaced with brick arch bridges in 1891. Around 2012, an additional bridge was constructed adjacent to the brick arch bridge to support a new track and associated infrastructure built for the South Sydney Freight Line.

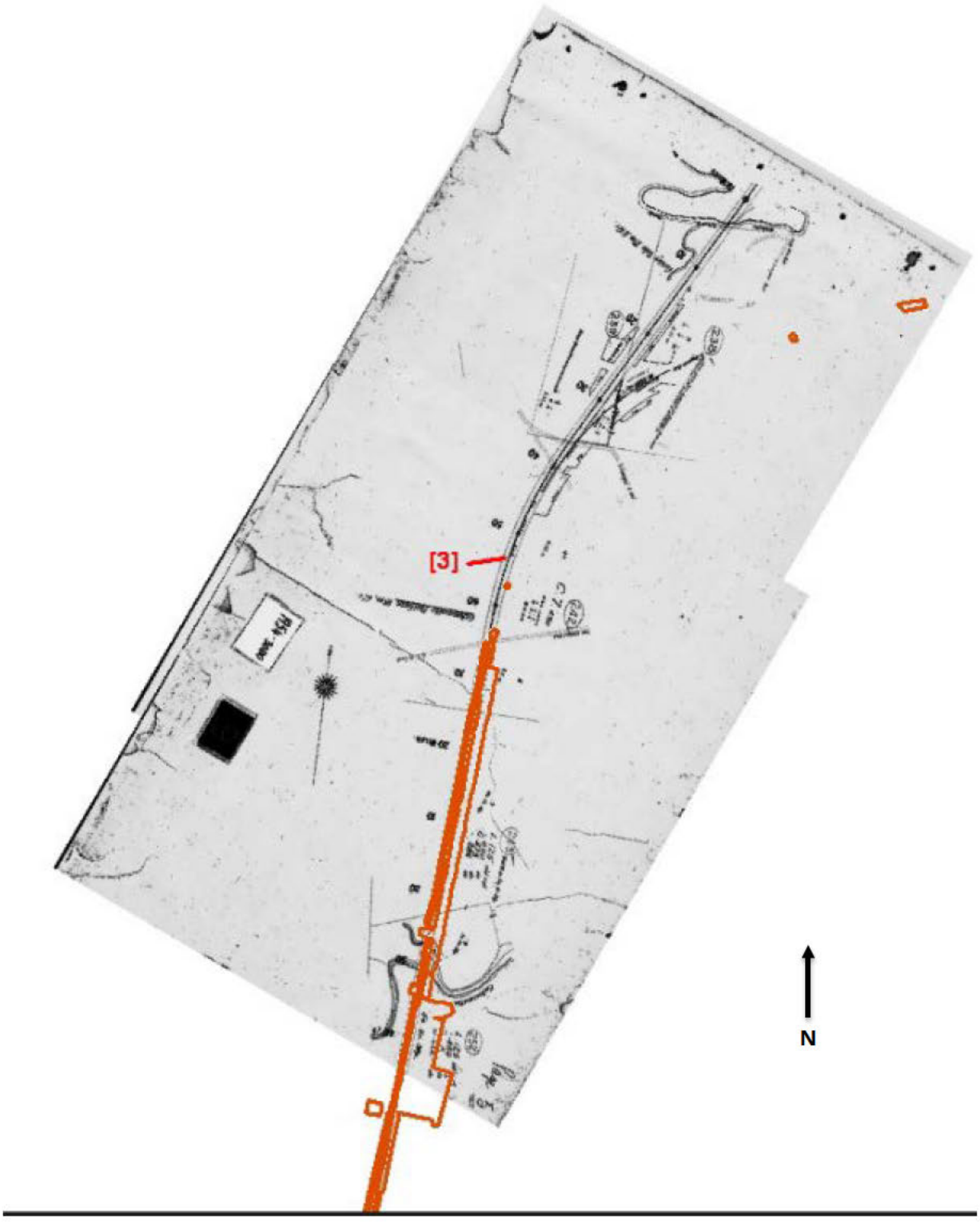
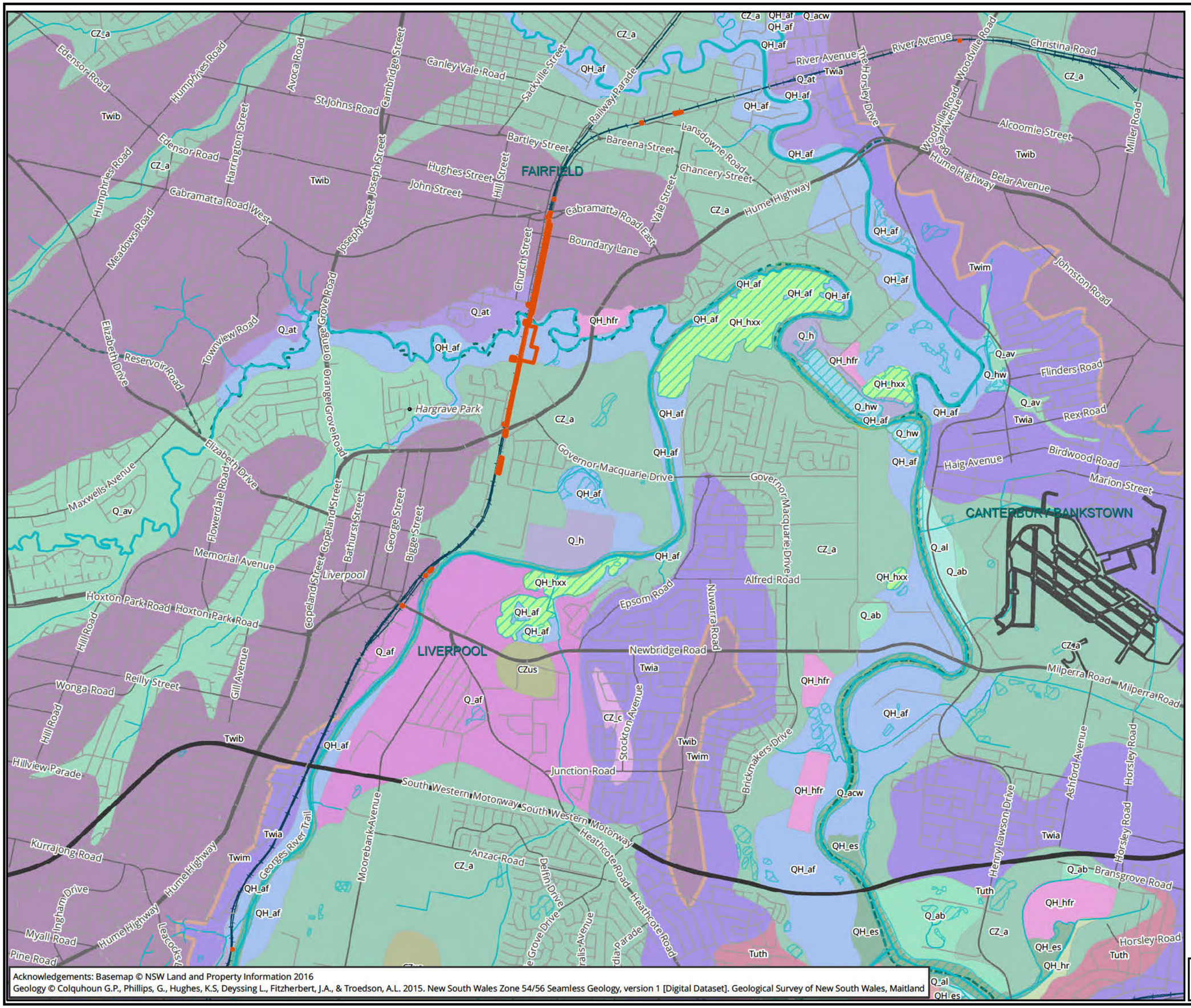


Photo 2 **Plan of the Main South Railway Line, focusing on the project site (orange outline) (Source: NSW Land Regsitry Services, Crown plan 3000)**



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Legend

Project area

Geological Units

- CZ_a - Alluvium
- CZ_ath - Alluvial terrace deposits- high-stand facies
- CZ_c - Colluvium
- CZus - Ungrouped Cenozoic sedimentary units
- Q_ab - Alluvial backswamp deposits
- Q_acw - Alluvial channel deposits-
- Q_af - Alluvial floodplain deposits
- Q_al - Alluvial levee/overbank deposits
- Q_at - Alluvial terrace deposits
- Q_av - Alluvial valley deposits
- Q_h - Anthropogenic deposits
- Q_hw - Anthropogenic stored water,
- QH_af - Alluvial floodplain deposits
- QH_es - Estuarine swamp
- QH_hfr - Anthropogenic deposits-Fill on Quaternary deposits
- QH_hr - Anthropogenic deposits-Reclaimed estuarine areas
- QH_hxx - Anthropogenic deposits-Extensive excavation of Quaternary deposits
- Tuth - Hawkesbury Sandstone
- Twia - Ashfield Shale
- Twib - Bringelly Shale
- Twim - Minchinbury Sandstone

Figure 3 Geological units within the vicinity of the project area

0 300 600 900 1,200 1,500

Metres
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 NSW Lambert

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Sydney, Newcastle, Wangaratta & Wollongong

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Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
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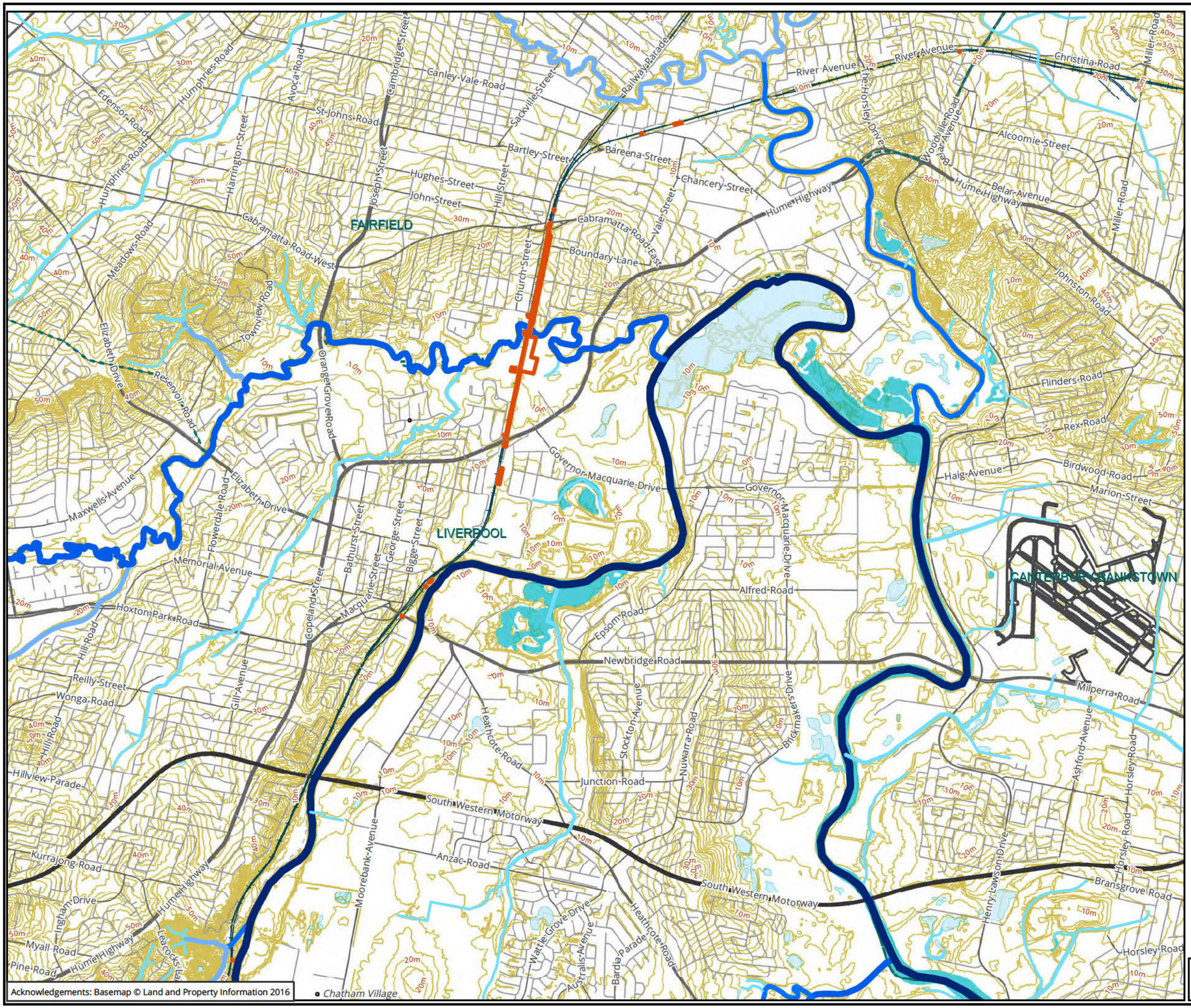

Legend

- Project area
- Contour

Hydrology

- Canal-Drain
- Natural watercourse

Strahler order

- 1
- 2
- 3
- 4
- 5
- 7

Figure 4 Topography and hydrology of the project area

0 325 650 975 1,300 1,625

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 NSW Lambert

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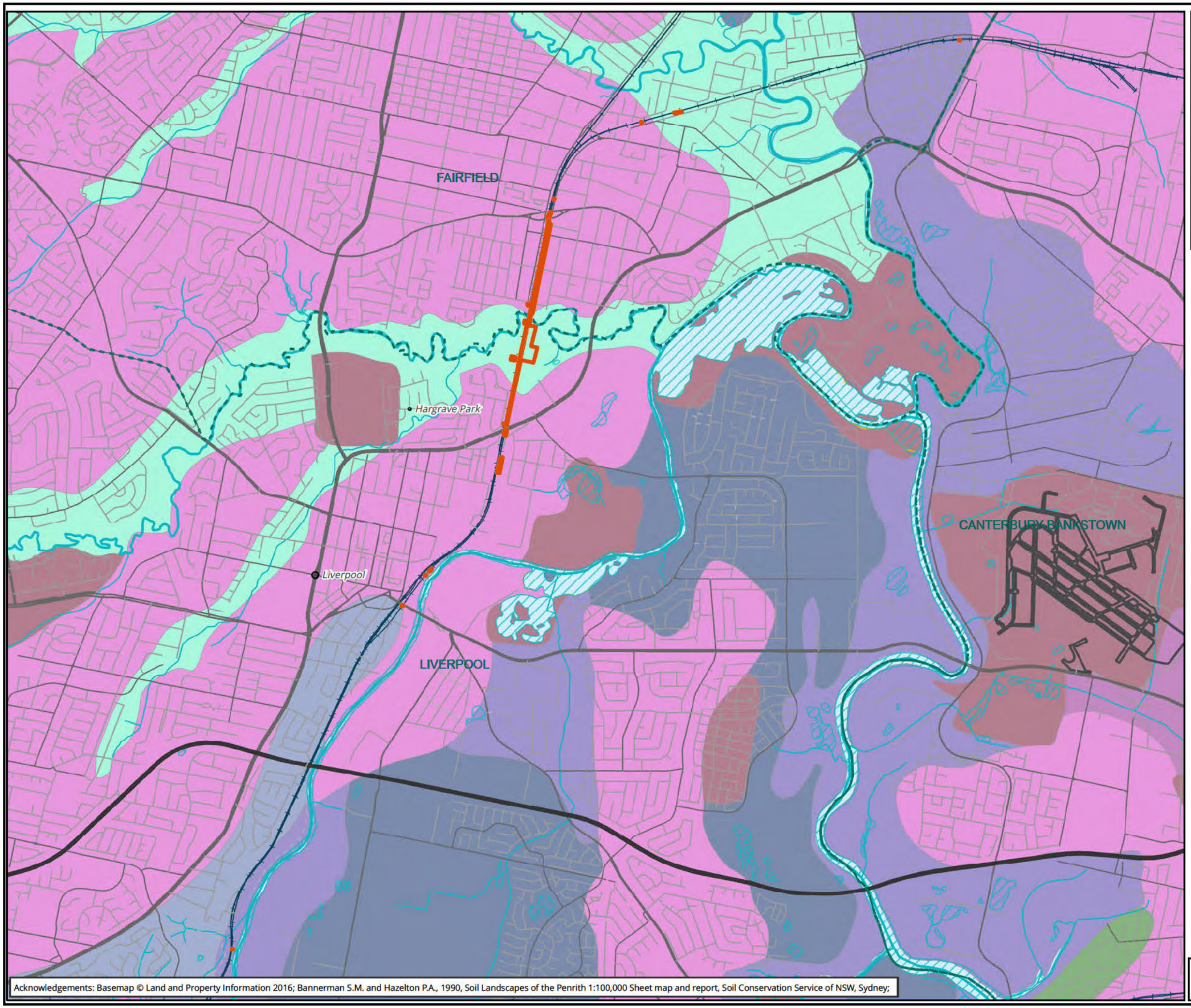

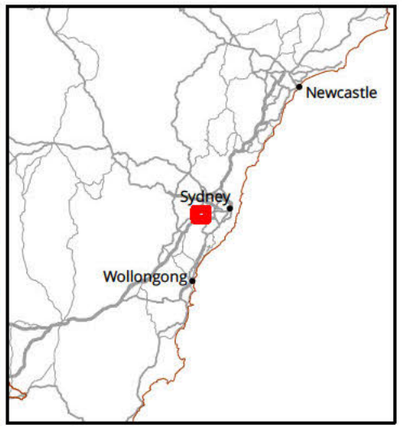

Legend

- Project area

Soil Landscape units

- bg - BIRRONG
- bp - BERKSHIRE PARK
- bt - BLACKTOWN
- lh - LUCAS HEIGHTS
- lu - LUDDENHAM
- ri - RICHMOND
- sc - SOUTH CREEK
- WATER - WATER
- xx - DISTURBED TERRAIN

Figure 5 Soil landscapes within the project area

0 300 600 900 1,200 1,500

Metres
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 NSW Lambert

N

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Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
Location:P:\27800s\27833\Mapping
27833_AR_F5_Soils

Acknowledgements: Basemap © Land and Property Information 2016; Bannerman S.M. and Hazelton P.A., 1990, Soil Landscapes of the Penrith 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney;

4.2 Previous archaeological work and ethnohistory

Archaeological evidence suggests that Aboriginal peoples have inhabited Australia for at least 50,000 years (Cooper et al. 2018). Dates of the earliest occupation of the continent by Aboriginal people are subject to continued revision as more research is undertaken. The timing for the human occupation of the Sydney Basin is still uncertain. While there is some possible evidence for occupation of the region around 40,000 years ago, the earliest known radiocarbon date for the Aboriginal occupation of the Sydney Basin is associated with an archaeological deposit at Parramatta, which was dated to 30,735 ± 407 BP (Jo McDonald Cultural Heritage Management 2005, Jo McDonald Cultural Heritage Management Pty Ltd 2005). Archaeological evidence of Aboriginal occupation of the Cumberland Plains indicates that the area was intensively occupied from approximately 4,000 years BP (Dallas 1982).

Despite a proliferation of Aboriginal heritage sites there is considerable ongoing debate about the nature, territory and range of pre-contact Aboriginal language groups present in the greater Sydney region. These debates have arisen largely because, by the time colonial diarists, missionaries and proto-anthropologists began making detailed records of Aboriginal people in the late 19th century, pre-European Aboriginal groups had been broken up and reconfigured by European settlement activity. The following information relating to Aboriginal people on the Cumberland Plains is based on such early records.

There is some confusion relating to group names, which can be explained by the use of differing terminologies in early historical references. Language groups were not the main political or social units in Aboriginal life. Instead, land custodianship and ownership centred on the smaller named groups that comprised the broader language grouping. There is some variation in the terminology used to categorise these smaller groups; the terms used by Attenbrow (2002) will be used here. The project site is in the vicinity of three language groups, Dharawal, Gundungurra and the hinterland Darug.

After the arrival of European settlers the movement of Aboriginal people became increasingly restricted. European expansion along the Cumberland Plain was swift and soon there had been considerable loss of land to agriculture. This led to violence and conflict between Europeans and Aboriginal people as both groups sought to compete for the same resources (Brookes & Associates et al. 2003, p.16). At the same time diseases such as small pox were having a devastating effect on the Aboriginal population. Death, starvation and disease were some of the disrupting factors that led to a reorganisation of the social practices of Aboriginal communities after European contact. The formation of new social groups and alliances were made as Aboriginal people sought to retain some semblance of their previous lifestyle.

4.2.1 Regional overview

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

Jo McDonald Cultural Heritage Management (2000) undertook a survey of 64 acres of land in advance of a proposed light industrial subdivision, within Erskine Park, approximately 25 kilometres distant. A review of previous archaeological investigations indicated that 17 of the 61 excavated sites upon the Cumberland Plain had no surface artefacts, and the ratio for recorded surface artefacts to subsurface was 1:25. Predictive modelling identified the potential for sites to be present in association with water sources, with the size and density increasing with stream order, with creek junctions providing a focus for activity. Other locations such as ridgetops between drainage lines also had the potential to provide evidence of occupation. The area surveyed contained first and second order drainage lines, and it was predicted that background scatters of artefacts may be associated with first order creeks, and that higher density sites signifying concentrated activities, may be identified in association with the second order creek. The survey identified nine sites,

including six artefact scatters and three isolated finds. Six of the identified sites were located on lower hillslopes, two on creek bank/lower hillslopes, and one on a creek bank/floodplain. The majority of sites were identified between 50 and 200 metres from water sources. Subsequently, sensitivity mapping was developed and it was recommended that subsurface investigation take place in areas of higher sensitivity.

Dominic Steele Consulting Archaeology (2001) carried out an assessment of three artefact scatter sites located within a 350 hectare parcel of land situated between Luddenham Road and Mamre Road at South Creek, Luddenham, approximately 30 kilometres distant. Dallas had previously surveyed the area in 1998, identifying twelve artefact scatters. Of these twelve scatters, one was located within a disturbed ford below South Creek Bridge, five were located along Cosgrove Creek, three upon the flood prone flats between Cosgrove and South Creek, and three upon the eastern edge of a ridgeline overlooking Badgerys-South Creek dam. It was noted that previous finds located upon the flats and along Cosgrove Creek, with the exception of one site, were well dispersed, and highly disturbed by water and flood action in the area. Steele determined that these low lying flood prone areas possessed low archaeological potential, where as a principle area of archaeological sensitivity was identified within the vicinity of South Creek and the former dam, with the adjacent areas north and south of this highly sensitive area possessing moderate archaeological potential. Two silcrete quarrying sites had also been identified along South Creek. Steele argues that the available evidence suggests that the confluence of various creek lines within the vicinity of the 350 hectares of land represents a focus of Aboriginal land use and occupation.

Jo McDonald Cultural Heritage Management (2006) completed an Aboriginal archaeological assessment of the Western Sydney Parklands of Bungarribee precinct and interface lands, as part of the Western Sydney Region Parklands Project, approximately 10 kilometres distant. Predictive modelling indicated that Aboriginal sites are likely to occur in various densities across the Cumberland Plain. Areas of archaeological potential are more likely to occur in areas where limited disturbance has occurred. It was also concluded that the absence of surface artefacts does not support an absence of subsurface deposits. A survey of the Western Sydney Parklands identified a total of 52 sites, 18 of which were previously unrecorded, and five of which were defined as area possessing potential archaeological deposit (PAD). Of these sites, 22 possessed moderate or high archaeological potential. McDonald argues that the continuous presence of surface artefact sites within the project site suggests that these sites are exposures of more extensive subsurface deposit.

Australian Museum Business Services (AMBS) (2012) conducted a wide ranging report, assessing the entirety of the Austral and Leppington North precincts for the Urban Form Analysis of the South West Growth Centres, approximately 18 kilometres distant. Although surveys were targeted at specific properties which at the time represented accessible properties, the results of the survey were combined with the existing regional model and a review of studies within the local area in order to produce sensitivity mapping for the entirety of the Austral and Leppington North precincts. The predictive model employed by AMBS stated that the most common site type occurring in the area would be stone artefacts scatters, and that undisturbed alluvial soils have the potential to be associated with stratified archaeological deposits. The results of the survey largely confirmed this predictive model, with AMBS identifying seven new sites including six isolated finds and one artefact scatter/ PAD.

4.2.2 Local overview

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

Denis Byrne & Hilary du Cros (1985) undertook an assessment for the Open Space Project of Prospect Creek located approximately 5 kilometres north-west of the project site, between Windemere Road and Fairfield Street on behalf of EBC Consultants Pty Ltd. Prospect Creek, is similar to Cabramatta Creek in that it is

situated within a low lying area with soils that consist of clay loam soils that are characteristic of the Triassic Wianmatta Group shales. These soils have then been overlaid by alluvium deposits along the extent of the creek lines. Predictive modelling for Prospect Creek indicated that artefact scatters were likely to occur along creek lines within the Cumberland Plains, however it was argued that these sites are likely to have been disturbed or destroyed by recent human and natural activity in the area. The survey identified nine isolated artefacts. These isolated finds were considered to be within a secondary context, given the disturbed context in which they were identified, and were likely previously part of low density artefact scatters. The lack of identification of intact archaeological sites was attributed to the history of ground disturbance along Prospect Creek, and the limited ground visibility throughout most of the surveyed area.

Central West Archaeological & Heritage Services (2002) completed an Aboriginal archaeological assessment of 7 kilometres of pipeline between Hoxton Park Release Areas and Liverpool Sewage Treatment Plant. The survey was carried out across areas of disturbed creek banks, upon alluvial floodplains and adjacent plains, and within predominately disturbed road corridors and areas of dense urban development. Alluvial floodplains were identified via predictive modelling to be areas of high archaeological sensitivity. However, it was determined that it was unlikely for sites to be identified upon floodplains within the proposed pipeline corridor, due to high levels of disturbance, and the flood prone nature of these areas. No Aboriginal sites were identified during the survey. Two areas where little disturbance had occurred were recommended from monitoring along the northern and southern banks of Cabramatta Creek, Hoxton Park, adjacent the Hinchinbrook Creek junction; and the norther bank and alluvial terrace at the second creek crossing of Cabramatta Creek, located approximately 400 metres east of Hinchinbrook Creek.

Cultural Heritage Connections (2006) was commissioned by Parsons Brinckerhoff to conduct an Aboriginal archaeological assessment of the proposed SSFL. This assessment incorporated a portion of the current study area located along the rail corridor and Jacquie Osmond Reserve. The assessment included a detailed desktop assessment and a visual inspection of areas identified during the desktop assessment as having low levels of previous disturbance. The desktop assessment and visual inspection determined that the rail corridor was highly disturbed and Aboriginal cultural values are unlikely to be present within the existing corridor. The visual inspection identified two Aboriginal archaeological sites (SSFL 1 and SSFL 2). The assessment determined that the proposed works would not impact on these sites. The site inspection conducted at Cabramatta Creek determined that the creek crossing at this location had been highly disturbed and no Aboriginal archaeological potential remained (Photo 3).

Photo 3 Area along Cabramatta Creek Surveyed by Cultural Heritage Connections (2006)

Haglund & Associates Pty Ltd (2007) undertook archaeological test excavations of areas of PAD for the proposed extension of road reserve Horsley Drive, between the M7 and Cowpasture Road. A survey conducted by B. Oakley in 2005 did not identify any surface sites due to low levels of surface visibility, however it was determined that the area proposed for the extension of the road reserve contained five areas of PAD. Six areas were tested as part of the assessment. Of the six areas tested, three were assessed to have little or no archaeological or cultural significance, with a further two possessing moderate to low significance, with no potential for further information to be obtained. One area was assessed to have moderate archaeological significance, and though disturbed to some extent the site was recommended for further salvage. Most of the areas that were tested were highly disturbed by earthworks, cultivation activities, and development. It was concluded that the area was likely to have been utilized for transitional activities, with the potential for repetitive occupation nearby Eastern Creek.

Australian Museum Business Services (AMBS) (2008) were commissioned by Parsons Brinckerhoff Australia Pty Ltd to undertake a preliminary cultural heritage assessment for the Rosehill Recycled Water Scheme. Twenty kilometres of pipeline which extended between Fairfield, Smithfield and Camellia in western Sydney were assessed. AMBS stated that investigations within the local and regional contexts demonstrated that the presence of archaeological objects on the ground surface are not reliable indicators of subsurface potential. It

has also been demonstrated in previous assessments that areas adjacent to creek lines are culturally sensitive areas. Fairfield Park, located 2.6 kilometres north-east of the proposed pipeline, was determined to have low archaeological potential. The assessment concluded that parklands and creek lines along the proposed route have the potential to contain physical evidence of Aboriginal occupation, and surveying would need to be undertaken to assess archaeological significance.

Artefact Heritage Services (2011) undertook a Aboriginal due diligence assessment on behalf of Endeavour Energy, at Light Horse Park, Liverpool, located approximately 2.8 kilometres south-west of the project site. One low density artefact scatter and Collingwood Precinct Aboriginal Place had been previously identified within the vicinity of Light Horse Park. It was noted that the proximity of Georges River to Light Horse Park would have made the area favourable for Aboriginal occupation. However, due to levels of subsurface disturbance within the proposed feeder route, it was predicted that though there was the potential for subsurface artefact sites to be present below fluvial deposits, it is unlikely that these sites have remained intact within the development zone. No Aboriginal sites were identified during the survey, and the park was assessed as having low archaeological potential and significance.

Biosis Pty Ltd (2018) undertook an Aboriginal heritage assessment for building upgrades to Canley Vale High School located approximately 1.6 kilometres north-east of the project site. A survey of the site identified an area of moderate archaeological potential upon an upper creek terrace that abutted the southern extent of Orphan School Creek. Several sites had been previously identified along the extent of Orphan School Creek, and consisted of artefact and modified tree sites. Subsurface test excavations were undertaken in the western portion of the PADs extent where impact was proposed. No artefacts were identified during the test excavations. Soils within the test pits excavated displayed evidence of intensive disturbance. It was determined that the potential for intact Aboriginal sites to occur within the PAD extent was low.

4.2.3 AHIMS site analysis

A search of the AHIMS database (Client Service ID: 506217) identified 94 Aboriginal archaeological sites and 1 Aboriginal place within a 7 kilometre search radius centred on the proposed study area. None of these registered sites are located within the study area (Figure 6). AHIMS search results are provided in Appendix 1. Table 10 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 106 results presented here, compared to the 94 sites identified in AHIMS.

Table 9 AHIMS site type frequency

Site type	Number of occurrences	Frequency (%)
Artefact	49	46.22
Modified trees (scarred or engraved)	30	28.30
PAD	25	23.58
Aboriginal resources and gathering	1	0.09

Site type	Number of occurrences	Frequency (%)
Shell	1	0.09
Total	**106**	**100.00**

A simple analysis of the Aboriginal cultural heritage sites registered within the 7 x 7 kilometre buffer of the study area indicates that Artefact sites are the most common featured 46.22% (n=49) of the sample. Modified trees and PAD are of a similar count, being 28.3% (n=30) and 23.58% (n=25) respectively. Least represented are Aboriginal resource and gather and shell sites which both account for only 0.09% (n=1) each.

The dominance of artefact sites is unsurprising. Artefact scatters and isolated lithic sites are some of the most common site types recorded on the Cumberland Plain. The large amount of modified trees recorded is likely the result of large water systems within the vicinity of the study area. These would have supported large trees suitable for Aboriginal use as well as being attractive places for Aboriginal habitation. Likewise, the land use history of the surrounding area is largely rural until late in the 19th century. As a result, remnant trees may have been preserved compared to areas further east.

Figure 6 AHIMS Search Results
THIS FIGURE HAS NOT BEEN INCLUDED AS IT CONTAINS RESTRICTED INFORMATION

4.3 Discussion

A review of previous archaeological studies within the region and locality of the project site in correlation to the landscape context of the project site has assisted in the formulation of a predictive statements applicable for the purpose of this assessment. Previous investigations have determined that artefact, PAD and modified tree sites are the most likely site types to occur within the project site provided low levels of disturbance are present.

Predictive modelling for conducted for the region indicate that artefact scatters were likely to occur along creek lines within the Cumberland Plains, however it was argued that these sites are likely to have been disturbed or destroyed by recent human and natural activity in the area (Byrne & du Cros 1985). Central West Archaeological & Heritage Services (2002) identified that undisturbed areas within alluvial floodplains were areas of high archaeological sensitivity. Based on the background research undertaken there is potential that undisturbed alluvial plains landforms could be present within areas along Cabramatta Creek such as Jacquie Osmond Reserve or Warwick Farm Recreation Reserve.

The vast majority of the project site has been subject to high levels of previous ground disturbance due to the construction and ongoing maintenance of the rail line, along with residential development and the construction of roads and various infrastructure services. Aboriginal objects or sites are therefore unlikely to occur within the rail corridor, or other areas of previous disturbance within the project site.

Areas located outside of the rail corridor, within Warwick Farm Recreation Reserve have demonstrated evidence of subsurface archaeological deposits as evidenced by the archaeological excavations conducted by Therin in 2007. Proposed works are located within the vicinity of these deposits, at Warwick Farm Recreation Reserve and Jacquie Osmond Reserve, suggesting there is potential that these deposits may be impacted. Background research outlined in section 4.1.4 including review of historical plans and research, geotechnical reports and personal communications conducted for the project site indicates that Warwick Farm Recreation Reserve has been subject to relatively low levels of previous disturbance. This background research indicates that Jacquie Osmond Reserve has been subject to moderate levels of previous ground disturbance.

Review of geotechnical investigations have indicated that disturbances were present in Jacquie Osmond Reserve in close proximity to the rail corridor. Personal communications with the Jacquie Osmond Softball Association have also indicated 6 inch deep and 6 inch wide excavations had been undertaken in random 20 foot long strips across the reserve, but the number and locations of these excavations could not be identified. It is also unlikely that these works have impacted the entire Reserve and the ambiguity of the information makes it impossible to determine where possible disturbances are located. As a result sub-surface archaeological deposits are considered likely to occur across these areas.

4.3.1 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 project site and where they are more likely to be located.

These statements have been based on:

- Aboriginal site distribution in relation to landscape descriptions within the project site.
- Consideration of site type, raw material types and site densities likely to be present within the project site.
- Findings of the ethnohistorical research on the potential for material traces to present within the project site.
- Potential Aboriginal use of natural resources present or once present within the project site.

- Consideration of the temporal and spatial relationships of sites within the project site and surrounding region.

Table 10 below indicates the site types most likely to be encountered across the project site. The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the project site.

Table 10 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 50 metres of the project site; they have high potential to be present in undisturbed areas within the project site.
Potential archaeological deposits (PADs)	Potential sub surface deposits of cultural material.	Moderate: PADs have been previously recorded in the region across a wide range of landforms including alluvial flats. PAD sites have been previously recorded within 50 metres of the project site. They have the potential to be present in undisturbed landforms.
Modified trees	Trees with cultural modifications	Moderate: Modified trees have been previously recorded in the region have the potential to be present on mature native trees. Due to extensive vegetation clearance only a small number of mature native trees have survived within the project site therefore there is only moderate potential they will be present.
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 project site. There is some potential for shell middens to be located in vicinity of permanent water sources. There is a low potential of Shell Middens being present within the project site.
Quarries	Raw stone material procurement sites.	Low: There is no record of any quarries being within or surrounding the project site.
Axe grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	Low: The geology of the project site lacks suitable horizontal sandstone rock outcrops for axe-grinding grooves. Therefore there is low potential for axe grinding grooves to occur in the project site.

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 project site are not commonly associated with burials.
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 project site.
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 project site.
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 project site 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 project site. There is one Aboriginal place located in the vicinity of the project site

5 Archaeological survey

A field investigation of the project site was undertaken on 6 December 2018, attended by Taryn Gooley (Heritage Team Leader/Senior Archaeologist, Biosis). The inspection sampling strategy, methodology and a discussion of results are provided below.

5.1 Archaeological survey objectives

The objectives of the survey were to:

- Attempt to re-identify Aboriginal archaeological sites and/or Aboriginal places previously identified in the project site.
- Undertake a pedestrian survey of the project site targeting all areas with the potential for Aboriginal heritage.
- Identify and record Aboriginal archaeological sites visible on the ground surface.
- Identify and record areas of PADs.

5.2 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 or has the potential to exist within the project site.

5.2.1 Sampling strategy

The survey effort targeted areas of the project site located outside of the established rail corridor and which had been found to contain low levels of disturbance during background research as these areas were more likely to contain Aboriginal sites that may be impacted. These areas included Jacquie Osmond Reserve and Warwick Farm Recreation Reserve.

The survey consisted of a single transect following the random meander technique which targeted areas of exposure and higher surface visibility in order to identify any areas of archaeological potential or Aboriginal objects and sites. All areas identified as displaying low levels of disturbance and therefore likely to contain Aboriginal sites were targeted by the meandering transect.

5.2.2 Survey methods

The archaeological survey was conducted on foot by one archaeologist. Recording during the survey followed the archaeological survey requirements of the Code and industry best practice methodology. Information recorded during the survey included:

- Aboriginal objects or sites present in the project site during the survey.
- Survey coverage.
- Any resources that may have potentially have been exploited by Aboriginal people.
- Landform.
- Photographs of the site indicating landform.
- Evidence of disturbance.

- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the project site was undertaken. Photographs and recording techniques were incorporated into the survey including representative photographs of survey units, landform, vegetation coverage, ground surface visibility (GSV) and the recording of soil information for each survey unit were possible. 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 (GPS) and the Map Grid of Australia (MGA) (94) coordinate system.

5.3 Field investigation results

Due to the high levels of previous ground disturbance and the level of urban development within the remainder of the project site, the field investigation focused on Warwick Farm Recreation Reserve and Jacquie Osmond Reserve. Background research identified these areas as most likely to contain potential Aboriginal sites. One random meandering transect targeting areas likely to contain Aboriginal sites based on background research was undertaken. AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 were also inspected during the field investigation (Figure 7, Photo 4 and Photo 5).

Generally the survey was hampered by poor GSV and exposures due to grass cover and disturbances. Overall GSV and exposure across the project site was approximately 10% with isolated areas of high visibility present in areas of exposure (Photo 6).

No Aboriginal objects or modified trees were identified during the survey. The two previously recorded AHIMS sites identified in the background research could not be relocated during the survey due to low GSV across Warwick Farm Recreation Reserve and Jacquie Osmond Reserve. The area to the west of the rail line within Warwick Farm Recreation Reserve was assessed as having high archaeological potential due to the presence of previously recorded AHIMS sites with demonstrated archaeological deposits, and low levels of previous ground disturbances observed. It is likely that further subsurface archaeological deposits exist within the undisturbed areas within Warwick Farm Recreation Reserve.

The area to the east of the existing rail line within Jacquie Osmond Reserve displayed higher levels of disturbance and was assessed as having moderate archaeological potential (Figure 7). Jacquie Osmond Reserve displayed evidence of superficial ground disturbance associated with the establishment of baseball playing fields that may have caused some disturbance to topsoils. Personal communications with the Softball Association also indicated that an unknown number of 6 inch deep and 6 inch wide trenches had been placed randomly across the fields, although the locations of these trenches was unknown.

The field investigation and the background research conducted for the project site did not suggest that activities such as bulk earth works or removal of soils have occurred in Jacquie Osmond Reserve (refer to section 4.2). Previous archaeological investigations in the area demonstrate that alluvial flats within close proximity to higher order waterways have high potential to contain subsurface archaeological deposits. It is therefore likely that Aboriginal objects exist within this area, however, they may be in a disturbed context.

Areas of significant disturbances identified within the project site included a previously cleared laydown area, a modified drainage line, access tracks adjacent to the rail line, the rail line and bridge crossing, and a large asphalted area on the eastern side of the rail line (Photo 7 and Photo 8). The creek line immediately around the bridge crossing is highly disturbed from bridge and rail construction. These areas of disturbance have been assessed as having low archaeological potential (Figure 7).

Photo 4 AHIMS 45-5-3271/CC1 facing north east

Photo 5 AHIMS 45-5-3428/CC1 facing east

Photo 6 **Photo showing low ground surface visibilty with an isolated area of exposure where grass has not grown (orange arrow).**

Photo 7 **Disturbances along rail corridor**

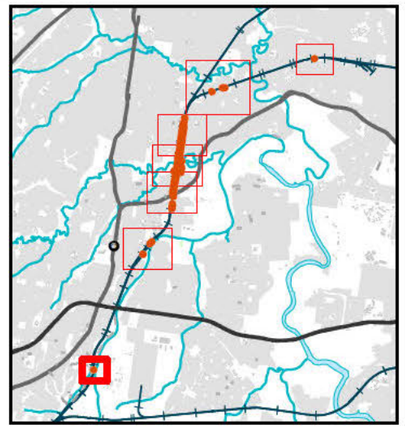
Photo 8 Disturbances along rail corridor

Table 11 Survey coverage

Survey unit	Landform	Survey unit area (m²)	Visibility per cent	Exposure per cent	Effective coverage area (m²)	Effective coverage per cent
1	Alluvial flat	160500	10	10	1605	1

Table 12 Landform summary

Landform	Landform area (m²)	Area effectively surveyed (m²)	per cent of landform effectively surveyed	Number of Aboriginal sites	Number of artefacts or features
Alluvial flats	160500	1605	1	2	0



Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.1 Field investigation results

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,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 27833
Date: 28 March 2019,
Checked by: TLG, Drawn by: AEDM, Last edited by: amurray
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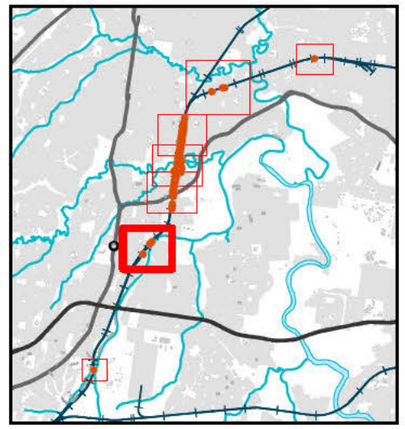

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.2 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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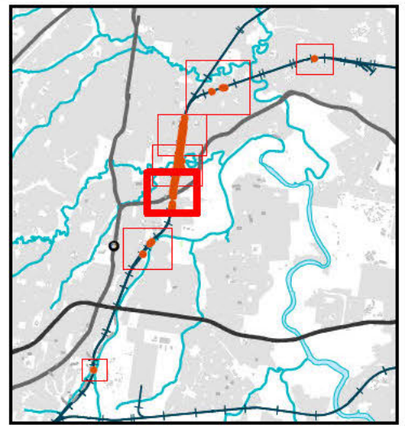

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.3 Field investigation results

0 30 60 90 120 150

Metres

Scale: 1:4,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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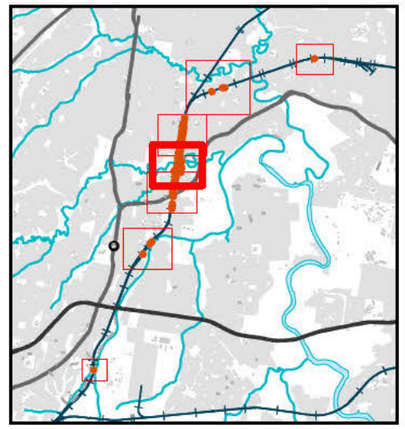

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.4 Field investigation results

0 25 50 75 100 125

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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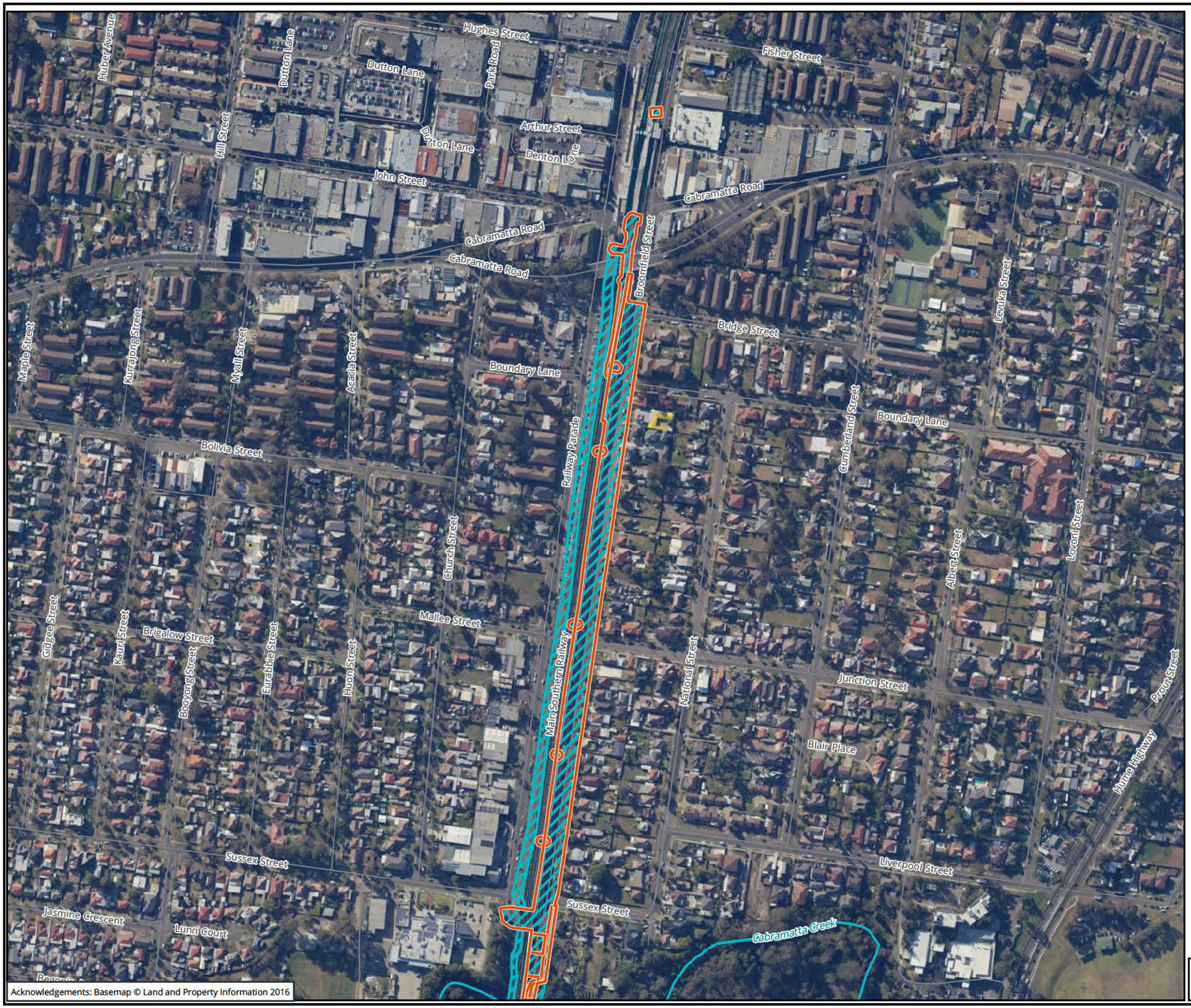

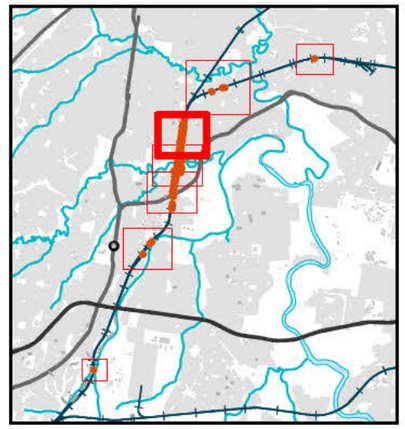

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.5 Field investigation results

0 30 60 90 120 150

Metres

Scale: 1:4,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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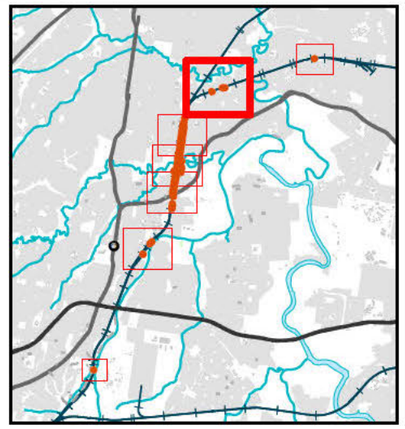

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.6 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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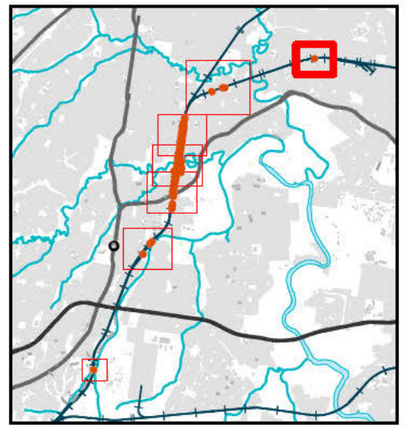

Legend

- Project area

Archaeological potential

- High
- Moderate
- Disturbance

Figure 7.7 Field investigation results

0 10 20 30 40 50

Metres

Scale: 1:1,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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6 Test excavations

Following the results of the field investigation, a test excavation program was undertaken to characterise the extent, nature and archaeological (scientific) value of Aboriginal cultural heritage within the area of moderate archaeological potential in Jacquie Osmond Reserve.

These test excavations were undertaken from the 5 May 2020 to the 12 May 2020 and were attended by Biosis representatives Ashleigh Keevers Eastman, Matthew Tetlaw, Matthew Smith, and Maggie Butcher.

Representatives from the RAPs also attended the test excavations from the 5 May to 12 May 2020 and included Gandangarra LALC, Murra Bidgee Mullangari, Darug Custodian Aboriginal Corporation and Kamilaroi Yankunjatjara Working Group.

The sampling strategy, methodology and results of the test excavation program are discussed below.

6.1 Research questions

Research questions provide a framework for undertaking sub-surface investigations and ensure that the information collected during the sub-surface testing program contributes to the knowledge of the sites and the broader archaeological record. Research questions include:

- *Do non-disturbed or minimally disturbed soil profiles exist within the area of moderate archaeological potential?*
- *Can the study area be accurately classified with reference to the two AHIMS sites (AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1) located to the north-west of the study area in the now identified area of high archaeological potential?*
- *What are the extent and nature of any archaeological deposits (if present) within the area of moderate potential.*
- *How does the character of archaeological deposit within the study area (if present) inform the scientific understanding of Aboriginal occupation and land use models for the region?*

6.2 Test excavation methodology

Test excavations within the study area conformed to the project methodology approved by RAPs and outlined below:

- Test excavations were undertaken within areas of moderate potential identified by the archaeological survey. This area of moderate potential is located within a portion of Lot 2 DP 250138 at the Jacquie Osmond Reserve, Warwick Farm (Figure 1).
- Test excavations 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 a site or PAD area was excavated in five centimetre spits; the subsequent test pits conducted within the site or PAD area were excavated in either 10 centimetre spits or

stratigraphic units (whichever is smaller) to the base of Aboriginal object-bearing units being the removal of the A-horizon soil deposit down to the sterile clay or bedrock layer (B-horizon).

- If the depth of deposit prevents reaching sterile deposits within the 50 by 50 centimetre test pit, additional 50 by 50 centimetre test pits may be excavated adjacent to the original test pit (for example expanding the test pit to 50 by 100 centimetres) to reach the sterile deposits.
- Test pits were 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 (three metre^2).
- The code dictates 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 five millimetre sieves.
- All cultural material was collected, bagged and clearly labelled. They are being temporarily stored in the Biosis office at (Unit 8, 27 Annie Street, Wickham NSW).
- For each test pit that is 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 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 will immediately cease and the NSW Police and Heritage NSW will be notified.

6.3 Test excavation results

A total of 26 test pits were excavated across seven transects, in the area of moderate potential within a portion of Lot 2 DP 250138 at the Jacquie Osmond Reserve, Warwick Farm. These test excavations identified subsurface artefacts in transects 7, 11 and 12. In total, eight artefacts were uncovered. A small error in data collection resulted in the mislabelling of transects. Transect numbering begins at six.

Individual test pit and soil analysis results are provided in Appendix 2. Results are shown in Table 13 and a detailed discussion of results is provided below.

Table 13 Test excavation results

Site	Landform	Area (m^2)	Area tested (m^2)	Area effectively tested (%)	No. of sites	No. of artefacts
Jacquie Osmond AS1	Flat	21442	6.5	0.002	1	8

6.3.1 Transect 6

As noted above a small error in data collection resulted in the mislabelling of transects. Transect numbering begins at six, therefore transects are numbered six to 12. A total of three test pits were excavated within transect 6 at a distance of 40 metre intervals. Test pits reached maximum depths of 1000 millimetres each. No artefacts were identified within this transect.

The stratigraphic profiles across the test pits were quite diverse. Pit 1 (Photo 9, Photo 10) was relatively homogenous, featuring dark brown softly compacted sandy loam (7.5YR 3/2) in the first two spits (0-200 millimetres) transitioning to brown softly compacted sandy loam within spits 3 and 4 (200–400 millimetres). This was followed by dark greyish brown moderately compacted silty clay (10YR 4/2) within spits 5 to 7 (400–700 millimetres). The pH level across the spits remains neutral (pH 6.5–6). Disturbances such as glass and ceramic were present in spits 1 to 3 (0–300 millimetres) and grass root inclusion were noted in spits 1 to 4 (0–400 millimetres).

The first spit (0–100 millimetres) of test pit 2 contained a grey (5YR 5/1) soft loamy sand, while spits 2 and 3 (100–300 millimetres) contained a very dark grey (5YR 3/1) soft loamy sand, with spit 3 (200–300 millimetres) also transitioning into a yellowish red (5YR 5/8) soft loamy sand. Spits 4 to 7 (300–700 millimetres) contains reddish yellow (5YR 6/6) soft loamy sand with 20% mottled red (2.5YR 5/8) speck inclusions. Spits 8 to 10 (700–1000 millimetres) remain the same colour with the same inclusions, however the soil texture transitions onto a soft clayey sand. The pH varies across the spits, beginning with alkaline soil in spit 1 (pH 8), followed by neutral (pH 6.5) in spit 2 (100–200 millimetres) and increasingly alkaline (pH 7.5 to 8.5) from spits 2 to 10 (100–1000 millimetres). No disturbances were identified in pit 2.

Within test pit 3, the first spit (0–100 millimetres) contained very dark greyish brown (10YR 3/2) silty sandy loam. Soil transitioned into a strong brown (7.5YR 4/6) silty clay in spit 2 (100–200 millimetres), followed by a very dark greyish brown (10YR 3/2) silty sandy loam with 5% charcoal inclusions and 10% iron stone nodules within spit 3 (200–300 millimetres). Spits 4 to 5 (300–500 millimetres) contained yellowish brown (10YR 5/4 silty sand with the same inclusions, followed by spit 6 that transitions into a strong brown (7.5YR 4/6) clayey silt with 2% charcoal and 5% ironstone inclusions. Strong brown (7.5YR 4/6) silty clay with the same inclusions is seen in spit 7 (600–700 millimetres) and transitions into clayey silt in spit 8 (700–800 millimetres). Spits 9 and 10 contain strong brown (7.5YR 4/6) clayey silt to silty clay. The pH levels transition from neutral (pH 6) within spit 1 (0–100 millimetres) to alkaline (pH 8) in spit 2 (100–200 millimetres) and return to neutral (pH 6 to 7) from spits 3 to 6 (200–600 millimetres). Spits 7 to 10 (600–1000 millimetres) increase in alkalinity (pH 7.5 to 8). Grassroots were recorded within all spits (0–1000 millimetres).

Photo 9 Transect 6 Pit 1

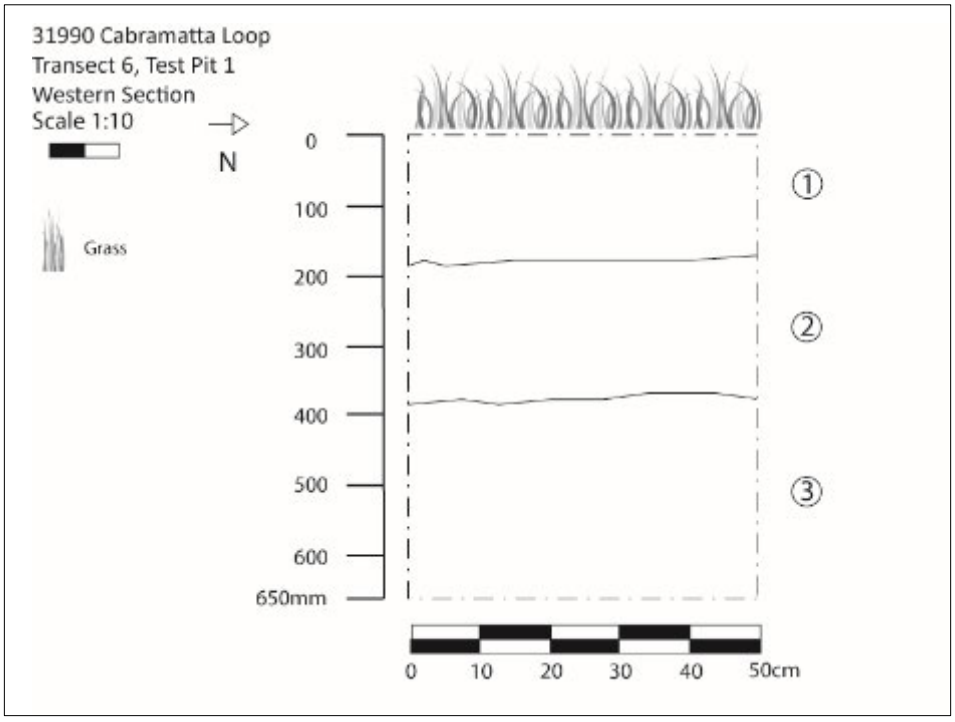


Photo 10 Transect 6 Pit 1 section drawing showing the three soil contexts present (1), (2), and (3)

6.3.2 Transect 7

Transect 7 originally contained three test pits which were excavated at 40 metre intervals due to a lack of cultural material identified across the study area.

Soil depths within this portion of the study areas varied. Pit 1 was excavated to a depth of 700 millimetres before finishing on brown (10YR 4/3) clay. Soil depths extended within Pit 2 to a depth of 1060 millimetres. No basal layer was reached. Pit 3 was originally excavated to a depth of 1000 millimetres, however a basal layer had not been reached. It was therefore decided that as a single artefact had been identified within spit 2 (100–200 millimetres) of pit 3, pit 3 was to be expanded to allow for the exploration of the deposit, and to determine whether a basal layer could be reached. Due to safety concerns regarding the depth of the pit, Pit 3 was expanded to a 1 x 1 metre square area (pits 3.1, 3.2 and 3.4). Pits 3.1, 3.2 and 3.3 were excavated to a maximum depth of 700 millimetres, and pit 3 was excavated to a depth of 1500 millimetres. A basal layer was not reached, and safety restriction prevented Biosis from excavating the pit further.

The soil stratigraphy varied greatly throughout transect 7. Pit 1 contained black (5YR 2.5/1) soft sandy silty loam within spit 1 (0–100 millimetres), followed by a very dark greyish brown (10YR 3/2) to soft clayey silty loam with 1% 10 millimetre charcoal inclusions within spits 2 to 3 (100–300 millimetres). Spit 4 (300–400 millimetres) contained brown (7.5YR 4/4) moderately compact clayey silt with the same inclusions, transitioning to greyish brown (10YR 5/2) moderately compacted silty clay with decreasing ironstone content within spit 6 and 7 (500–700 millimetres). The pH ranged from neutral (pH6) within spits 1 to 5 (0–500 millimetres) to alkaline within the remaining spits (500–700 millimetres). Grass roots were present in all spits (0–700 millimetres).

Pit 2 contained a dark brown (7.5YR 3/2) moderately compacted silty sandy loam within spit 1 (0–100 millimetres). Spits 2 and 3 (100–300 millimetres) contained brown (7.5YR 4/3) moderately compacted clayey silt to yellowish brown (10YR 5/4) sandy silt. Spits 4 to 7 remain consistently 10YR 5/4 yellowish brown moderately compacted sand. The pH ranged from neutral (pH 6–6.5) in spits 1 and 2 (0–200 millimetres) to alkaline (pH 8–8.5) from spits 3 to 7 (200–700 millimetres). Grass roots were present throughout all spits.

Stratigraphy for Pits 3, 3.1, 3.2 and 3.3 (Photo 11, Photo 12, Photo 13, Photo 14) were consistent. With spits 1 to 8 containing soft sandy loam transitioning in colour from grey (5YR 5/1) in spits 1 to 3 (0–300 millimetres) to reddish yellow (5YR 6/6) within spits 4 to 7 (300–700 millimetres). Pit 3 extended to a maximum depth of 1.5 metres, with spits 8 to 15 (700–1500 millimetres) consisting of reddish yellow (5YR 6/6) soft clayey sand. All spits contained 20% red (2.5YR 5/8) mottled speck inclusions. pH also displays consistency throughout the pits starting with a neutral (pH 6) spit 1 and 2 (0–200 millimetres), followed by alkaline (pH8.5) spits 3 to 15 (200–1500 millimetres). Two artefacts were recovered from this 1 x 1 metre open area, one silcrete medial fragment in spit 2 (100–200 millimetres) of pit 3.2 and one silcrete angular fragment in spit 2 of pit 3.

Photo 11 Transect 7 Pit 3

Photo 12 Transect 7 Pit 3.1 (right), 3.2 (center) and 3.3 (left)

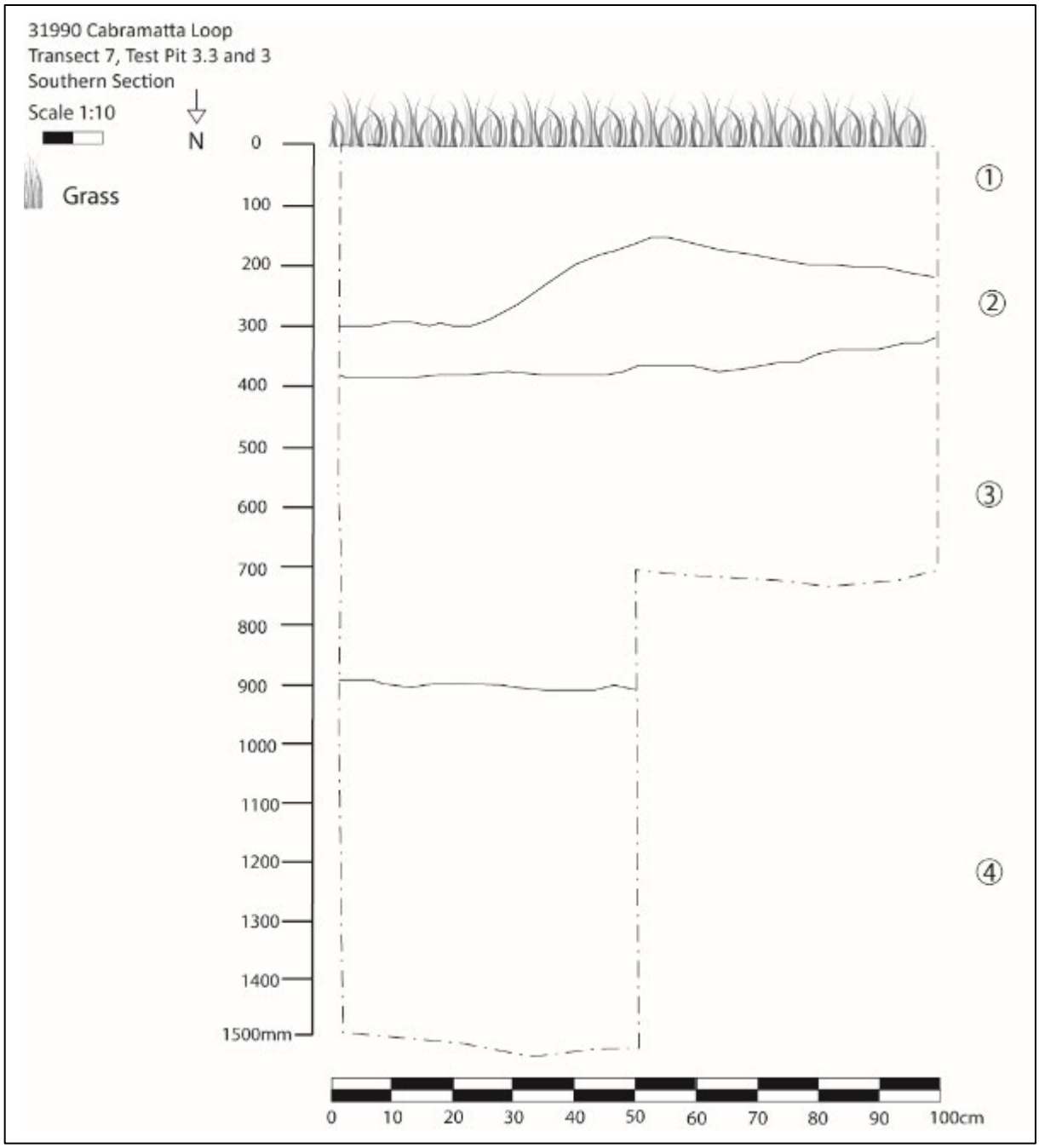


Photo 13 Transect 7 pit 3 and 3.3 section drawing showing the four soil contexts present (1), (2), (3) and (4)

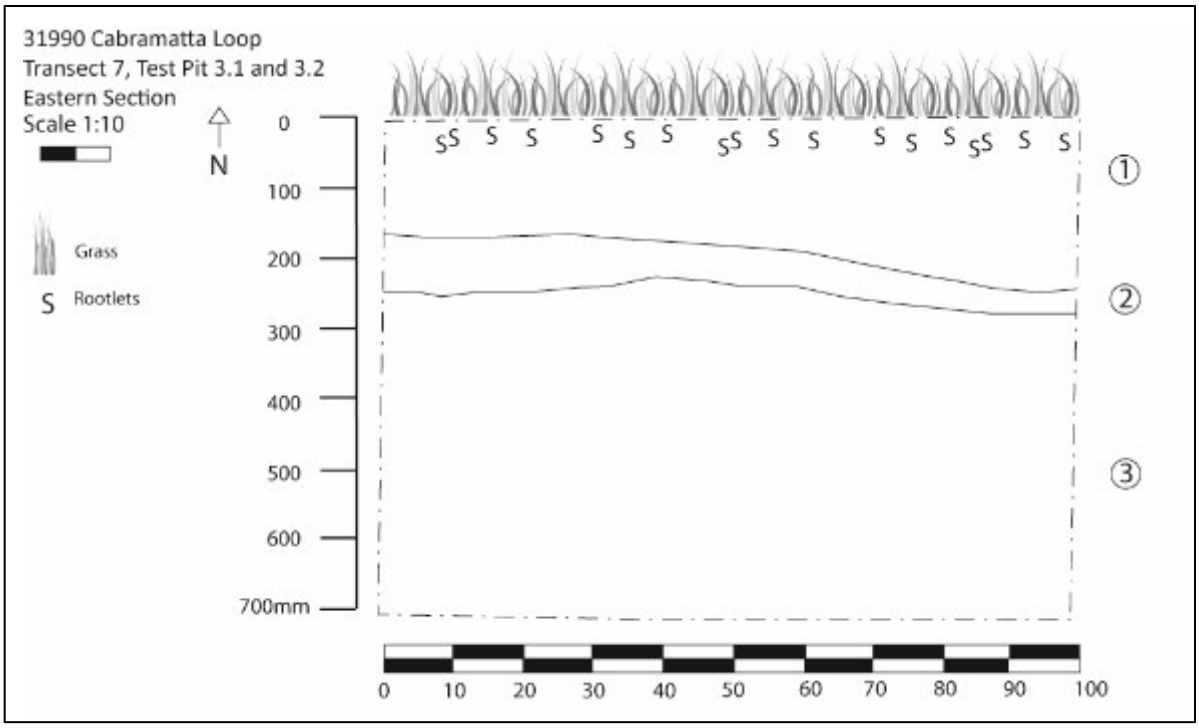


Photo 14 Transect 7 pit 3.1, 3.2 section drawing showing the three soil contexts present (1), (2),and (3)

6.3.3 Transect 8

Transect 8 contained four test pits at 20 metre intervals. Test pits 1 to-3 reached a depth of 700 millimetres while pit 4 reached a shallow depth of 400 millimetres. No artefacts were uncovered in this transect.

Pits 1 to 3 (Photo 15, Photo 16, Photo 17, Photo 18) are largely uniform with upper spits 1 and 2 (0–200 millimetres) containing dark brown (7.5YR 3/2) soft silty loams transitioning to brown (7.5YR 4/3) silty clay loams within spits 3 to 7 (200–700 millimetres). Charcoal flecks of approximately 2-5 millimetres in size are dispersed throughout the sequence, accounting for 2% of the volume. Grass root inclusions were noted in these pits from 0-700 millimetres. The pH of pit 1 and 2 ranged from neutral (pH 7) within spit 1 (0–100 millimetres), transitioning to alkaline (pH 7.5) within spits 2 and 3 (100–300 millimetres), and returning to neutral (pH 6.5) within spits 4 to 7 (300–700 millimetres). Pit 3 displayed variation with spit 1 and 2 (0–200 millimetres) containing a neutral (pH 6) pH, followed by alkaline (pH 8) spit 3 to 7 (200–700 millimetres).

Pit 4 contains black (5YR 2.5/1) soft sandy loam within spits 1 and 2 (0–200 millimetres), which transitions to brown (7.5YRN 4/3) moderately compacted sandy loam within spit 3 (200–300 millimetres) and strong brown (7.5YR 4/6) moderately compacted silty clay in spit 4 (0–400 millimetres). This pit contained no inclusions.

Photo 15 Transect 8 Pit 1

Photo 16 Transect 8 Pit 2

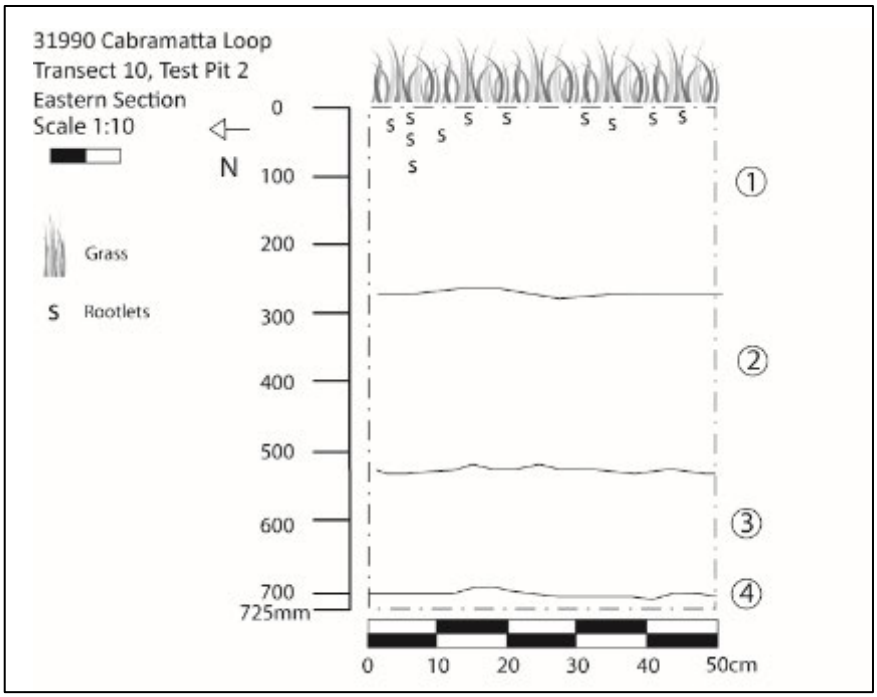


Photo 17 Transect 8 Pit 1 section drawing showing the four soil contexts present (1), (2), (3) and (4)

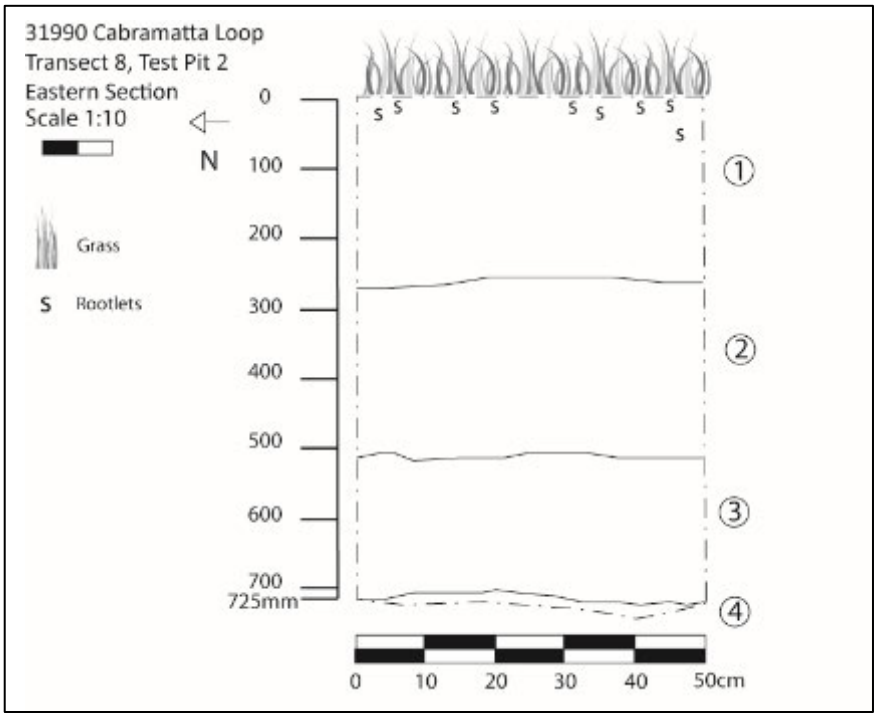


Photo 18 Transect 8 Pit 2 section drawing showing the four soil contexts present (1), (2), (3) and (4)

6.3.4 Transect 9

Transect 9 (Photo 19, Photo 20) included a total of three test pits positioned at 40 metre intervals due to a lack of cultural material within the area, following the identification of no artefacts within transect 8. The depths of these pits varied from 500 to 700 millimetres. No artefacts were recorded in this transect.

The stratigraphic profile of pit 1 consisted of dark brown (7.5YR 3/2) soft silty loam in the upper spits 1 and 3 (0–300 millimetres), which transitioned to brown (7.5YR 4/4) soft silty clay from spit 4 to 5 (300–500 millimetres). Charcoal fleck inclusions of 2–5 millimetres were present (1%). The presence of grass roots was noted in all spits (0–500 millimetres). The pH of pit 1 ranges from neutral (pH 6.5) in spit 1 and 2 (0–200 millimetres), to alkaline (pH 7.5) within spits 3 and 4 (200–400 millimetres).

Pits 2 and 3 both featured brown (7.5YR 4/4) sandy silty loam within spit 1 (0–100 millimetres), followed by black (5YR 2.5/1) moderately compacted sandy silty loam from spit 2 to 3 (100–300 millimetres) that transitioned to dark brown (7.5YR 3/2) moderately compacted silty clay loam in spits 4 to 6 (300–600 millimetres). Spit 7 (600–700 millimetres) transitioned to brown (7.5YR 4/3 to 7.5YR 5/4) hard silty clay loam. Pit 1 contained 1% charcoal flecks ranging in size from 2 to 5 millimetre in spit 1 (0 –100 millimetres), followed by no inclusions in spit 2 (100–200 millimetres). 20% ironstone nodules and 5% charcoal flecks was recorded in spits 3 to 7 (200–700 millimetres), while pit 3 contained no inclusions in the first two spits (0–200 millimetres), followed by 20% ironstone nodules from spit 3 to 6 (200–600 millimetres). Grass roots were noted throughout all spits. The pH remained neutral within both pits (pH 5–6.5).

Photo 19 Transect 9 Pit 1

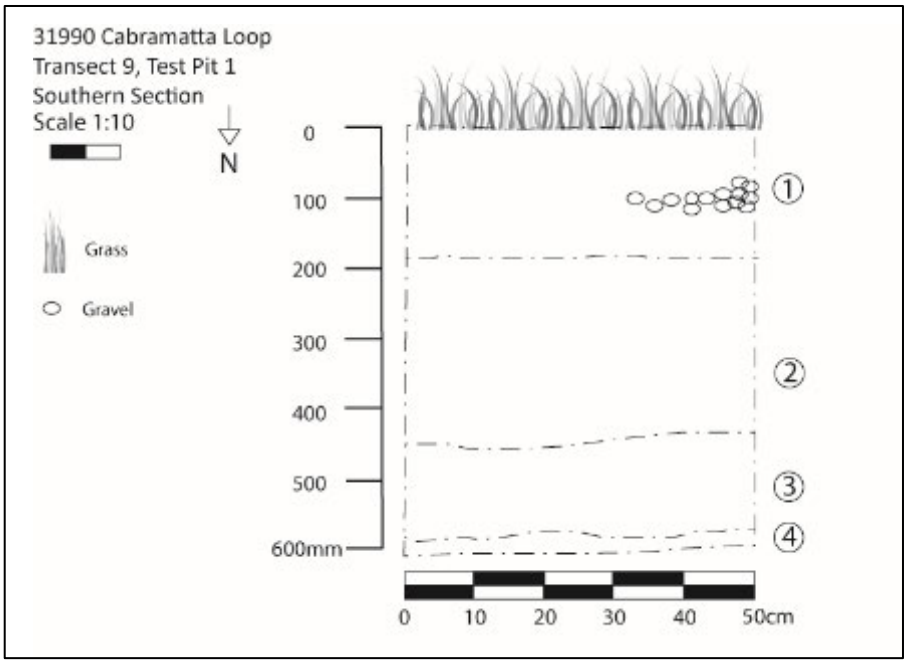


Photo 20 Transect 9 Pit 1 section drawing showing the four soil contexts present (1), (2), (3) and (4)

6.3.5 Transect 10

Transect 10 included a total of two test pits at 20 metre intervals. Depths varied with 700 millimetres in pit 1 (Photo 21, Photo 22) and 900 millimetres in pit 2. No artefacts were identified in this transect.

The stratigraphic profile of these two test pits varies only slightly. Pit 1 contains a dark brown (7.5YR 3/3) moderately compacted silty loam in spits 1 and 2 (0–200 millimetres). This transitions to a dark brown (7.5YR 3/4) moderately compacted silty clay loam within spits 3 to 7 (200–700 millimetres). Large amounts of charcoal flecks of 1 to 5 millimetres in size were note in spit 3 (200–300 millimetres) and spits 4 to 7 (300–700 millimetres). Grass roots is noted within spit 1 and 2 (0 -200 millimetres), and small tree roots in spits 2 to 5 (100 -500 millimetres). The pH remained neutral (pH 5–6.5) throughout all spits.

Pit 2 is relatively consistent, comprising a dark brown (7.5YR 3/3) silty clay loam within spits 1 to 4 (0–400 millimetres), followed by brown (7.5 4/3) moderately compacted silty clay loam from spits 5 to 7 (400 to 700 millimetres). This transitions to a brown (7.5YR 4/4) moderately compacted silty clay within spits 8 to 9 (800–900 millimetres). Charcoal flecks are present in all spits (0–900 millimetres). Grassroots were noted within spit 1 and spits 3 to 5 (200–500 millimetres), while small tree roots were identified within spits 2 and spits 6 to 9 (500–900 millimetres). The pH varied from alkaline (pH 7–7.5) within spits 1 and 2 (0–200 millimetres), to neutral (pH6.5–7) within spits 3 to 7 (200–700 millimetres), and back to alkaline (pH 7.5) within spits 8 and 9 (700 to 900 millimetres).

Photo 21 Transect 10 pit 1

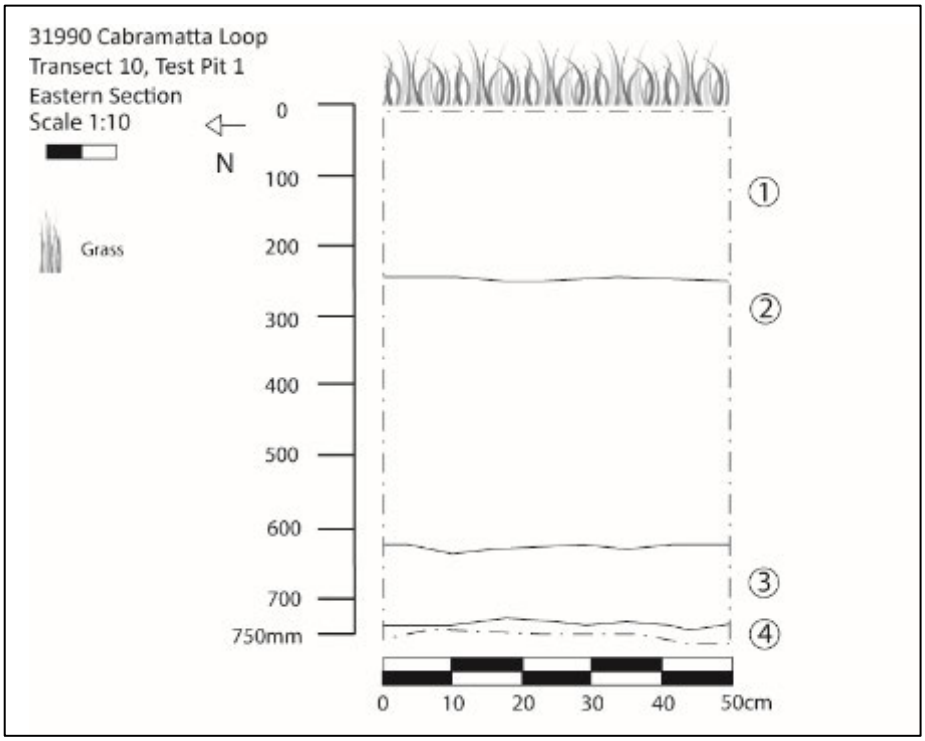


Photo 22 Transect 10 Pit 1 section drawing showing the four soil contexts present (1), (2), (3) and (4)

6.3.6 Transect 11

Transect 11 included a total of four test pits. Pits 1 and 2 were spaced at 40 metres apart due to the lack of cultural material identified within transect 10. During excavations, artefacts were identified in pit 1, therefore the remaining pits were excavated at 20 metre spacing intervals to identify the extent of the artefact scatter. All test pits in this transect were of variable depths. Pits 1 (Photo 23, Photo 25), 2 and 4 reached depths of 1

metre, while pit 3 (Photo 24, Photo 26) reached 900 millimetres. Four artefacts were identified within this transect:

- Pit 1 contained a single silcrete medial fragment in spit 2 (100–200 millimetres).
- Pit 3 contained two silcrete medial fragments in spit 3 (200–300 millimetres).
- Pit 4 contained a single mudstone complete flake in spit 3 (200–300 millimetres).

The stratigraphy of these pits was slightly variable. Pit 1 begins as a dark brown (7.5YR 3/2) moderately compacted silty sandy loam within spit 1 (0–100 millimetres), transitioning to a dark brown (7.5YR 3/3) moderately compact silty sandy clay. Spits 3 to 4 (200–400 millimetres) contained strong brown (7.5YR 4/6) moderately compact sandy silt, transitioning to yellowish red (5YR 4/6) moderately compacted silty clay within spit 5 (400–500 millimetres). Spits 6 to 10 (500–1000 millimetres) consist of yellowish red (5YR 4/6) hard silty clay. Inclusions within the pit include one millimetre charcoal flecks within spits 2 to 4 (100–400 millimetres), with no charcoal inclusions in all other spits. Grassroots were noted within all spits, while pH remained consistently alkaline (pH 7–8).

Pit 2 contained a dark brown (7.5YR 3/4) moderately compact silty sandy loam within spits 1 and 2 (0–200 millimetres). The following spits displayed consistency, with brown (7.5YR 4/3) moderately compact sandy silt from spits 3 to 7 (200–700 millimetres) followed by dark yellowish brown (10YR 4/6) moderately compact sandy silt from spits 8 to 10 (700–1000 millimetres). Inclusions were identified within spits 2 to 7 (100–700 millimetres). Grassroots were noted within spits 1 to 7 (0–700 millimetres). The pH of spits 1 to 7 (0–700 millimetres) was neutral (pH6–7), followed by alkaline within spits 8 to 10 (700 to 1000 millimetres).

Pit 3 contained dark brown to brown (7.5YR 3/2 to 7.5YR 4/3) moderately compacted clayey silt within spit 1 (0–100 millimetres). The brown (7.5YR 4/3) moderately compact clayey silt continued into spit 3 (100 to 300 millimetres). Spits 4 to 6 (300–600 millimetres) contained brown (7.5YR 4/3) moderately compact silty clay, followed by greyish brown (10YR 5/2) moderately compact clay within spit 7 and 8 (600–800 millimetres). Charcoal inclusions of 2–5 millimetres made up 5% of spits 2 (100–200 millimetres), 5 and 6 (400–600 millimetres), increasing to 10% in spit 3 (200–300 millimetres), and 15% in spit 4 (300–400 millimetres). Grassroots were recorded within spits 1 to 4 (0–400 millimetres), with ceramic and plastic also identified within spit 4 (300–400 millimetres). The pH level within spit 1 to 4 remained neutral (pH 6–6.5), followed by alkaline (pH 7.5) in pits 5 and 6 (400–600 millimetres), returning to neutral (pH 6.5) in spits 7 and 8 (600–800 millimetres).

Pit 4 contained dark brown (7.5YR 3/3) moderately compact sandy silty loam within spits 1 and 2 (0–200millimetres). This transitioned into a brown (7.5YR 4/3) moderately compact clayey silt in spit 3 (200–300 millimetres). Spit 4 to 5 (300–500 millimetres) consisted of a very dark greyish brown (10YR 3/2) moderately compact clayey silt, followed by a dark greyish brown (10YR 4/2) hard silty clay within spits 6 to 10 (500–1000 millimetres). Inclusions of 2- 10 millimetre iron stone nodules and 2–15 millimetre charcoal flecks comprised 5% each of spits 2 to 5 (100–500 millimetres), reducing to 2% charcoal in spits 6 to 10 (500 to 1000 millimetres). Grassroots were noted within all spits. The pH of spits 1 to 5 (0 to 500 millimetres) remained neutral (pH 5.5 to 6), followed by alkaline (pH 7.5) in spits 6 to 10 (500–1000 millimetres).

Photo 23 Transect 11 Pit 1

Photo 24 Transect 8 Pit 3

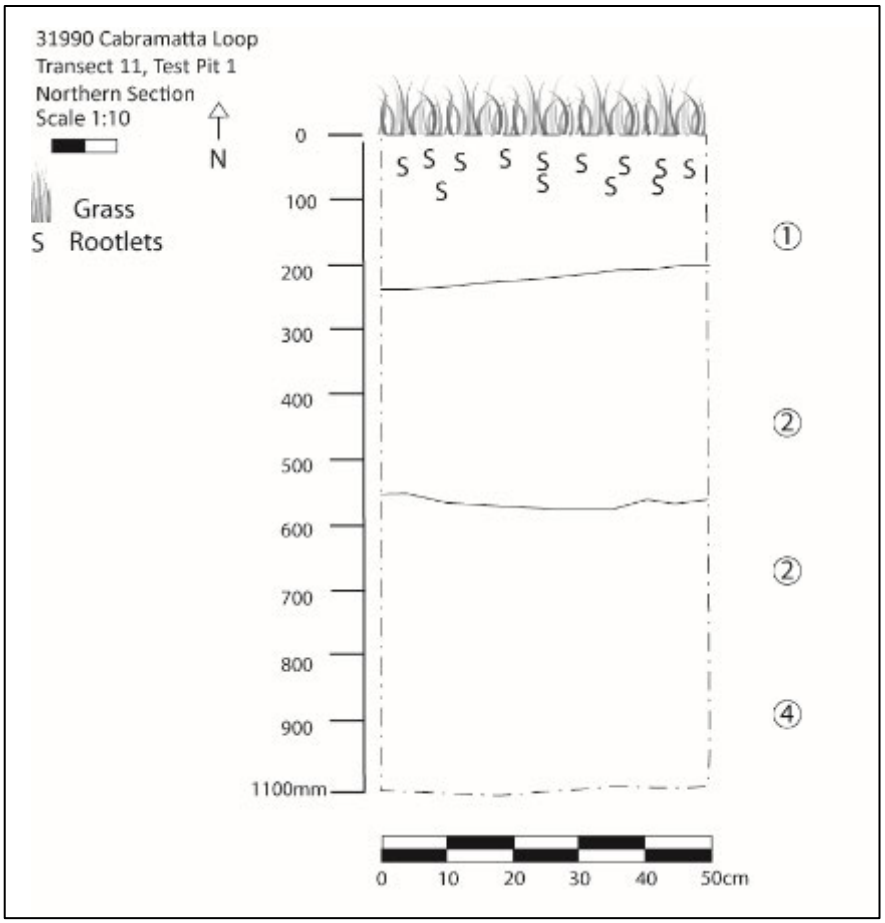


Photo 25 Transect 11 Pit 1 section drawing showing the four soil contexts present (1), (2), (3) and (4)

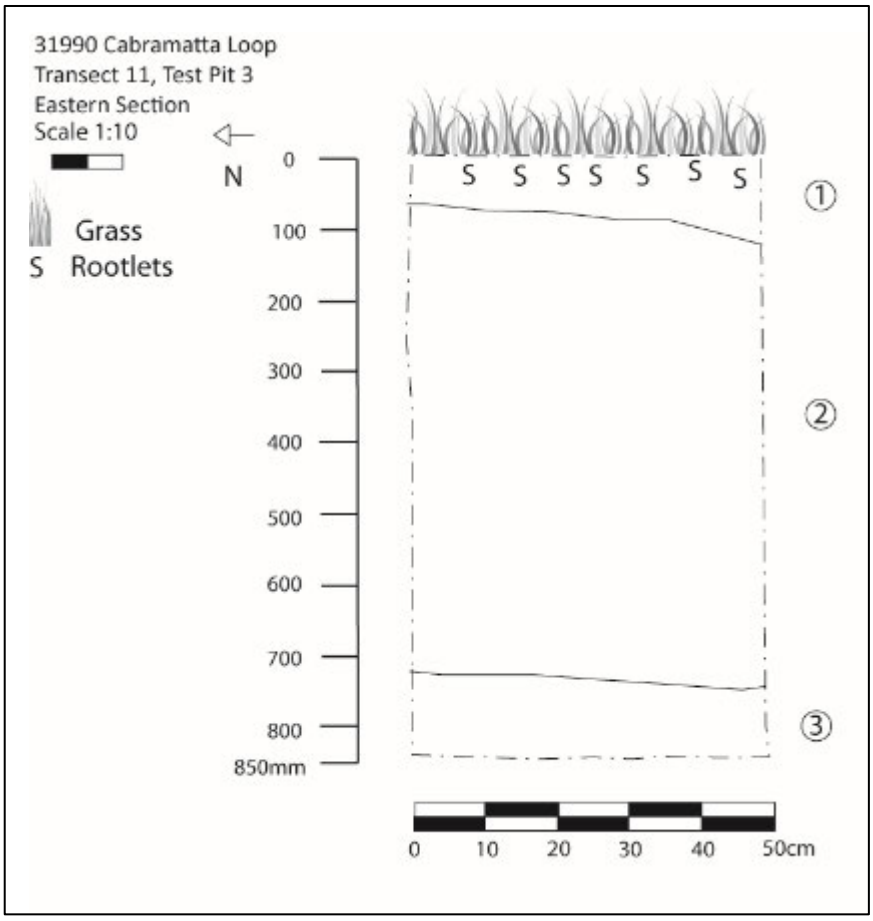


Photo 26 Transect 11 Pit 3 section drawing showing the three soil contexts present (1), (2), and (3)

6.3.7 Transect 12

Transect 12 included a total of four test pits. The first two pits were excavated at 40 metre intervals due to a lack of cultural material in the area, however, following the identification of artefacts in pit 2; pits 3 and 4 were excavated at 20 metre intervals to explore the extent of the site. A range of depths occurred across the pits, with pit 1 (Photo 27, Photo 29) reaching a depth of 1000 millimetres, while pits 2 and 3 reached 600 and 650 millimetres respectively. Pit 4 (Photo 28, Photo 30) was relatively shallow at 400 millimetres. Two artefacts were recovered from this transect:

- Pit 2 contained a silcrete proximal flake within spit 5 (400–500 millimetres).
- Pit 4 contained a single silcrete medial fragment within spit 4 (300–400 millimetres).

The stratigraphical profile of all pits was relatively consistent. Pit 1 contained a very dark greyish brown (10YR 3/2) sandy silty loam within spit 1 and 2 (0–200 millimetres). This was followed by strong brown (7.5YR 5/8) sandy silt within spits 3 and 4 (200–400 millimetres), transitioning to strong brown (7.5YR 5/8) clayey silt in spits 5 to 7 (400–700 millimetres). Spits 8 to 10 (700–1000 millimetres) consisted of the same colour with silty clay texture. Grassroots were noted within all spits. The pH also remained consistently neutral (pH 6.5) throughout the pit.

Pit 2 also contained a very dark greyish brown (10YR 3/2) sandy silty loam in spit 1(0–100 millimetres) that transitioned to a brown (7.5YR 4/3) sandy silty loam in spit 2 (100–200 millimetres). Spits 3 and 4 (200–400 millimetres) consisted of a brown (7.5YR 4/4) clayey silt, that transitioned to a brown (7.5YR 4/4 to 4/2) silty clay spit 5 and 6 (400–600 millimetres). Inclusions of 2-5 millimetre charcoal flecks comprised 5% of spit 3

(200–300 millimetres), increasing to 10% in spits 4 to 6 (300–600 millimetres). Grassroots were recorded throughout and pH remained neutral (pH 6.5–7) across all spits.

Pit 3 consisted of a dark brown (7.5YR 3/3) sandy silty loam within spits 1 and 2 (0–200 millimetres), followed by a strong brown (7.5YR 4/6) sandy silt in spits 3 and 4 (200–400 millimetres). Spit 5 (400 -500 millimetres) contained a dark greyish brown (10YR 4/2) clay, transitioning to a strong brown (7.5YR 4/6) sandy silt in spit 6 (500–600 millimetres). Spits 7 and 8 comprised of a brown (10YR 4/2) clay. Grass roots were recorded within all spits. The pH remained consistently neutral across all spits (pH 6.5–7).

Pit 4 contained a dark brown (7.5YR 3/2) silty sandy loam within spit 1 (90–100 millimetres). Spit 2 transitioned to a brown (7.5YR 4/3) sandy silt that continued until spit 4 (300–400 millimetres). Inclusions of 2–10 millimetres charcoal flecks comprised 2% of spit 2 (100–200 millimetres) and 5% of spits 3 and 4 (200–400 millimetres). Grassroots were recorded throughout the pit and pH remained consistently neutral (pH 6.5–7).

Photo 27 Transect 12 Pit 1

Photo 28 Transect 12 Pit 4

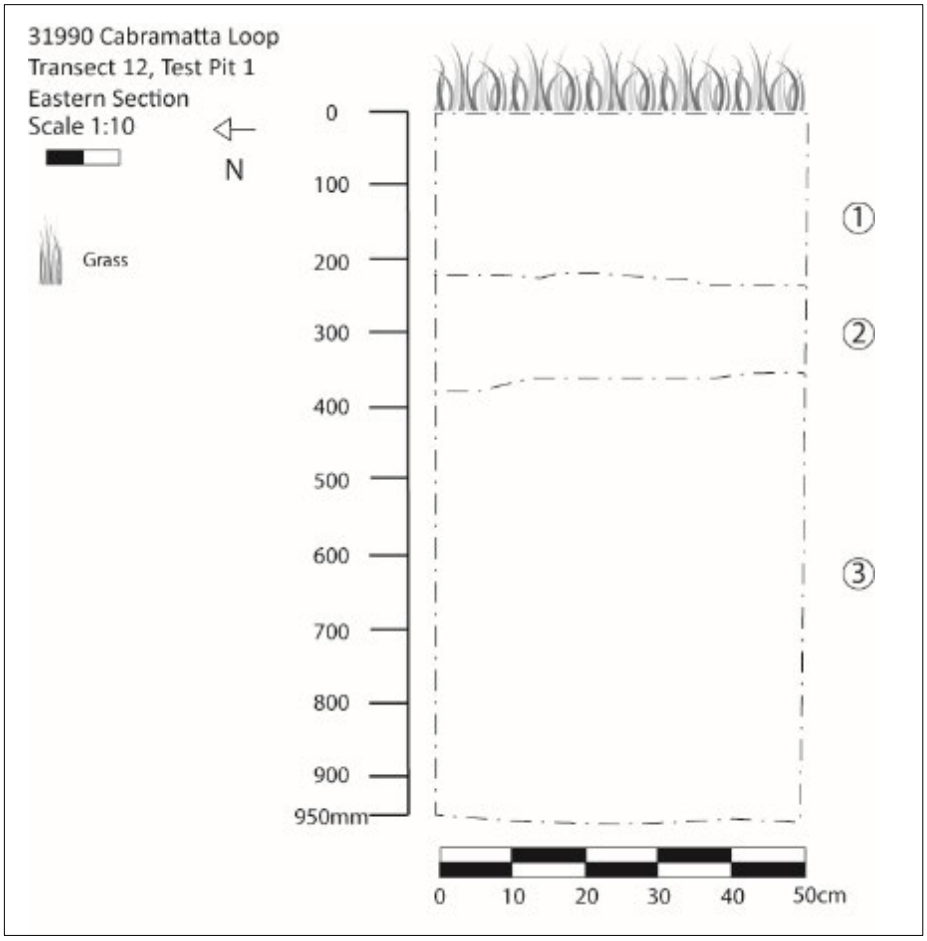


Photo 29 **Transect 12 Pit 1 section drawing showing the three soil contexts present (1), (2), and (3)**

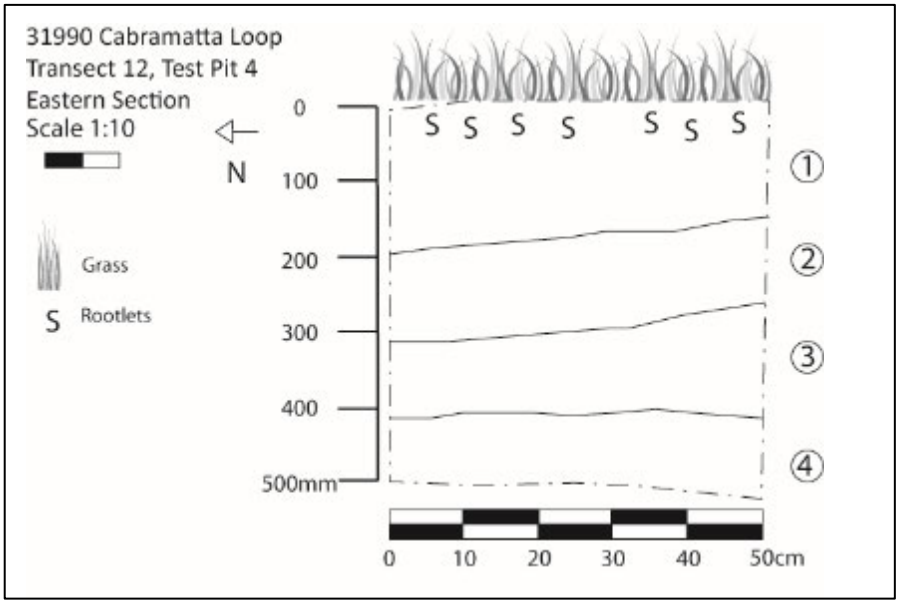


Photo 30 **Transect 12 Pit 4 section drawing showing the four soil contexts present (1), (2), (3) and (4)**

Figures 8 and 9 Test Excavation Results & Aboriginal Sites Identified by Assessment
THESE FIGURES HAVE BEEN REMOVED AS THEY CONTAIN INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL

7 Analysis and discussion

7.1 Sub-surface artefact analysis results

The following analysis has been undertaken for the sub-surface assemblage of the study area excavated as part of the test excavation program. A total of eight Aboriginal artefacts were identified and recorded from the program of test excavations. Several non-Aboriginal artefacts were also recovered, including glass and ceramic fragments. The low sample size may result in higher margins of error during the artefact analysis and skew the results: therefore, a whole assemblage approach was applied.

The artefact analysis addresses a series of themes including:

- Spatial distribution.
- Stone raw material procurement.
- Stone reduction technology.

Stone artefacts collected from the excavations were labelled by transect, pit and spit to locate them vertically and horizontally within the study area. Artefacts were collected and then individually analysed by Biosis. The recording form prompts the user to record all relevant artefact attributes; this enabled a typological, technological and metrical analysis of the assemblage to be undertaken. Analysis was undertaken using a standard set of digital Vernier caliper, scale, and stereographic microscope. All measurements were recorded in millimetres to one decimal place. Appendix 3 contains the detailed sub-surface lithics recordings.

Collected artefacts were transported to a temporary storage location consisting of a locked storage cabinet in the Biosis Newcastle Office at Unit 8, 27 Annie Street, Wickham NSW for lithic analysis. This location was changed from the methodology (14/17-27 Power Ave, Alexandria NSW 2015) due to resourcing changes from COVID-19 restrictions. The artefacts have since been returned to the Biosis Sydney office (14/17-27 Power Ave, Alexandria NSW 2015).

The analysis of artefacts recorded during the sub-surface excavations has been undertaken as a whole assemblage in order to characterise the artefact assemblage present within the study area.

7.1.1 Artefact distribution

The eight artefacts were located in an area identified in the Environmental Impact Statement as being of moderate archaeological potential within an alluvial flat landform. All artefacts were recovered from the southern portion of the study area. These artefacts were identified in transects 7, 11 and 12 (Table 14).

Table 14 Distribution of artefacts within the study area

Transect no.	Artefact count
11	4
7	2
12	2

Test pit 3 (transect 11) had the highest density of artefacts with 25% (n=2) of the total artefacts identified, and the remainder of the test pits each had one artefact (together amounting to 75% of the total artefacts identified) (Table 15).

Table 15 Distribution of artefacts within each test pit

Transect and test pit no.	Artefact count
T 11 TP 3	2
T 7 TP 3	1
T 7 TP 3.2	1
T 11 TP 1	1
T 11 TP 4	1
T 12 TP 4	1
T 12 TP 2	1

The vertical distribution of artefacts at a site can be a good indicator of occupation intensity as spits with higher artefact concentrations are likely to have seen longer or more intensive occupation than spits with smaller artefact concentrations. This analysis can also help identify variation in occupation over time, with multiple large and small clusters of artefacts at different depths indicating separate depositional periods and possibly indicating separate occupation events. The results of artefact concentrations by spit depth shows the highest concentration of artefacts was found between 100 and 200 millimetres (37.5%, n=3) (Table 16). This was followed by 200 and 300 millimetres (25%, n=2). Lower artefact frequencies of 12.5% (n=1) were found at depths between 300–400 millimetres (transect 12 pit 5), 400 to 500 millimetres (transect 12 pit 4), and 800 to 900 millimetres (transect 11 pit4).

Artefacts were found most frequently in context 2 and 3, which consisted predominantly of soft loamy sand and moderately compacted clayey silt. Artefacts were also found in context 4 and 5 which was comprised of moderately compacted silty clay; and context 9 which consisted of highly compacted silty clay.

Table 16 Concentrations of artefacts by depth

Spit Number	Count (n)	Percentage %
Spit 2 (100-200)	3	37.50
Spit 3 (200-300)	2	25
Spit 4 (300-400)	1	12.50
Spit 5 (400-500)	1	12.50
Spit 9 (800-900)	1	12.50
Total	8	100

7.1.2 Artefact composition

The assemblage recovered from the test excavations was dominated by broken flake fragments (medial, proximal, and distal) make up 75% (n=6) of the assemblage. The most common broken flake type in the assemblage was medial flakes making up 37.5% (n=3) of the total (Table 17). Proximal flakes were the second most common broken artefact type representing 25% (n=2), and distal flakes comprised of 12.5% (n=1) of the total assemblage. Angular fragments and complete flakes were also recorded (12.5%, n=1 each) at lower rates.

Table 17 Sub-suface assemblage artefact types

Artefact Type	Count (n)	Percentage (%)
Medial Flake	3	37.50
Proximal Flake	2	25
Distal Flake	1	12.50
Angular Fragment	1	12.50
Complete Flake	1	12.50
Total	8	100

Two artefacts were recorded as having retouch, one complete flake (transect 11, test pit 4) (Photo 31**Error! Reference source not found.**), and one proximal fragment (transect 12, test pits 4) (Photo 32**Error! Reference source not found.**). They did not fit into any of the typologically defined tool forms and did not display evidence of use wear suggesting they were discarded prior to any use.

Photo 31 Complete mudstone flake with retouch (transect 11 test pit 4)

Photo 32 Proximal silcrete fragment with retouch (transect 12 test pit 4)

An analysis of flake features was undertaken and included an analysis of platform type, and termination type. This was done to characterise the nature of the flaked assemblage and to allow assumptions to be made on the level of the knapper's skill and technology strategies. A flaked platform was identified on the complete flake and on one of the proximal flakes; and a crushed platform was identified on the other proximal flake. No platform was present on the medial or distal fragments.

Flake platforms are the remnants of a core from which a flake was removed and can provide useful information about the way a core was reduced, during what stage of reduction the flake was removed at and the skill of the knapper (Holdaway & Stern 2004, p.119). Platforms that are produced in the reduction of a raw material include a number of different types. Cortical platforms contain unmodified surfaces still containing the outer surface or cortex of a core and indicate early reduction (Holdaway & Stern 2004, p.119). Flaked platforms contain one to two flake scars and indicate a later stage of reduction compared to cortical flakes (Holdaway & Stern 2004, pp.119–20). Facetted platforms contain more than two flake scars and are representative of, late stage reduction (Holdaway & Stern 2004, p.119). Crushed platforms occur when a flake platform has been damaged and no platform attributes can be recorded (Holdaway & Stern 2004, p.120). These platforms often occur when flakes are struck from unsuitable platforms and can indicate an inexperienced knapper.

An analysis of termination types was also undertaken for the two artefacts exhibiting a termination. The complete flake featured a hinge termination (50%, n=1), while the distal fragment featured a feather termination (50%, n=1) (Table 18).

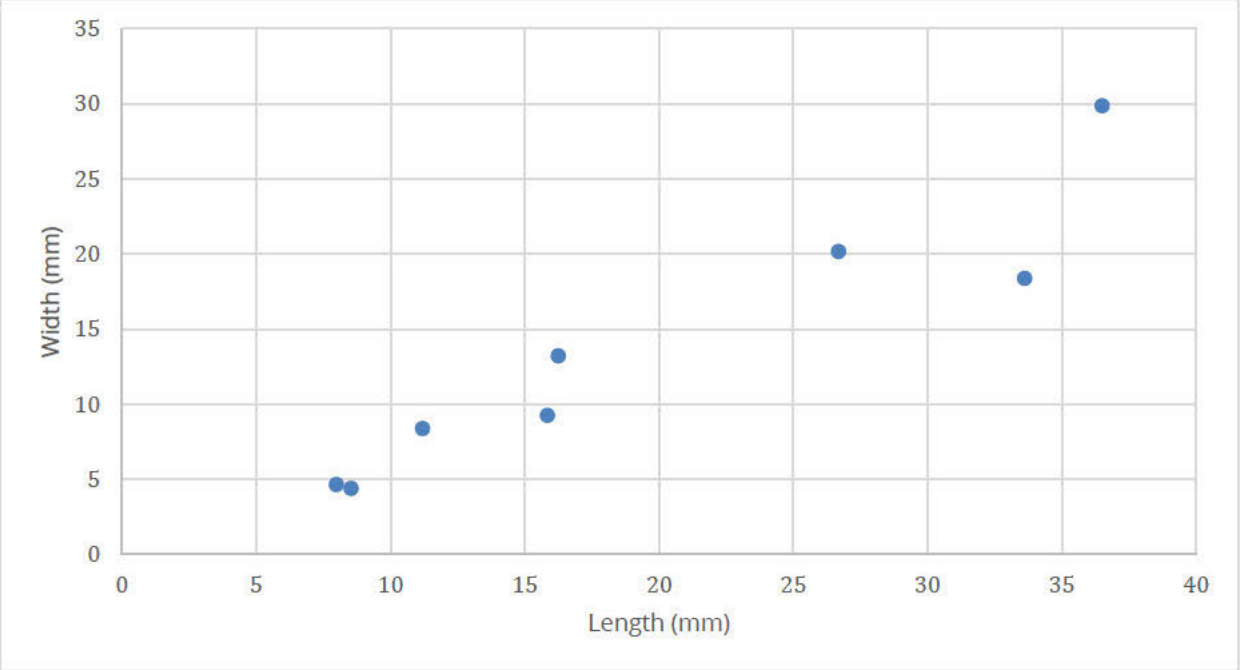
Feather terminations are achieved when the knapper has struck the core at an appropriate distance from the core edge with the appropriate amount of force, meaning the knapper is showing some degree of control in the process (Holdaway & Stern 2004, pp.132–133). Hinge terminations are most often produced when there is

not enough force to detach a feather terminated flake, such as when a core is struck too far from the platform edge or an incorrect striking angle is used.

Table 18 Termination types within the assemblage

Platform type	Count	Percentage (%)
Hinge	1	50
Feather	1	50
Total	2	100

The overall size of artefacts within an assemblage can provide insight into the intensity and stages of reduction present at a site. A total of 62.5% (n=5) of the artefacts within the assemblage measure less than 20 millimetres lengths and widths, suggesting the majority of artefacts are small in size and indicative of later stage or intensive reduction (Graph 1). The remainder of the artefacts measure between 25 and 40 millimetres (37.5%, n=3).



Graph 1 Size distribution of artefacts

Raw material

The dominant material was silcrete, accounting for 87.5% (n=7) of the assemblage, followed by mudstone at 12.5%% (n=1) (Table 19) (see Photo 33 to Photo 39). Both raw materials are commonly found in sites across the Sydney region with known silcrete quarries located in Western Sydney at Pheasants Nest and along the Nepean River.

Table 19 Artefact material frequency

Material	Number	Frequency (%)
Silcrete	7	87.5%

Material	Number	Frequency (%)
Mudstone	1	12.5%
Total	8	100

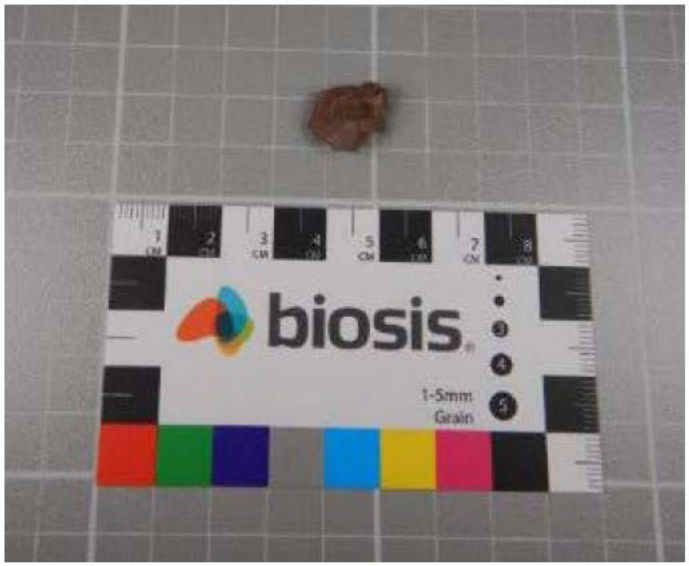


Photo 33 **Angular silcrete fragment (transect 7 test pit 3)**

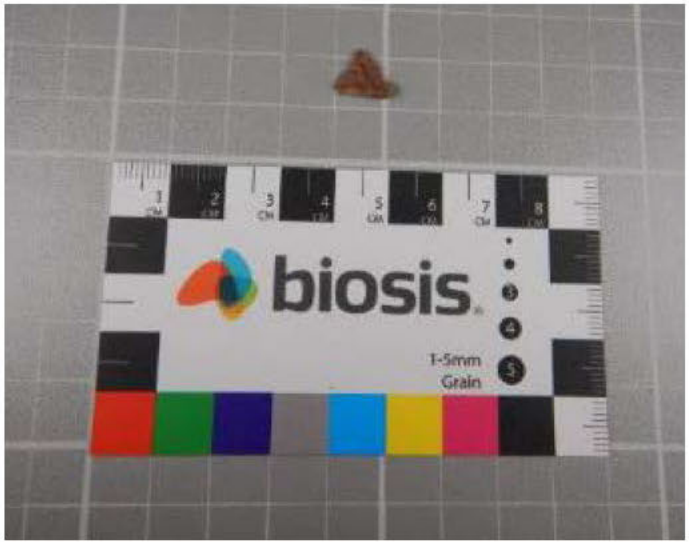


Photo 34 **Medial silcrete fragment (transect 7 test pit 3.2)**

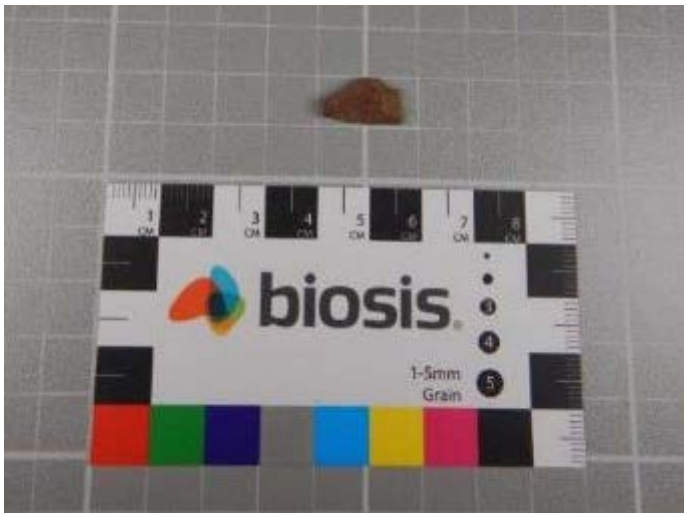


Photo 35 **Medial silcrete fragment (transect 11 test pit 1)**

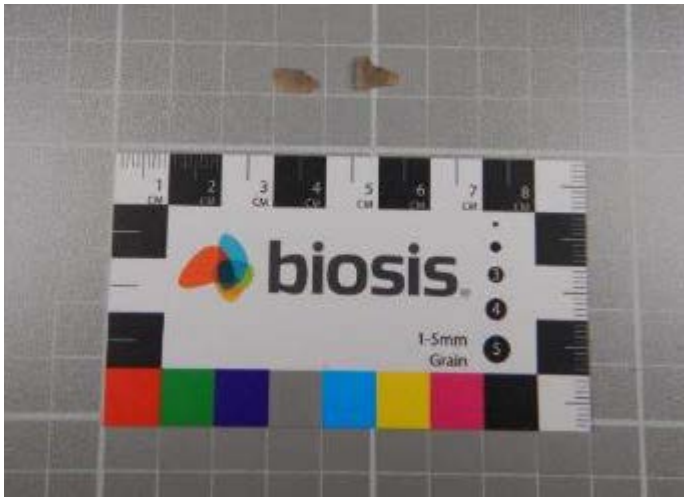


Photo 36 **Medial silcrete fragment and distal silcrete fragment (transect 11 test pit 3)**

Photo 37 **Complete mudstone flake (transect 11 test pit 4)**

Photo 38 Proximal silcrete fragment (transect 12 test pit 2)

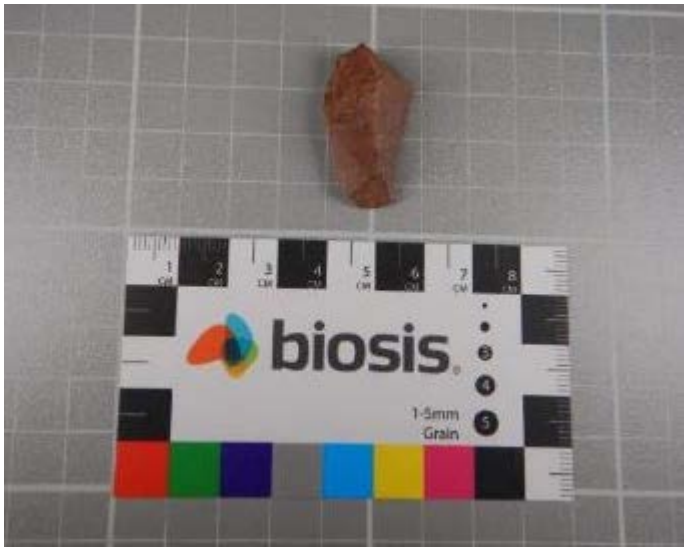


Photo 39 Proximal silcrete fragment (transect 12 test pit 4)

Tools

Tool analysis follows a typologically defined method of analysis where a tool type has been defined in such a way that the type is more than the sum of its attributes. This allows inferences to be made about technology, function and style of stone artefacts in an assemblage.

None of the artefacts displayed characteristics of formal tool types and no evidence of use wear was found. This indicates that no recorded tools were identified in the study area.

8 Discussion of results

The project site is characterised by undulating slopes forming in the north that flow south from two crest landforms towards Cabramatta Creek, forming flood plains on either side of the creek line. Artefact, and PAD sites have been previously recorded within the region and the immediate vicinity of the study area upon well drained topographies within the vicinity of permanent sources of fresh water.

Previous archaeological investigations identified an area of PAD located within 50 metres of the project site at Warwick Farm Recreation Reserve. This area of PAD was initially identified as an artefact scatter and PAD site and registered on the AHIMS register as AHIMS 45-5-3271/CC1. Test excavations conducted by Therin in 2007 confirmed the area of PAD within AHIMS 45-5-3271/CC1. The test excavations also found that the area of PAD extended to the south of AHIMS 45-5-3271/CC1 within Warwick Farm Recreation Reserve towards Lawrence Hargrave School. Therin recorded this extension of AHIMS 45-5-3271/CC1 on the AHIMS database as AHIMS 45-5-3428/CC1.

The field investigation confirmed that the majority of the project site has been subject to high levels of previous ground disturbance from the construction and ongoing maintenance of the rail line, along with residential development and the construction of roads and various infrastructure services. Aboriginal objects or sites are therefore unlikely to occur within the rail corridor, and other areas of previous disturbance within the project site (Figure 7). These areas of disturbance have therefore been assessed as having low archaeological potential.

Areas located outside of the rail corridor within Warwick Farm Recreation Reserve have demonstrated evidence of subsurface archaeological deposits as evidenced by the archaeological excavations conducted by Therin in 2007. Background research conducted for the project site indicates that Warwick Farm Recreation Reserve and Jacquie Osmond reserve have been subject to relatively low and moderate levels of previous disturbance respectively. AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 were inspected as part of the field investigation.

The field investigation confirmed that AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 located at Warwick Farm Recreation Reserve have undergone low levels of disturbance indicating that further subsurface archaeological deposits are likely to be present. This area was therefore assessed as having high archaeological potential due to the low levels of disturbance, and its proximity to Cabramatta Creek (Figure 7).

Jacquie Osmond Reserve displayed higher levels of disturbance than the Warwick Farm Recreation Reserve. These disturbances were associated with superficial ground disturbance activities involved in the maintenance of the softball fields within the project site. Jacquie Osmond Reserve was therefore assessed as having moderate archaeological potential (Figure 7). The test excavations conducted within Warwick Farm Recreation Reserve at AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1 in 2007 demonstrated that the alluvial plains adjacent to Cabramatta Creek have a high potential to contain subsurface archaeological deposits. It was therefore determined that Aboriginal objects likely exist within Jacquie Osmond Reserve; however, they may be present in a disturbed context and will be of low density and low scientific significance.

Test excavations were undertaken in the area of moderate potential identified at Jacquie Osmond Reserve. A total of 26 test pits were excavated in line with the Code, with seven of these test pits containing Aboriginal artefacts. The site contained eight artefacts in total, making up an estimated site density of 1.23 artefacts per square metre excavated. The vertical distribution of artefacts indicated that spit 2 contained the highest number of artefacts with 37.5% present (n=3), with was followed by spit 3 with 25% of artefacts (n=2), then spit 4, spit 5 and spit 9, which each contained 12.5% of artefacts (n=1 each).

The artefact assemblage was dominated by silcrete raw materials (87.5%) with one mudstone artefact also identified (12.5%). These raw materials are both commonly found throughout sites across Sydney and were readily available at multiple locations in Western Sydney such as at Pheasants Nest and along the Nepean River. No evidence of cortex was found on any artefacts in the assemblage suggesting these raw materials were heavily reduced before ending up at the site. This can be an indicator that raw materials were transported long distances.

Assemblage characteristics showed few clear trends in form and function, presenting difficulties for making high level inferences. Artefact types were made up of three medial flakes, two proximal flakes, and one each of an angular fragment, complete flake and distal flake. Two of these artefacts also displayed retouch, suggesting some secondary modification following flake removal, however no use wear was observed to indicate they were utilised as tools. The lack of cores and tools suggests the assemblage is not representative of a complete reduction sequence which would typically be found in areas where artefact manufacture was occurring. Rather, the low density and characteristics of the assemblage are suggestive of discard associated with sporadic or low intensity occupation, such as resource collection zones or travel pathways. These artefact types also represent common types found across most sites throughout Sydney and are of limited scientific significance as a result.

As previously discussed the majority of artefacts (87.5%) are contained between spit 2 and spit 5 (100–500 millimetres) and are located in a loose loamy to silty sand or loose silty clay; however, one artefact was also recorded within spit 9 (800–900 millimetres) of pit 4 transect 11, and was associated with a moderately compacted clay.

These soils appear to be a mix of natural and disturbed soils, with disturbance of topsoils soils likely to have occurred during the flattening of the playing field. Artefacts appear to be located in both the natural and potentially disturbed soil profiles. This could therefore indicate that study area was an area of Aboriginal occupation but has also undergone disturbance which may have displaced some artefacts.

The 30 centimetre discontinuity between the artefact in spit 9 and the artefact identified in spit 5 could represent one of several possibilities. The artefact in spit 9 may represent an earlier phase of occupation, or a modern displacement

All artefacts identified within spits 2 to 5 (100–500 millimetres) consisted of silcrete raw materials, while the artefact identified in spit 9 (800–900 millimetres) was made from mudstone. The artefact in spit 9 was also the largest recorded artefact in the assemblage and the only complete artefact recorded. The difference in characteristics between the artefact in spit 9 (800–900 millimetres) and artefacts in spits 2 to 5 (100–500 millimetres) could therefore suggest different artefact manufacture processes and raw material selection representative of different phases of occupation.

These trends may also just be a result of the small sample size which will have resulted in false or skewed data trends. The flake size of the artefact in spit 9 (800–900 millimetres) while the largest in the assemblage is not significantly different to the artefacts in spits 2 to 5 (100–500 millimetres). Artefacts are also are not typically found within clay deposits and the large discontinuity could instead be a result of post depositional factors such as the artefact being knocked out of the pit wall during excavations due to its larger size. The mudstone raw material and artefact type is also extremely common throughout the region across all phases of occupation, often being associated with silcrete artefacts and is not in itself a strong indicator for separate phases of occupation. Furthermore, other excavations in the region have not identified any similar occurrences, suggesting the most likely hypothesis is that the artefact in spit 9 (800–900 millimetres) is not in-situ and is therefore of low scientific significance as it does not retain its contextual information (see AMBS 1996, AMBS 1997, AMBS 2000, Austral Archaeology 2008).

8.1 Research questions

This section provides detailed responses to the research questions, based on the results above.

Do non-disturbed or minimally disturbed soil profiles exist within the area of moderate archaeological potential?

Soils within the study area appear to have undergone some disturbance as a result of human activities within the study area, which have generally affected topsoils where glass and ceramic have been noted. Eight artefacts were recovered during the test excavation program from depths ranging between 100–900 millimetres, with a majority of the artefacts identified within loose loamy to silty sand or loose silty clay between 100–600 millimetres. It is considered likely that artefacts between 100–300 millimetres have undergone some disturbance. Deeper deposits below 300 millimetres may be intact as no evidence of size sorting was determined during the artefact analysis, although the limited sample size has likely skewed this data. Overall the excavations suggests that soils within the area of moderate archaeological potential have not been adversely affected by post depositional forces such as flooding activities within the local area, with the potential for artefacts to be present in the top 500 millimetres of soils deposit. Given the disturbances present in the top 300 millimetres there is potential that some of these artefacts are no longer in their original context and are therefore of low scientific significance.

Can the study area be accurately classified with reference to the two AHIMS sites (AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1) located to the north-west of the study area in the now identified area of high archaeological potential?

The study area contained eight artefacts recovered from the test excavations on an alluvial flat landform within 250 metres of Cabramatta Creek. This site is similar to the site features of AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, both of which contained low densities of artefacts on the alluvial flats within 250 metres of Cabramatta Creek. No further comparisons can be made between these sites due to a lack of information. AHIMS 45-5-3271/CC1 has no accompanying site card or report available and no further information beyond site type and location can be determined. AHIMS 45-5-3428/CC1 contains a site card but no accompanying report on AHIMS. This site card indicates that 27 artefacts were identified during test excavations and is likely an extension of AHIMS 45-5-3271/CC1; however, no further information is available to compare with the current study area. Therefore the study area cannot be accurately classified with reference to the two AHIMS sites, beyond basic site pattering which suggests both areas may have been low density areas of occupation.

What are the extent and nature of any archaeological deposits (if present) within the area of moderate potential.

A total of the eight artefacts were recovered from the test excavations within the area of moderate potential. These artefacts were identified within the southern portion of the study area on an alluvial flat landform, and were within 250 metres of Cabramatta Creek. These artefacts displayed use of silcrete and mudstone raw materials, both of which are extremely common in the region. The assemblage contained three medial fragments, two proximal fragments, and one each of an angular and distal fragment and complete flake. The complete flake and one of the proximal fragments displayed evidence of retouch but no usewear. The complete flake and one of the proximal fragments had a flaked platform, and the other proximal fragment had a crushed platform. The artefacts were recovered from a depth ranging between 100–900 millimetres, with the majority of the assemblage found between 100 and 500 millimetres in depth. Artefacts appeared to be located in both natural and disturbed soil contexts suggesting some disturbance of the assemblage. There is potential for artefacts to be present across the study area in disturbed contexts, however any potential artefacts will be of low scientific significance as they no longer retain their original contextual information

How does the character of archaeological deposit within the study area (if present) inform the scientific understanding of Aboriginal occupation and land use models for the region?

The study area contained eight artefacts recovered from the test excavations on an alluvial flat landform within 250 metres of Cabramatta Creek. This site is similar to the site features of AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, both of which contained low densities of artefacts on the alluvial flats within 250 metres of Cabramatta Creek, suggesting the occupation of the site was similar to what has been found previously across the local area. The low density of artefacts and lack of a complete reduction sequence, including cores and retouch debitage suggests a lack of artefact manufacture processes within the study area. This would suggest the study area was not likely to have been an area of long term or intensive occupation as such uses typically result in artefact assemblages containing more complete reduction sequences, formal tools or larger densities of artefacts. It is most likely that the area was used for resource exploitation and represents sporadic or low intensity occupation which has resulted in the opportunistic discard of artefacts in the identified low densities.

9 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 project site.

9.1 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, Heritage NSW, NSW Department of Planning 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 Heritage NSW 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.

9.2 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. 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:

Table 20 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.

The site condition ratings used for archaeological sites are:

Table 21 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 project site 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 22 outlines the site representativeness ratings used for archaeological sites.

Table 22 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 23.

Table 23 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. This scoring procedure has been applied to the Aboriginal archaeological sites identified during the survey and sub-surface testing.

9.2.1 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 24 below.

Table 24 Scientific significance assessment of archaeological sites recorded within the project site

Site name	Site content	Site condition	Representativeness	Scientific significance
AHIMS 45-5-3271/CC1	1	2	1	4–Moderate
AHIMS 45-5-3428/CC1	1	2	1	4–Moderate
AHIMS 45-5-5333/ Jacquie Osmond AS1	1	1	1	3–Low

Table 25 Statements of scientific significance for archaeological sites recorded within the project site

Site name	Statement of significance
AHIMS 45-5-3271/CC1	AHIMS 45-5-3271/CC1 is recorded as an isolated artefact, and PAD. No further information about this site is available but review of AHIMS 45-5-3428 suggests it has been tested as part of an assessment undertaken by Therin in 2007. An inspection of the site during this assessment found that the site is in good condition. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as moderate.
AHIMS 45-5-3428/CC1	AHIMS 45-5-3428 /CC1 was recorded in 2007 by Michael Therin. A copy of this site card was obtained from the AHIMS database. The information contained within this site card indicates that Aboriginal archaeological test excavations were undertaken by Therin in 2007 within PAD site AHIMS 45-5-3271, and the surrounding area. Excavations within the area identified 27 subsurface Aboriginal artefacts across four test pits. Therin therefore registered AHIMS 45-5-3428 as an extension of AHIMS 45-5-3271. An inspection of the site during this assessment found that the site is in good condition. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as moderate.
AHIMS 45-5-5333/Jacquie Osmond AS1	AHIMS 45-5-5333/Jacquie Osmond AS1 consisted of eight artefacts identified across an alluvial flat landform within 250 metres of Cabramatta Creek. The artefacts were identified from seven of 26 excavated test pits, suggesting an average site density of 1.23 artefact per square metre excavated. It appeared that the artefact assemblage may have undergone some disturbance as a result of construction of the playing fields. This was limited to upper soil deposits where glass and modern materials were identified during the test excavations, with the potential for deeper deposits (below 300 millimetres) to be intact. The artefact assemblage was primarily made up of silcrete, with one mudstone artefact identified between 800 and 900 millimetres. Two of these artefacts displayed evidence of retouch, however no diagnostic tool types were identified. The assemblage composition and density are both commonly found throughout the region and are of low scientific value. This site type occurs frequently throughout the Cumberland Plans region. The archaeological significance of this site has therefore been assessed as low.

9.3 Impact assessment

As previously outlined, the project proposes the following works:

- New rail track–providing a 1.65 kilometre long section of new track with connections to the existing track at the northern and southern ends.
- Track realignment–moving about 550 metres of existing track sideways (slewing) to make room for the new track.
- Bridge works–constructing two new bridge structures adjacent to the existing rail bridges over Sussex Street and Cabramatta Creek.
- Road works–reconfiguring Broomfield Street for a distance of about 680 metres between Sussex and Bridge streets.
- Ancillary work would include communication and signalling upgrades, works to existing retaining and noise walls, drainage work and protecting/relocating utilities.

- Construction compounds and work sites–Construction of compounds involves using areas as a base of construction activities including storage of plant, equipment and site offices and facilities.

These works will involve a range of ground disturbances, however they have largely been confined to areas of existing disturbance or areas of low archaeological potential where possible and, with the exception of Jacquie Osmond Reserve, will not result in impacts to Aboriginal values, AHIMS 45-5-3428, AHIMS 45-5-3271, or the area of high archaeological potential associated with these sites.

The construction of a site compound is proposed within Jacquie Osmond Reserve (Compound C4) and will contain site offices and associated facilities such as showers and meal rooms, areas for plant, equipment and materials to be stored, fencing, security facilities and parking for between 60 to 80 cars. It has been assumed that these works will result in direct impacts to the entire area of moderate potential within Jacquie Osmond Reserve. Possible impacts will include:

- Impacts to the ground surface as a result of repeated use of vehicles and plant equipment on the area.
- Impacts as a result of compaction due to material and equipment storage, laydown of site offices and associated amenities and fencing.
- Relocation of the Sydney Water sewer main to an area parallel to the rail corridor.

A summary of impacts to Aboriginal sites is provided below in Table 26.

Table 26 Summary of potential archaeological impacts

AHIMS site no.	Site name	Significance	Type of harm	Degree of harm	Consequence of harm
AHIMS 45-5-3271	CC1	Moderate	No harm	None	No loss of value
AHIMS 45-5-3428	CC1	Moderate	No harm	None	No loss of value
AHIMS 45-5-5333	Jacquie Osmond AS1	Low	Direct	Total	Total loss of value

9.4 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, p.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 has been implemented in this project. Based on the results of the field investigations and background research, the location of compounds was modified in order to avoid impacts to AHIMS sites and the area of high archaeological potential within Warwick Farm Recreation Reserve. This ensures the preservation of these Aboriginal heritage values within proximity to the project site for future generations to enjoy in line with the principles of ESD and intergenerational equity. This avoidance strategy also ensures cumulative impacts within the Cumberland Plains are mitigated.

As the project is CSSI ,impacts could not be avoided to AHIMS 45-5-5333/Jacquie Osmond Reserve AS 1. Test excavations were therefore undertaken in the extent of AHIMS 45-5-5333/Jacquie Osmond Reserve AS 1 to determine the nature and extent of archaeological deposits within Jacquie Osmond Reserve (Compound C4)

and to retrieve as much data as possible about Aboriginal occupation of the study area. The test excavations revealed a low density subsurface artefact scatter. The artefacts recovered during the test excavations have been catalogued and analysed which has contributed to our current knowledge of Aboriginal archaeological site type and distribution throughout the Cumberland Plains region. An ASIRF will be submitted following completion of works so the site information is accessible for educational purposes. The test excavations have increased our current understanding of Aboriginal occupation in the region ensuring that any scientific and cultural information obtained can be accessed and used by future generations. Further testing and salvage of this site is not recommended as the sporadic, low density nature of the deposit and the limited scientific value of the additional artefact assemblage would not provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region

In addition, a long term care agreement in consultation with RAPs should be implemented for artefacts recovered during the test excavations and community consultation with the Aboriginal community will be maintained throughout the construction phase. It is recommended that artefacts recovered from the excavations be given back to the Aboriginal community through a long term care agreement with the Gandangara LALC, where they can then be used to teach subsequent generations about Aboriginal culture or can be reburied in a culturally appropriate place at a later date. We believe this considers the principles of ESD and intergenerational equity and more importantly ensures that recovered artefacts are managed according to the wishes of RAPs.

During the consultation process Gandangara LALC requested that an Aboriginal representative be present to monitor ground disturbance works in the site extent of AHIMS 45-5-5333/Jacquie Osmond AS1. Biosis has not recommended monitoring as the site consisted of a low density subsurface archaeological deposit of low archaeological significance. It was not expected that further assessment of this site would provide additional scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region.

If ARTC wishes to engage the LALC for monitoring it is recommended that this form part of the unexpected finds procedure and may occur if undisturbed artefact bearing soils below a depth of 100 milimetres were expected to be disturbed within the site extent of AHIMS 45-5-5333/Jacquie Osmond AS1 only.

10 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: Continued consultation with the registered Aboriginal parties throughout construction of the project

The proponent should continue to inform the RAPs of the status of works and about the management of Aboriginal cultural heritage sites within the study area where there is a change, throughout construction of the project. Updates should be provided at least every six months as per the Heritage NSW guidelines. A copy of the final version of this report will be sent to the RAPs, Heritage NSW and the AHIMS register for information.

Recommendation 2: No further archaeological works required in the project site

This assessment has identified a low density subsurface archaeological deposit within Jacquie Osmond Reserve (Jacquie Osmond AS1). This site is considered to have low archaeological significance. It is not expected that salvage of this site would provide further scientific or cultural information which would contribute to our understanding of Aboriginal archaeology within the region and therefore further subsurface excavation, in the form of salvage, is not required.

Recommendation 3: AHIMS 45-5-3271/CC1 and AHIMS 45-5-3428/CC1, and identified areas of high archaeological potential to be identified as exclusions zones

AHIMS 45-5-3271/CC1, AHIMS 45-5-3428/CC1, and the areas of identified high archaeological potential are located outside of the project footprint and no works are proposed in these sites. These areas should be identified as exclusion zones in the CEMP so no unintentional impacts can occur.

Recommendation 4: Development of a long term care and control agreement

It is recommended that a method of long term care is developed for the artefacts recovered from Jacquie Osmond AS1 and in the event that any unexpected finds are identified as part of the works. A long term care agreement setting out the obligations and methods of long term safekeeping should be developed in consultation with the RAPs. It is recommended that artefacts are handed to Gandangarra Local Aboriginal Land Council under a long term care agreement where they can freely accessed by interested community members and used for educational purposes.

Recommendation 5: Submission of an ASIRF for any site impacted as part of the works

An ASIRF will be submitted to AHIMS following the impacts to Aboriginal site Jacquie Osmond AS1 as part of the proposed works.

Recommendation 6: Discovery of Unanticipated Aboriginal Objects and Aboriginal Ancestral Remains

An Unexpected Heritage Finds and Human Remains Procedure must be prepared to manage unexpected heritage finds and human remains in accordance with guidelines and standards published by the Heritage Council of NSW or Heritage NSW. This Procedure must be included in the CEMP and implemented for the duration of construction.

The Unexpected Heritage Finds and Human Remains Procedure must specify that 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 object, the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders, and implementing archaeological monitoring.

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. The Unexpected Heritage Finds and Human Remains Procedure must specify that if any suspected human remains are discovered during any activity:

1. Works must immediately cease at that location and not further move or disturb the remains.
2. The NSW Police and Heritage NSW's Environmental Line on 131 555 must be notified as soon as practicable and provide details of the remains and their location.
3. Work at that location must not recommence unless authorised in writing by Heritage NSW.

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Appendices

Appendix 1 AHIMS results

THE FOLLOWING APPENDIX IS NOT TO BE MADE PUBLIC

INFORMATION WHICH IS CONSIDERED RESTRICTED, CULTURALLY SENSITIVE OR CONFIDENTIAL HAS BEEN REDACTED OR REMOVED FROM THIS APPENDIX.

Appendix 2 Test excavation results

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
Cabramatta Loop Transect 6												
1	1	5/05/2020	Flat	0	100	7.5YR 3/2 Dark Brown	Soft sandy silty clay	no inclusions	6.5		grass roots, glass and ceramic	Dark brown sandy loam, softly compacted
	2	5/05/2020	Flat	100	200	7.5YR 3/2 Dark Brown	Soft sandy silty clay	charcoal flecks 2-5mm 2%	6.5		grass roots, glass and ceramic	Dark brown sandy loam, softly compacted
	3	5/05/2020	Flat	200	300	7.5YR 4/3 Brown	Soft silty clay loam	charcoal 2-5mm 30%	6		grass roots, glass and ceramic	Brown sandy loam, softly compacted
	4	5/05/2020	Flat	300	400	7.5YR 4/3 Brown	Soft silty clay loam	charcoal flecks 2-5mm 30%	6		grass roots	Brown sandy loam, softly compacted
	5	5/05/2020	Flat	400	500	10YR 4/2 Dark greyish brown	Soft silty clay	charcoal flecks 2-5mm 2%	6			Dark greyish brown silty clay, moderately compacted
	6	5/05/2020	Flat	500	600	10YR 4/2 Dark greyish brown	Moderately compact silty clay	charcoal flecks 2-5mm 2%	6			Dark greyish brown silty clay, moderately compacted
	7	5/05/2020	Flat	600	700	10YR 4/2 Dark	Moderately compact silty clay	charcoal flecks 2-15mm 2%	6			Dark greyish brown silty clay,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
						greyish brown						moderately compacted, on clay
2	1	8/05/2020, 11/05/2020	Flat	0	100	5YR 5/1 Grey	Soft sandy loam	rootlets	8			
	2	8/05/2020, 11/05/2020	Flat	100	200	5YR 3/1 very dark grey	Soft loamy sand	Sparse rootlets	6.5			
	3	8/05/2020, 11/05/2020	Flat	200	300	5YR 5/8 yellowish red, 5YR 3/1 very dark grey	Soft loamy sand		7.5			
	4	8/05/2020, 11/05/2020	Flat	300	400	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	5	8/05/2020, 11/05/2020	Flat	400	500	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	6	8/05/2020, 11/05/2020	Flat	500	600	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7	8/05/2020, 11/05/2020	Flat	600	700	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	8	8/05/2020, 11/05/2020	Flat	700	800	5YR 6/6 reddish yellow	Soft clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	9	8/05/2020, 11/05/2020	Flat	800	900	5YR 6/6 reddish yellow	Soft clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	10	8/05/2020, 11/05/2020	Flat	900	1000	5YR 6/6 reddish yellow	Soft clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
3	1	8/05/2020, 11/05/2020	Flat	0	100	10YR 3/2 very dark greyish brown	Silty Sandy Loam	grass roots	6		Grass roots	Dark brown silty sandy loam, moderately compacted
	2	8/05/2020, 11/05/2020	Flat	100	200	7.5YR 4/6 strong brown	Silty Clay	grass roots	8		Grass roots	Strong brown silty clay heavily compacted
	3	8/05/2020, 11/05/2020	Flat	200	300	10YR 3/2 very dark greyish brown	Silty Sandy Loam	Charcoal 2-10mm 5%, iron stone	6		Grass roots	Dark brown silty sandy loam,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
								nodules 10%				moderately compacted
	4	8/05/2020,	Flat	300	400	10YR 5/4 yellowish brown	Sandy Silt	Charcoal 2-10mm 5%, iron stone nodules 10%	6.5		Grass roots	Yellowish brown sandy silt, moderately compacted
	5	8/05/2020,	Flat	400	500	10YR 5/4 yellowish brown	Sandy Silt	Charcoal 2-10mm 5%, iron stone nodules 10%	6.5		Grass roots	Yellowish brown sandy silt, moderately compacted
	6	8/05/2020,	Flat	500	600	10YR 5/4 yellowish brown to 7.5YR 4/6 strong brown	Clayey Silt	Charcoal 2-5mm 2%, iron stone nodules 5%	7		Grass roots	yellowish brown sandy silt to strong brown clayey silt, moderately compacted
	7	8/05/2020,	Flat	600	700	7.5YR 4/6 strong brown	Silty Clay	Charcoal 2-5mm 2%, iron stone nodules 5%	7.5		Grass roots	Strong brown clayey silt, moderately compacted
	8	8/05/2020,	Flat	700	800	7.5YR 4/6 strong brown	Clayey Silt	Charcoal 2-5mm 2%, iron	7.5		Grass roots	Strong brown clayey silt,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
								stone nodules 5%				moderately compacted
	9	8/05/2020,	Flat	800	900	7.5YR 4/6 strong brown	Clayey Silt	grass roots	7.5		Grass roots	Strong brown clayey silt, moderately compacted, increasing clay content
	10	8/05/2020,	Flat	900	1000	7.5YR 4/6 strong brown	Silty Clay	grass roots	8		Grass roots	Strong brown silty clay heavily compacted
Cabramatta Loop Transect 7												
1	1	7/05/2020	Flat	0	100	5YR 2.5/1 black	Soft sandy Silty Loam	no inclusions	6.5		grass roots	Black sandy silty loam
	2	7/05/2020	Flat	100	200	10YR 3/2 very dark greyish brown	Soft clayey Silty Loam	charcoal 10mm 1%	6.5		grass roots	Very dark grayish brown silty clayey loam with strong brown silty large pockets coming through
	3	7/05/2020	Flat	200	300	10YR 3/2 very dark greyish brown	Soft clayey Silty Loam	charcoal 10mm 1%	6		grass roots	Very dark grayish brown silty clayey loam

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												with strong brown (7.5YR 4/6) silty large pockets coming through
	4	7/05/2020	Flat	300	400	7.5YR 4/4 brown	Moderately compact clayey Silt	charcoal 2-10mm 1%	6		grass roots	Brown clayey siltcontaining (7.5YR 4/6) strong brown silty pockets, soils are very mixed
	5	7/05/2020	Flat	400	500	10YR 4/2 dark greyish brown to 10YR 5/2 greyish brown	Hard silty clay	iron stone nodules 2% 10mm	6		grass roots	Clear cut onto dark greyish brown silty clay gradually turning to grayish brown silty clay, with ph changing to 7.5
	6	7/05/2020	Flat	500	600	10YR 5/2 greyish brown	Moderately compacted silty clay	iron stone nodules 5% 10mm	7.5		grass roots	moderately compacted grayish brown silty clay

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7	7/05/2020	Flat	600	700	10YR 5/2 greyish brown	Moderately compacted silty clay	iron stone nodules 2% 10-20mm	7.5		grass roots	moderately compacted grayish brown silty clay, finishing on 10YR 4/3 brown clay
2	1	8/05/2020	Flat	0	100	7.5YR 3/2 dark brown	Moderately compacted silty sandy loam	no inclusions	6			
	2	8/05/2020	Flat	100	200	7.5YR 4/3 brown	Moderately compacted Clayey Silty Loam	charcoal 20mm	6.5	grass roots		Brown silty clay loam, moderately compacted
	3	8/05/2020	Flat	200	300	7.5YR 4/3 brown to 10YR 5/4 yellowish brown	Moderately compacted Sandy Silt	no inclusions	8	grass roots		brown silty clayloam to yellowish brown sandy silt, moderately compacted
	4	8/05/2020	Flat	300	400	10YR 5/4 yellowish brown to 5YR 4/6 yellowish red	Moderately compacted Sand	no inclusions	8.5	grass roots		Yellowish brown sandy silt, moderately compacted, to reddish

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												brown clayey sandy silt
	5	8/05/2020	Flat	400	500	10YR 5/4 yellowish brown to 5YR 4/6 yellowish red	Moderately compacted Sand	no inclusions	8.5	grass roots		Yellowish brown sandy silt, moderately compacted, to reddish brown clayey sandy silt, mixed soils
	6	8/05/2020	Flat	500	600	10YR 5/4 yellowish brown to 5YR 4/6 yellowish red	Moderately compacted Sand	no inclusions	8.5	grass roots		Yellowish brown sandy silt, moderately compacted, to reddish brown clayey sandy silt, mixed soils, increasing clay content
	7	8/05/2020	Flat	600	700	10YR 5/4 yellowish brown to 5YR 4/6 yellowish red	Moderately compacted Sand	charcoal flecks 2-5mm 1%	8.5	grass roots		Yellowish brown sandy silt, moderately compacted, to reddish brown clayey sandy silt, mixed soils,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												increasing clay content
	8	8/05/2020	Flat	700	800	10YR 5/4 yellowish brown to 5YR 4/6 yellowish red	Moderately compacted Sand	no inclusions	8.5			Yellowish brown sandy silt, moderately compacted, to reddish brown clayey sandy silt, mixed soils, increasing clay content
	9	8/05/2020	Flat	800	900	5YR 4/6 yellowish red	Moderately compacted Sandy Clay	no inclusions	8.5			moderately to heavily compacted, to reddish brown silty sandy clay
	10	8/05/2020	Flat	900	1000	5YR 4/6 yellowish red	Moderately compacted Sandy Clay	no inclusions	8.5			
	11	8/05/2020	Flat	1000	1060	5YR 4/6 yellowish red	Moderately compacted Sandy Clay	no inclusions	8.5			
3	1		Flat	0	100	5YR 5/1 grey	Soft Sandy Loam	20% red (2.5YR 5/8) mottled specks	7.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	2			100	200	5YR 3/1 very dark grey	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	6.5	1 x Silcrete flake		Intermixed with spit 2
	3			200	300	5YR 5/8 yellowish red, 5YR 3/1 very dark grey	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	4			300	400	5YR 6/6 reddish yellow	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	5			400	500	5YR 6/6 reddish yellow	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	6			500	600	5YR 6/6 reddish yellow	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	7			500	600	5YR 6/6 reddish yellow	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	8			600	700	5YR 6/6 reddish yellow	Soft Loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	9			700	800	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	10			800	900	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	11			900	1000	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	12			1000	1100	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	13			1100	1200	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	14			1200	1300	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
	15			1300	1400	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	16			1400	1500	5YR 6/6 reddish yellow	Soft Clayey sand	20% red (2.5YR 5/8) mottled specks	8.5			
3.1	1	8/05/2020	Flat	0	100	5YR 3/1 very dark grey	Soft loamy sand		6.5			
	2	8/05/2020	Flat	100	200	5YR 3/1 very dark grey	Soft loamy sand	sparse rootlets	6.5			
	3	8/05/2020	Flat	200	300	5YR 5/8 yellowish red, 5YR 3/1 very dark grey	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	4	8/05/2020	Flat	300	400	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	5	8/05/2020	Flat	400	500	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	6	8/05/2020	Flat	500	600	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7	8/05/2020	Flat	600	700	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
3.2	1	8/05/2020	Flat	0	100	5YR 3/1 very dark grey	Soft loamy sand		6.5			
	2	8/05/2020	Flat	100	200	5YR 3/1 very dark grey	Soft loamy sand	sparse rootlets	6.5			
	3	8/05/2020	Flat	200	300	5YR 5/8 yellowish red, 5YR 3/1 very dark grey	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	4	8/05/2020	Flat	300	400	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	5	8/05/2020	Flat	400	500	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	6	8/05/2020	Flat	500	600	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7	8/05/2020	Flat	600	700	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
3.3	1	8/05/2020	Flat	0	100	5YR 3/1 very dark grey	Soft loamy sand		6.5			
	2	8/05/2020	Flat	100	200	5YR 3/1 very dark grey	Soft loamy sand	sparse rootlets	6.5			
	3	8/05/2020	Flat	200	300	5YR 5/8 yellowish red, 5YR 3/1 very dark grey	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	4	8/05/2020	Flat	300	400	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	5	8/05/2020	Flat	400	500	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
	6	8/05/2020	Flat	500	600	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7	8/05/2020	Flat	600	700	5YR 6/6 reddish yellow	Soft loamy sand	20% red (2.5YR 5/8) mottled specks	8.5			
Cabramatta Loop Transect 8												
1	1	6/05/2020	Flat	0	100	7.5YR 3/2 dark brown	Soft silty Loam	no inclusions	7		grass roots	Dark brown silty loam, softly compacted
	2	6/05/2020	Flat	100	200	7.5YR 3/2 dark brown	Soft Silty Loam	charcoal flecks 2% 2-4mm	7.5		grass roots	Dark brown silty loam, softly compacted
	3	6/05/2020	Flat	200	300	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-4mm	7.5		grass roots	Brown silty clay loam, moderately compacted
	4	6/05/2020	Flat	300	400	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-4mm	6.5		grass roots	Brown silty clay loam, moderately compacted, increasing clay content
	5	6/05/2020	Flat	400	500	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-5mm	6.5		grass roots	Brown silty clay loam, moderately compacted, increasing clay content

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	6	6/05/2020	Flat	500	600	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 1% 2-5mm	7		grass roots	Brown silty clay, moderately compacted
	7	6/05/2020	Flat	600	700	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 2% 2-5mm	7		grass roots	Brown silty clay, moderately compacted, finishing on clay
2	1	6/05/2020	Flat	0	100	7.5YR 3/2 dark brown	Soft silty Loam	no inclusions	7		grass roots	Dark brown silty loam, softly compacted
	2	6/05/2020	Flat	100	200	7.5YR 3/2 dark brown	Soft Silty Loam	charcoal flecks 1% 2-5mm	7		grass roots	Dark brown silty loam, softly compacted
	3	6/05/2020	Flat	200	300	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-4mm	7.5		grass roots	Brown silty clay loam, moderately compacted
	4	6/05/2020	Flat	300	400	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-4mm	6.5		grass roots	Brown silty clay loam, moderately compacted, increasing clay content

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	5	6/05/2020	Flat	400	500	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 2% 2-4mm	6.5		grass roots	Brown silty clay loam, moderately compacted, increasing clay content
	6	6/05/2020	Flat	500	600	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 2% 2-4mm	6.5		grass roots	Brown silty clay, moderately compacted
	7	6/05/2020	Flat	600	700	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 2% 2-5mm	7		grass roots	Brown silty clay, moderately compacted, finishing on clay
3	1	6/05/2020	Flat	0	100	7.5YR 3/2 dark brown	Soft silty Loam	no inclusions	6		grass roots	Dark brown silty loam, softly compacted
	2	6/05/2020	Flat	100	200	7.5YR 3/2 dark brown	Soft Silty Loam	stone fill thin layer 200-400mm thick medium sized stone up to 300mm	6		grass roots	Dark brown silty loam, softly compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	3	6/05/2020	Flat	200	300	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 30% 2-4mm	8		grass roots	Brown silty clay loam, moderately compacted
	4	6/05/2020	Flat	300	400	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 20% 2-4mm	8		grass roots	Brown silty clay loam, moderately compacted, increasing clay content
	5	6/05/2020	Flat	400	500	7.5YR 4/3 brown	Moderately impacted Silty Clay Loam	charcoal flecks 20% 2-10mm	8		grass roots	Brown silty clay loam, moderately compacted, increasing clay content
	6	6/05/2020	Flat	500	600	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 15% 2-15mm	8		grass roots	Brown silty clay, moderately compacted
	7	6/05/2020	Flat	600	700	7.5YR 4/4 brown	Moderately impacted Silty Clay	charcoal flecks 15% 2-15mm	8		grass roots	Brown silty clay, moderately compacted, finishing on clay
4	1			0	100	5YR 2.5/1 black	Soft Sandy Loam					

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	2			200	300	5YR 2.5/1 black	Soft Sandy Loam					
	3			300	400	7.5YR 4/3 brown to 7.5 4/6 strong brown	Moderately impacted Sandy Loam					
	4			300	400	7.5 4/6 strong brown	Moderately Impacted Silty Clay					
Cabramatta Loop Transect 9												
1	1			0	100	7.5YR 3/2 dark brown	Soft Silty Loam	gravel 2% 20-30mm	6.5		Grass roots	Dark brown silty loam, softly compacted, some gravel fill present
	2			100	200	7.5YR 3/2 dark brown	Soft Silty Clay Loam	charcoal flecks 1% 5mm	6.5		Grass roots	Dark brown silty loam, softly compacted
	3			200	300	7.5YR 3/4 dark brown	Soft Silty Clay Loam	charcoal flecks 2-15mm	7.5		Grass roots	Dark brown silty loam, moderately compacted
	4			300	400	7.5YR 4/4 brown	Soft Silty Clay	charcoal flecks 1% 2-5mm	7.5		Grass roots	Strong brown silty loam,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												moderately compacted
	5			400	500	7.5YR 4/4 brown	Soft Silty Clay	charcoal flecks 1% 2-5mm	7.5		Grass roots	Strong brown silty loam, moderately compacted
2	1			0	100	7.5YR 4/4 brown	Soft Silty Clay	charcoal flecks 1% 2-5mm	6.5		Grass roots	Strong brown silty loam, moderately compacted, finishing on strong brown
	2			100	200	5YR 2.5/1 black	Moderately compact Sandy Silty Loam	no inclusions	6		Grass roots	Black sandy silty loam
	3			200	300	5YR 2.5/1 black to 7.5YR 3/2 dark brown	Moderately compact Silty Clay Loam	iron stone nodules 5% 5-10mm	6		Grass roots	Black sandy silty loam to dark brown silty clay loam, contains iron stone nodules
	4			300	400	7.5YR 3/2 dark brown to 7.5YR 4/3 brown	Moderately compact Silty Clay Loam	iron stone nodules 20% 5-10mmand charcoal flecks 5% 2-5mm	6		Grass roots	Dark brown , to brown silty clay loam, contains iron stone nodules

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	5			400	500	7.5YR 3/2 dark brown to 7.5YR 4/3 brown	Moderately compact Silty Clay Loam	iron stone nodules 20% 5-10mmand charcoal flecks 5% 2-5mm	6		Grass roots	Dark brown, to brown silty clay loam, contains iron stone nodules
	6			500	600	7.5YR 3/2 dark brown to 7.5YR 4/3 brown	Moderately compact Silty Clay Loam	iron stone nodules 20% 5-10mm and charcoal flecks 5% 2-5mm	6.5		Grass roots	Dark brown, to brown silty clay loam, contains iron stone nodules
	7			600	700	7.5YR 4/3 brown to 7.5YR 5/4 brown	Hard Silty Clay Loam	iron stone nodules 5% 5mm and charcoal flecks 2% 2-5mm	6.5		Grass roots	Brown silty clay loam onto Brown clay with red mottles
3	1			0	100	7.5YR 5/4 brown	Silty Clay Loam	no inclusions	5		Grass roots	Brown clay with red mottles
	2			100	200	5YR 2.5/1 black	Moderately compact Soft Sandy Silty Loam	no inclusions	6		Grass roots	Black sandy silty loam

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	3			200	300	5YR 2.5/1 black to 7.5YR 4/2 brown	Moderately compact Sandy Silty Loam	iron stone nodules 2% less than 10mm	6		Grass roots	Black sandy silty loam to brown silty loamy clay
	4			300	400	7.5YR 4/2 brown to 10YR 4/2 dark greyish brown	Moderately compact Silty Clay	iron stone nodules 20% less than 10mm	6		Grass roots	Brown silty loamy clay to dark greyish brown silty loamy clay
	5			400	500	10YR 4/2 dark greyish brown	Moderately compact Silty Clay	iron stone nodules 30% less than 10mm	6		Grass roots	Dark greyish brown silty loamy clay
	6			500	600	10YR 4/2 dark greyish brown	Moderately compact Silty Clay	iron stone nodules 20% less than 10mm	6		Grass roots	Dark grayish brown silty loamy clay finishing on brown clay (10YR 4/3)
Cabramatta Loop Transect 10												
1	1			0	100	7.5YR 3/3 dark brown	Moderately compacted Silty Loam		5		grass roots	Dark brown silty loam
	2			100	200	7.5YR 3/4 dark brown	Moderately compacted Silty Loam	charcoal flecks 10% 1-5mm	6.5		grass roots, small tree roots	Dark brown silty loam

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	3			200	300	7.5YR 3/4 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 20% 1-5mm	6.5		small tree roots	Dark brown silly clay loam
	4			300	400	7.5YR 3/4 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 20% 1-10mm	5		small tree roots	Dark brown silly clay loam
	5			400	500	7.5YR 3/4 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 20% 1-10mm	6.5		small tree roots	Dark brown silly clay loam
	6			500	600	7.5YR 3/4 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 20% 1-10mm	6.5			Dark brown silly clay loam
	7			600	700	7.5YR 4/6 strong brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 1-5mm	7.5			strong brown silty loam clay
2	1			0	100	7.5YR 3/3 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 1mm	7		grass roots	Dark brown silty clay loam
	2			900	960	7.5YR 4/4 brown	Moderately compacted Silty Clay	charcoal flecks 2% 2-5mm	7.5		small tree roots	Brown silty clay finishing on clay

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	3			100	200	7.5YR 3/3 dark brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 1-5mm	6.5		grass roots	Dark brown silty clay loam
	4			200	300	7.5YR 4/3 brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 2-5mm	6		grass roots	Brown silty clay loam
	5			300	400	7.5YR 4/4 brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 2-5mm	6.5		grass roots	Brown silty clay loam
	6			500	600	7.5YR 4/4 brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 2-5mm	7		small tree roots	Brown silty clay loam
	7			600	700	7.5YR 4/4 brown	Moderately compacted Silty Clay Loam	charcoal flecks 2% 2-5mm	7		small tree roots	Brown silty clay loam
	8			700	800	7.5YR 4/4 brown	Moderately compacted Silty Clay	charcoal flecks 2% 2-5mm	7.5		small tree roots	Brown silty clay
	9			800	900	7.5YR 4/4 brown	Moderately compacted Silty Clay	charcoal flecks 2% 2-5mm	7.5		small tree roots	Brown silty clay finishing on clay
Cabramatta Loop Transect 11												

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
1	1			0	100	7.5YR 3/2 dark brown	Moderately compact Silty Sandy Loam	no inclusions	7.5		grass roots	Brown silty sandy loam, moderately compacted
	2			100	200	7.5YR 3/3 dark brown	Moderately compact Silty Sandy Clay	charcoal 20mm 1%	7		grass roots	Brown silty sandy loam, moderately compacted with increasing clay content
	3			200	300	7.5YR 4/6 strong brown	Moderately compact Sandy Silt	charcoal 2mm 1%	7.5		grass roots	Strong brown clayey sandy silt, moderately compacted
	4			300	400	7.5YR 4/6 strong brown	Moderately compact Sandy Silt	charcoal 2mm 1%	7.5		grass roots	Strong brown clayey sandy silt, moderately compacted
	5			400	500	7.5YR 4/6 strong brown to 5YR 4/6 yellowish red	Moderately compact Silty Clay	no inclusions	7.5		grass roots	Strong brown clayey sandy silt, moderately compacted, to heavily compacted yellowish red

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												sandy silty clay
	6			500	600	5YR 4/6 yellowish red	Hard Silty Clay	no inclusions	8		grass roots	Heavily compacted yellowish red sandy silty clay
	7			600	700	5YR 4/6 yellowish red	Hard Silty Clay	no inclusions	8		grass roots	Heavily compacted yellowish red sandy silty clay
	8			700	800	5YR 4/6 yellowish red	Hard Silty Clay	no inclusions	8		grass roots	Heavily compacted yellowish red sandy silty clay
	9			800	900	5YR 4/6 yellowish red	Hard Silty Clay	no inclusions	8		grass roots	Heavily compacted yellowish red sandy silty clay
	10			900	1000	5YR 4/6 yellowish red	Hard Silty Clay	no inclusions	8		grass roots	Heavily compacted yellowish red sandy silty clay

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
2	1			0	100	7.5YR 3/4 dark brown	Moderately compact Silty Sandy Loam	no inclusions	6.5		grass roots	Dark brown silty sandy loam, moderately compacted, onto Brown sandy loamy silt
	2			100	200	7.5YR 3/4 dark brown	Moderately compact Silty Sandy Loam	2-5mm 5%	6.5		grass roots	Dark brown silty sandy loam, moderately compacted, onto Brown sandy loamy silt
	3			200	300	7.5YR 4/3 brown	Moderately compact Sandy Silt	2-10mm 5%	7		grass roots	Brown sandy silt, moderately compacted
	4			300	400	7.5YR 4/3 brown	Moderately compact Sandy Silt	2-10mm 5%	7		grass roots	Brown sandy silt, moderately compacted
	5			400	500	7.5YR 4/3 brown	Moderately compact Sandy Silt	2-10mm 5%	7		grass roots	Brown sandy silt, moderately compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	6			500	600	7.5YR 4/3 brown	Moderately compact Sandy Silt	2-10mm 5%	7		grass roots	Brown sandy silt, moderately compacted
	7			600	700	7.5YR 4/3 brown	Moderately compact Sandy Silt	2-10mm 5%	7		grass roots	Brown sandy silt, moderately compacted
	8			700	800	10YR 4/6 dark yellowish brown	Moderately compact Sandy Silt		7.5			Dark Yellowish brown sandy clay, high compacted
	9			800	900	10YR 4/6 dark yellowish brown	Moderately compact Sandy Silt		7.5			Dark Yellowish brown sandy clay, high compacted
	10			900	1000	10YR 4/6 dark yellowish brown	Moderately compact Sandy Silt		7.5			Dark Yellowish brown sandy clay, high compacted
3	1			0	100	7.5YR 3/2 dark brown to 7.5YR 4/3 brown	Moderately compact Clayey silt	no inclusions	6		grass roots	Brown silty sandy loam, moderately compacted, onto Brown sandy loamy silt

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	2			100	200	7.5YR 4/3 brown	Moderately compact Clayey Silt	charcoal 2-5mm 5%	6		grass roots	Moderately compacted Brown sandy loamy silt
	3			200	300	7.5YR 4/3 brown	Moderately compact Clayey Silt	charcoal 2-5mm 10%	6.5		grass roots	Moderately compacted Brown sandy loamy silt to sandy clayey silt
	4			300	400	7.5YR 4/3 brown	Moderately compact Silty Clay	charcoal 2-5mm 15%	6.5		grass roots, ceramic and plastic	Moderately compacted silty clay
	5			500	600	7.5YR 4/3 brown	Moderately compact Silty Clay	charcoal 2-5mm 5%	7.5			Moderately compacted silty clay, some sand content very fine grained
	6			600	700	7.5YR 4/3 brown	Moderately compact Silty Clay	charcoal 2-5mm 5%	7.5			Moderately compacted silty clay, some sand content very fine grained
	7			700	800	10YR 5/2 greyish brown	Moderately compact Clay	no inclusions	6.5			Moderately compacted greyish brown clay

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	8			800	900	10YR 5/2 greyish brown	Moderately compact Clay	no inclusions	6.5			Moderately compacted greyish brown clay
4	1			0	100	7.5YR 3/3 dark brown	Moderately compact Sandy Silty Loam	no inclusions	5.5		grass roots	Dark brown silty sandy loam, moderately compacted
	2			100	200	7.5YR 3/3 dark brown to 7.5 YR 4/3 brown	Moderately compact Sandy Silty Loam	iron stone 5-10mm 5%and charcoal 2-10mm 2%	6		grass roots	Dark brown silty sandy loam, to brown sandy loam silt, moderately compacted
	3			200	300	7.5 YR 4/3 brown	Moderately compact Clayey Silt	iron stone 5-10mm 5% and charcoal 2-15mm 5%	6		grass roots	brown sandy clayey silt, moderately compacted
	4			300	400	10YR 3/2 very dark greyish brown	Moderately compact Clayey Silt	iron stone 5-10mm 10% and charcoal 2-10mm 5%	6		grass roots	Very dark greyish brown clayey silt, moderately compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	5			400	500	10YR 3/2 very dark greyish brown	Moderately compact Clayey Silt	iron stone 5-10mm 10% and charcoal 2-10mm 5%	6		grass roots	Very dark greyish brown clayey silt, moderately compacted
	6			500	600	10YR 4/2 dark greyish brown	Hard Silty Clay	iron stone 5-10mm 5% and charcoal 2-10mm 2%	7.5		grass roots	Dark greyish brown silty clay, heavily compacted
	7			600	700	10YR 4/2 dark greyish brown	Hard Silty Clay	iron stone 5-10mm 5% and charcoal 2-10mm 2%	7.5		grass roots	Dark greyish brown silty clay, heavily compacted
	8			700	800	10YR 4/2 dark greyish brown	Hard Silty Clay	iron stone 5-10mm 5% and charcoal 2-10mm 2%	7.5		grass roots	Dark greyish brown silty clay, heavily compacted
	9			800	900	10YR 4/2 dark greyish brown	Hard Silty Clay	charcoal 2-10mm 2%	7.5		grass roots	Dark greyish brown silty clay, heavily compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	10			900	1000	10YR 4/2 dark greyish brown	Hard Silty Clay	charcoal 2-10mm 2%	7.5		grass roots	Dark greyish brown silty clay, heavily compacted
Cabramatta Loop Transect 12												
1	1			0	100	10YR 3/2 very dark greyish brown	Sandy Silty Loam	no inclusions	6.5		grass roots	Very dark greyish brown silty sandy loam, moderately compacted
	2			100	200	10YR 3/2 very dark greyish brown	Sandy Silty Loam	no inclusions	6.5		grass roots	Very dark greyish brown silty sandy loam to sandy silt, moderately compacted
	3			200	300	7.5YR 5/8 strong brown	Sandy Silt	no inclusions	6.5		grass roots	Strong brown sandy silt, moderately compacted
	4			300	400	7.5YR 5/8 strong brown	Sandy Silt	no inclusions	6.5		grass roots	Strong brown sandy silt, moderately compacted
	5			400	500	7.5YR 5/8 strong brown	Clayey Silt	no inclusions	6.5		grass roots	Strong brown sandy clayey silt,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												moderately compacted
	6			500	600	7.5YR 5/8 strong brown	Clayey Silt	no inclusions	6.5		grass roots	Strong brown sandy clayey silt, moderately compacted
	7			600	700	7.5YR 5/8 strong brown	Clayey Silt	no inclusions	6.5		grass roots	Strong brown sandy clayey silt, moderately compacted
	8			700	800	7.5YR 5/8 strong brown	Silty Clay	no inclusions	6.5		grass roots	Strong brown sandy clayey silt, moderately compacted
	9			800	900	7.5YR 5/8 strong brown	Silty Clay	no inclusions	6.5		grass roots	Strong brown sandy clayey silt, heavily compacted
	10			900	1000	7.5YR 5/8 strong brown	Silty Clay	no inclusions	6.5		grass roots	Strong brown sandy clayey silt, heavily compacted
2	1			0	100	10YR 3/2 very dark greyish brown	Sandy Silty Loam	no inclusions	6		grass roots	Very dark greyish brown silty sandy loam,

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
												moderately compacted
	2			100	200	7.5YR 4/3 brown	Sandy Silty Loam	no inclusions	6.5		grass roots	Dark brown silty sandy loam, moderately compacted
	3			200	300	7.5YR 4/4 brown	Clayey Silt	charcoal 2-5mm 5%	6.5		grass roots	Brown sandy clayey silt, moderately compacted, soils mixed
	4			300	400	7.5YR 4/4 brown	Clayey Silt	charcoal 2-10mm 10%	7		grass roots	Brown sandy clayey silt, moderately compacted, soils less mixed
	5			400	500	7.5YR 4/4 brown	Silty Clay	charcoal 2-10mm 10%	7		grass roots	Brown silty clay, moderately compacted, soils less mixed
	6			500	600	7.5YR 4/2 brown	Silty Clay	charcoal 2-5mm %	7		grass roots	Dark greyish brown clay, heavily compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
3	1			0	100	7.5YR 3/3 dark brown		no inclusions	6.5		grass roots	Dark brown silty sandy loam, moderately compacted
	2			100	200	7.5YR 3/3 dark brown	Sandy Silty Loam	no inclusions	6.5		grass roots	Dark brown silty sandy loam, moderately compacted
	3			200	300	7.5YR 4/6 strong brown		no inclusions	7		grass roots	Strong brown sandy silt, moderately compacted
	4			300	400	7.5YR 4/6 strong brown	Sandy Silt	no inclusions	7		grass roots	Strong brown sandy silt, moderately compacted, soils very mixed
	5			400	500	10YR 4/2 dark greyish brown	Clay	no inclusions	7		grass roots	Dark greyish brownclay, heavily compacted
	6			400	500	7.5YR 4/6 strong brown	Sandy Silt	no inclusions	7		grass roots	Strong brown sandy silt, moderately compacted

Test pit number	Context Number	Date	Landform	Start depth (mm)	End depth (mm)	Colour (Minsell Code)	Texture	Inclusions	pH	Artefacts	Disturbance	Notes
	7			500	600	10YR 4/2 brown	Clay	no inclusions	7		grass roots	Dark greyish brown clay, heavily compacted
	8			600	650	10YR 4/2 brown	Clay	no inclusions	7		grass roots	Dark greyish brown clay, heavily compacted
4	1			0	100	7.5YR 3/2dark brown	Silty Sandy Loam	no inclusions	6.5		grass roots	Dark brown silty sandy loam, moderately compacted
	2			100	200	7.5YR 3/2 dark brown to 7.5YR 4/3 brown	Sandy Silt	Charcoal 2%2-10mm	7		grass roots	Dark brown sandy silt, moderately compacted to brown sandy silt
	3			200	300	7.5YR 4/3 brown	Sandy Silt	Charcoal 5%2-10mm	6.5		grass roots	Brown sandy silt, moderately compacted
	4			300	400	7.5YR 4/3 brown	Sandy Silt	Charcoal 5%2-10mm	7		grass roots	Brown sandy silt, moderately compacted, with some clay content

Appendix 3 Transect and test pit photo catalogue


DSCN2916


DSCN2917


DSCN2918


DSCN2919


DSCN2920


DSCN2921


DSCN2922


DSCN2755


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Appendix 4 Artefact analysis

ID No.	Site ID.	Transect N.	Pit N.	Spit N.	Type	Raw material	Cortex (%)	Platform type	Platform width (mm)	Platform depth (mm)	Termination	Retouch type	Retouch location	Length (mm)	Width (mm)	Thickness (mm)	Flake scars	Tool type	Weight	Comments
1	31990	7	3	2	Angular fragment	Silcrete	5%							16.25	13.22	5.48				
2	31990	7	3.2	2	Medial fragment	Silcrete								11.19	8.38	2.21				
3	31990	11	1	2	Medial fragment	Silcrete								15.84	9.26	4.57				
4	31990	11	3	3	Medial fragment	Silcrete								7.98	4.65	1.42				
5	31990	11	3	3	Distal fragment	Silcrete					Feather			8.53	4.39	1.18				
6	31990	11	4	9	Complete	Mudstone		Flaked	20.17	6.31	Hinge	Scalar	Quadrant 2 and 4	36.5	29.87	9.2	3			Platform preparation-crushing
7	31990	12	4	4	Proximal fragment	Silcrete		Flaked	15.57	9.38		Stepped	Quadrant 2	33.62	18.39	13.29	1			Bulb of percussion
8	31990	12	2	5	Proximal fragment	Silcrete		Crushed						26.68	20.17	3.58				