APPENDIX L

Appendix L - Aboriginal Cultural Heritage Assessment,
Historical Heritage Assessment

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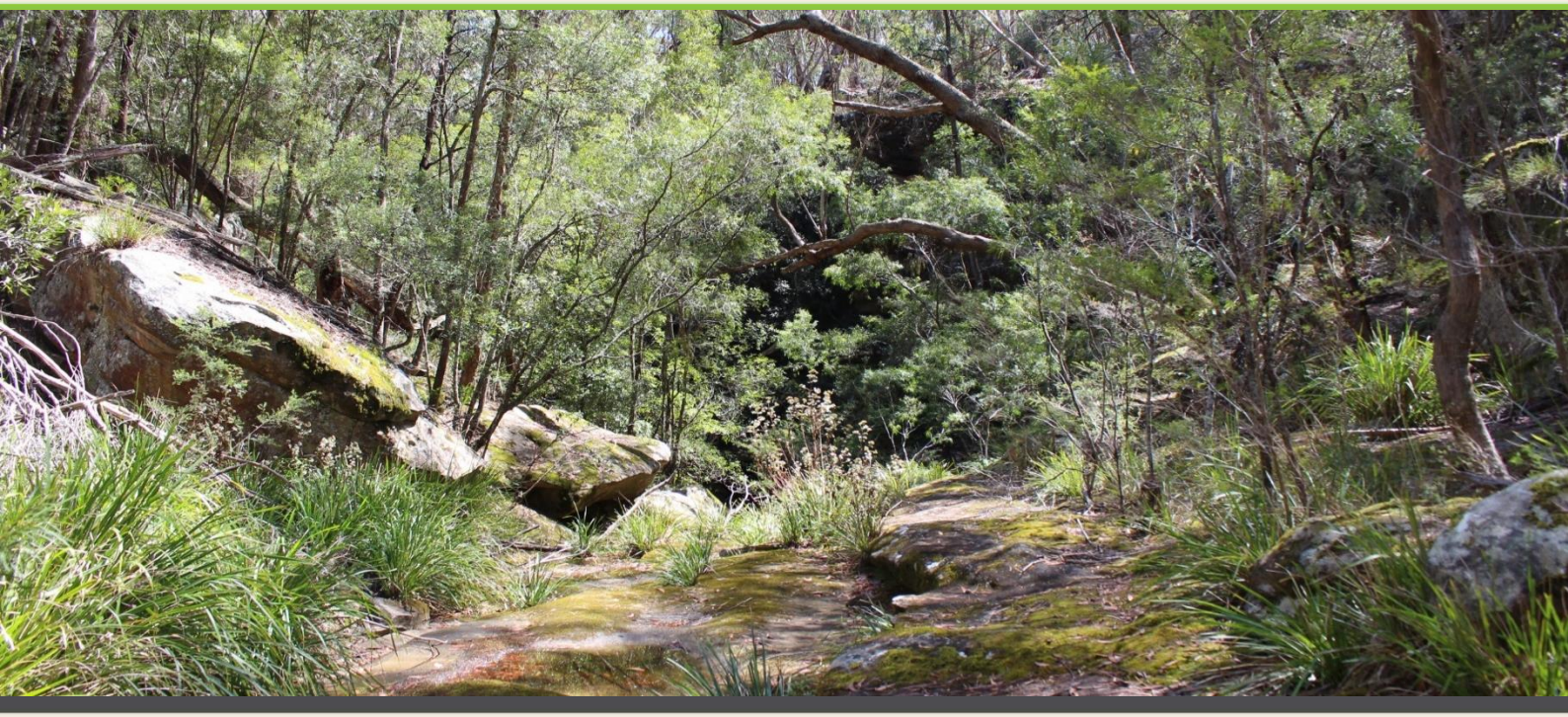

Aboriginal Cultural Heritage Assessment

Tahmoor South Project – Public Document

Nearest Town:	**Bargo**
Local Government Areas:	**Wingecaribbee and Wollondilly**
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Proponent:	**Tahmoor Coal Pty Ltd**
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Cover photograph: General photo of Dog trap creek, facing north. (Source: Niche)

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Executive Summary

This report presents the findings of an Aboriginal Cultural Heritage Assessment (ACHA) for Tahmoor Coal's Tahmoor South Project (the Project), an underground coal mine located in the Southern Coalfield of New South Wales (NSW). The proposed development will extend mining at Tahmoor Mine within the Project Area, using longwall methods, with the continued use of ancillary infrastructure at the existing Tahmoor Mine surface facilities area. The Project Area comprises of an area adjacent to, and to the south of, the Existing Tahmoor Approved Mining Area. It also overlaps a small area of the Existing Tahmoor Approved Mining Area comprising the surface facilities area, historical workings and other existing mine infrastructure.

Tahmoor Coal is seeking Development Consent for the Project from the NSW Minister for Planning under Division 4.1 of Part 4 of the NSW Environmental Planning and Assessment Act 1979 (State Significant Development).

Niche Environment and Heritage Pty Ltd was commissioned by Tahmoor Coal to produce an Aboriginal Cultural Heritage Assessment Report in accordance with the NSW Department of Planning and Environment Secretary's Environmental Assessment Requirements and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation, 2005)
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW Department of Environment, Climate Change and Water, 2010b)
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (NSW Department of Environment, Climate Change and Water, 2010c)
- *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Office of Environment and Heritage, 2011); and
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites, 2013).

To date, nineteen (19) separate Aboriginal stakeholders (including groups and individuals) have registered an interest in the Project Aboriginal Cultural Heritage Assessment. Consultation with all of these parties has been ongoing through the development of this report.

In addition to comprehensive surveys of the Subject Area and additional meetings with the Aboriginal community, the ACHA included a review of previous surveys and assessments from within the Subject Area and surrounds.

A total of forty one (41) Aboriginal heritage sites were identified within the Subject Area, comprising 40 physical sites and one Aboriginal Dreaming Story, and including 7 newly recorded sites and 34 previously recorded sites. The majority of physical sites (34 of 40[1]) have low scientific significance. There were two sites of moderate significance and a further three of high significance. It has been communicated by the Registered Aboriginal Parties that all sites have cultural significance. Within the Subsidence Study Area, (refer to Figure 8), 31 sites were identified, comprising:

- 25 sites of low significance
- 2 sites of moderate significance
- 4 sites of high significance

Of the40 sites within the Subject Area, one Aboriginal cultural heritage site is also located within the footprint of one of the proposed ventilation fan sites (TSC 2). There were no Aboriginal cultural heritage sites identified at any of the remaining areas proposed to be disturbed by the project for the construction of surface infrastructure; the second proposed ventilation fan site (TSC 1), or the footprint of the proposed extension to theReject Emplacement Area (REA) . Notwithstanding, detailed avoidance, mitigation and management measures have been developed to reduce potential impacts on Aboriginal heritage. These include recommendations to:

- Avoid surface impacts to axe grinding grooves and sandstone shelters.
- Monitor subsidence at grinding grooves and sandstone shelters.
- Consider engineering solutions to reduce potential subsidence impacts on sites of higher significance.
- Ensure that the Aboriginal community is involved in all aspects of managing Aboriginal heritage throughout the Project life.
- Develop a Heritage Management Plan with the Aboriginal community to detail all management requirements and responsibilities.

[1] There are 39 registered sites on AHIMS. The additional siteis an Aboriginal dreaming story and is not included in the count as it has no physical presence within the Subject Area.

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1. Introduction

Tahmoor Coal Pty Ltd (Tahmoor Coal) own and operate the Tahmoor Mine, an underground coal mine approximately 80 km south-west of Sydney in the Southern Coalfields of NSW (Figure 1). Tahmoor Coal produces up to two million tonnes per annum of product coal from its existing operations at the Tahmoor Mine, and undertakes underground mining under existing development consents, licences and the conditions of relevant mining leases.

Tahmoor Coal is seeking approval for the Tahmoor South Project (the proposed development), being the extension of underground coal mining at Tahmoor Mine, to the south and east of the existing Tahmoor Mine surface facilities area. The proposed development will continue to be accessed via the existing surface facilities at Tahmoor Mine, located between the towns of Tahmoor and Bargo.

The proposed development seeks to extend the life of underground mining at Tahmoor Mine until approximately 2040. The proposal will enable mining to be undertaken within the southern portion of Tahmoor Coal's existing lease areas and for operations and employment of the current workforce to continue for approximately a further 18 years.

The proposed development will extend mining at Tahmoor Mine within the Project Area, using longwall methods, with the continued use of ancillary infrastructure at the existing Tahmoor Mine surface facilities area. The Project Area is shown on Figure 1, Figure 2, Figure 3 and Figure 4 and comprises an area adjacent to, and to the south of, the Existing Tahmoor Approved Mining Area. It also overlaps a small area of the Existing Tahmoor Approved Mining Area comprising the surface facilities area, historical workings and other existing mine infrastructure.

In November 2012 the Tahmoor South Project was defined by the then NSW Department of Planning and Infrastructure (DP&I) as a State Significant Development (SSD 5825) under Section 78A (8a) of the *Environmental Planning and Assessment Act* 1979 (the EP&A Act). Through the planning focus review process, relevant NSW government agencies provided specific advice to DP&I on assessment requirements for the project as part of the Director-General's Requirements (DGRs).

In its current rendition the Tahmoor South Project's Development Consent will be sought from the NSW Minister for Planning under Division 4.1 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (State Significant Development).

The Secretary's Environmental Assessment Requirements (SEARs) for State Significant Development were issued for the Project on 9 June 2017. In regards to Aboriginal heritage, the SEARs state that the Environmental Impact Statement (EIS) for the Project must identify and describe the tangible and intangible Aboriginal cultural heritage values that exist across the whole area that will be effected by the development and document these in the Environmental Impact Statement (EIS). Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Tahmoor Coal Pty Ltd to produce an ACHA in accordance with SEARs and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (NSW Department of Environment and Conservation [DEC], 2005);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs) (NSW Department of Environment, Climate Change and Water [DECCW], 2010a);

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c);
- *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011); and
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS], 2013).

The objectives of this report, in consideration of the SEARs and the Office of Environment and Heritage's (OEH) submission to the NSW Department of Planning and Environment (DP&E), and the requirements of the above guidelines, are as follows:

- identify and describe Aboriginal objects located within the area of the Project.
- identify and describe sensitivity (in relation to cultural heritage) of different landforms present in the landscape affected by the Project.
- identify and describe the cultural heritage values, including the significance of the Aboriginal objects that exist across the whole area that will be affected by the Project, and the significance of these values for the Aboriginal people who have a cultural association with the land.
- describe how the requirements for consultation with Aboriginal people as specified in Clause 80C of the NSW *National Parks and Wildlife Regulation 2009* have been met.
- present the views of those Aboriginal people regarding the likely impact of the Project on their cultural heritage, including a copy of any submissions received and a response as necessary.
- identify and describe the actual or likely harm posed to Aboriginal objects or declared Aboriginal places from the Project with references to the cultural heritage values identified.
- provide a description of any practical measures that may be taken to protect and conserve those Aboriginal objects.
- provide a description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm, or if this is not possible, to manage (minimise) the harm.
- provide documentation of discussions with the Aboriginal stakeholders regarding commitments from the proponent related to social, economic and/or conservation gains to offset any loss of cultural heritage; and

This report will form part of an EIS which will be assessed and determined in accordance with Division 4.1 of Part 4 of the EP&A Act.

2. Structure of this Report

In order to meet the assessment requirements for the EIS, Table 1 outlines the locations within this ACHA that responds to each of the OEH's requirements as outlined in the Standard Environmental Assessment Requirements.

Table 1: Sections of the Aboriginal Cultural Heritage Assessment report that responds to the SEARS and OEH's Standard Requirements

OEH's Standard Environmental Assessment Requirements	
SEAR Requirement **2.Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have cultural association with the land must be documented in the EIS**	
Sections of the Aboriginal Cultural Heritage Assessment report that responds to OEH's requirements of Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW).	
Requirement	**Section of the report**
Consultation Stage 1 through to 4	**Section 5, Appendix 1 and Appendix 2**
The significance of cultural heritage values for Aboriginal people who have cultural association with the land.	**Section 12.3, Appendix 1 and Appendix 2**
3.***SEAR Requirement*** **The EIS must identify and describe the tangible and intangible Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011) and consultation with OEH regional officers.**	
Sections of the Aboriginal Cultural Heritage Assessment report that responds to OEH's requirements of the *Guide to investigating assessing and reporting on Aboriginal cultural heritage in NSW*.	
Requirement	**Section of the report**
A description of the development area and proposed Activity Area	**Section 2 and Section 3**
A description of Aboriginal objects and declared Aboriginal places located within proposed Activity Area	**Section 7, Section 12, Section 13, Appendix 5**
A description of the environment, including geology, soils, landforms, topography, waterways, vegetation, past land use and disturbance.	**Section 6**
A description of Aboriginal land use in the Activity Area	**Section 6 and Section 7**

OEH's Standard Environmental Assessment Requirements	
An outline of the statutory and legislative context in which the assessment is occurring**.**	**Section 3**
A description of how the requirements for consultation with Aboriginal people, as specified in clause 8OC of the National Parks and Wildlife Regulation 2009, have been met	**Section 4, Section 11, Appendix 1 and Appendix 2**
The views of those Aboriginal people regarding the likely impact of the proposed activity on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and Tahmoor Collieries response**.**	**Section 4, Section 11, Appendix 1 and Appendix 2**
The assessment methodology and sampling strategy for the ACHA.	**Section 8 and Appendix 3**
A preliminary ACHA that provides the results of a pedestrian survey of the project.	**Section 8 and Section 9**
An archaeological report in accordance with the Code of Practice for Archaeological Investigations in NSW that provides the results of subsurface assessment of Potential Archaeological Deposits to establish its nature, extent and significance:with a sample of sites, surface and subsurface tracked spatially within the Activity Area and likely options.	**Section 1, Section2, Section 3, Section 4, Section 6, Section 8, Section 9.2, Section 9.3, Section 10, Section 11, Section 12, Section 13, Section 14, Appendix 4, Appendix 5, Appendix 6**
A description of the cultural heritage values, including the significance of the Aboriginal objects and any declared Aboriginal places, which exist across the whole Project Area that will be affected by the proposed activity (test excavation program), and the significance of these values for the Aboriginal people who have a cultural association with the land	**Section 9.3 and Appendix 5**
A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity with reference to the cultural heritage values identified.	**Section 12**
A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.	**Section 13 and Section 14**
Completed Aboriginal Site Recording Forms and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each	**Appendix 7**

OEH's Standard Environmental Assessment Requirements	
Aboriginal site that is recorded during archaeological investigations completed for these environmental assessment requirements	
A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.	**Section 14**
SEAR Requirement **4. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures to mitigate impacts. Any objects recorded as part of this assessment must be documented and notified to OEH**	
Requirement	**Section of the report**
Impacts on Aboriginal cultural heritage values	**Section 13**
Attempts to avoid impact upon cultural heritage values and identify conservation outcomes	**Section 14.1**
Measures to mitigate impacts	**Section 14 and Section 15**
Objects recorded as part of this assessment must be documented and notified to OEH	**Section 10, Section 15, Appendix 5**

3. Site Location and Investigation Area

3.1 The Tahmoor South Project

The Tahmoor Mine is an underground operation which began coal mining in 1979. Coal is currently mined from within the Bulli Seam, producing mostly hard coking coal for steel production, and is transported via rail to Port Kembla for export. The current mining operations, in the Tahmoor North lease area, are forecast to continue until around 2022.

The Tahmoor South Project aims to ensure the life of underground mining at Tahmoor Mine for an additional 13 years until approximately 2035, with the extension of underground operations south from the mine surface facilities, within the Bargo area and towards the east under Pheasants Nest.

An EIS is being prepared to seek development consent and environmental approvals for the proposed Tahmoor South Project.

3.2 Location of the proposed Tahmoor South Project

The project is located within the Tharawal Local Aboriginal Land Council's boundary, and extends across the Wollondilly and Wingecaribbee Local Government Areas. Figure 1, Figure 2, Figure 3 and Figure 4 show the proposed Subject Area (within each of the figures the Subject Area is identified as the Project Area) within the overall region. Further to this the figures in this ACHA highlight the Subsidence Study Area. The Subsidence Study Area outlines the maximum area of impacts associated with the proposed Tahmoor South Project. The Subsidence Study Area is derived by combining the areas bounded by the following limits:

- The predicted limit of vertical subsidence as a result of the extraction of coal from within the extent of longwalls. The limit of vertical subsidence was taken as the 20 mm subsidence contour determined using the Incremental Profile Method (IPM); and
- A minimum distance of 600 m from the nearest edge of the proposed longwalls (longwall length based on original Mine Plan), as recommended by the independent *Inquiry into underground coal mining in the Southern Coalfields of NSW* (SCI, 2008).

In some instances, the predicted limit of vertical subsidence (20 mm contour) extends beyond the recommended 600 m. Therefore, to ensure a conservative assessment, the SSA has been defined based on whichever delineation is furthest from the proposed longwalls.

The majority of the land use in the area is rural in nature with the cleared sections of the area currently used for pasture or low intensity agriculture. The western side of the Subject Area, surrounding the Bargo River comprises of remnant vegetation, on Crown land. Remnant vegetation is also present along Dogtrap, Horne and Teatree Hollow Creeks. The south eastern corner of the subject area runs along Carters Creek.

4. Description of the Development Proposal

4.3 Proposed Mining Activities

Tahmoor Coal is seeking development consent for the continuation of underground mining at Tahmoor Mine, extending underground operations and associated infrastructure south, within the Bargo area.

The proposed development will use longwall mining to extract coal from the Bulli seam within the bounds of CCL 716 and CCL 747. Coal extraction of up to 4 million tonnes (Mt) of ROM coal per annum is proposed as part of the development, with extraction of up to 37 Mt of ROM coal over the life of the project. The majority of product coal produced will be coking coal, with a small secondary thermal coal product.

Once the coal has been extracted and brought to the surface, it will be processed at Tahmoor Mine's existing Coal Handling and Preparation Plan (CHPP) and coal clearance facilities, and then transported via the existing rail loop, the Main Southern Railway and the Moss Vale to Unanderra Railway to Port Kembla and Newcastle (from time to time) for Australian and international markets.

The proposed development will utilise the existing surface infrastructure at the Tahmoor Mine surface facilities area. Some upgrades are proposed to facilitate the extension. The proposed development also incorporates the planning for rehabilitation and mine closure once mining ceases.

The proposed development will make use of three ventilation shafts currently being used for the operations at Tahmoor North, being one upcast (T2) and two downcast shafts (T1 and T3). The two additional vent shafts proposed for the Tahmoor South Project will be located in the Central Domain as follows:

- TSC1: an upcast ventilation shaft that will be located on Tahmoor Coal's Charlies Point Road property; and
- TSC2: a downcast ventilation shaft that will be located on Crown Land adjacent to Tahmoor Coal's Charlies Point Road property.

An additional 50 -175 personnel will be required for the Tahmoor South Project development works, which may occur concurrently with the ongoing mining operations at Tahmoor North. Additional site amenities, including bath houses and additional onsite car parks will be required to accommodate the increased workforce during the transition period from mining operations at Tahmoor North and the Tahmoor South Project's development works.

In summary, the key components of the proposed development comprise:

- longwall mining in the Central Domain;
- mine development including underground redevelopment, ventilation shaft construction, pre-gas drainage and service connection;
- upgrades to the existing surface facilities area including:
    - upgrades to the CHPP;
    - expansion of the existing REA;
    - additional mobile plant for coal handling;
    - additions to the existing bathhouses, stores and associated access ways; and
    - upgrades to offsite service infrastructure, including electrical supply.
    - rail transport of product coal to Port Kembla, and Newcastle (from time to time);
    - mine closure and rehabilitation; and
    - environmental management.

The project has two main components that require inclusion in the ACHA prior to submission of the EIS. Both of these components have previously been assessed. They are:

- areas that may contain cultural heritage values which may be subject to impact from subsidence; and
- surface infrastructure to support the proposed mining operations.

4.4 The planning and approvals process

A Preliminary Environmental Assessment (PEA) was previously submitted to the DP&I in September 2012. The DP&I issued Director General's Requirements (DGR's) that outlined what economic, social and environmental issues needed to be assessed within an EIS. The project was put on hold in 2014 due to a range of factors, and the DGR's were subsequently withdrawn.

More recently the PEA was resubmitted to DP&E in mid-2017 requesting the Secretary's Environmental Assessment Requirements (SEARs) to assess impacts for the proposed development. The SEARs require an assessment of the likely Aboriginal heritage (cultural and archaeological) impacts of the development, having regard to OEH's requirements. The project is designated as State Significant Development (SSD) and will be assessed under Part4, Division 4.1 of the EP&A Act.

4.5 Project phasing

The Project is proposed to commence as soon as practicable after all the necessary approvals have been obtained and any prerequisite conditions fulfilled.

5. Aboriginal Community Consultation Process

In administering its statutory functions under Part 6 of the NSW *National Parks and Wildlife Act 1974*, the OEH requires that proponents consult with Aboriginal people about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and/or places within any given development area in accordance with Clause 80C of the NSW *National Parks and Wildlife Regulation 2009* and the ACHCRs (DECCW, 2010a). Although state significant development that is authorised by a development consent granted under Division 4.1 of Part 4 of the EP&A Act is exempt from requiring an Aboriginal Heritage Impact Permit under section 90 of the NSW *National Parks and Wildlife Act 1974* and accordingly, from compliance with the consultation process in Clause 80C of the NSW *National Parks and Wildlife Regulation 2009*, consultation with the Aboriginal community for this ACHA has nonetheless been undertaken in compliance with the requirements of these legislative instruments and the following guidelines:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs) (DECCW, 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b)
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c)
- *Guide to Investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011); and
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia ICOMOS, 2013).

The OEH maintains that the objective of consultation with Aboriginal communities about the cultural heritage values of Aboriginal objects and places is to ensure that Aboriginal people have the opportunity to improve ACHA outcomes by:

- providing relevant information about the cultural significance and values of Aboriginal objects and/or places.
- influencing the design of the method used to assess cultural and scientific significance of Aboriginal objects and/or places.
- actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal objects and/or places within the proposed project area; and
- commenting on draft assessment reports before they are submitted by the proponent to the OEH.

To assist proponents through the required consultation process, the DECCW[2] (2010a) has prepared a guidance document, namely the ACHCRs. Consultation in the form outlined in the ACHCRs is a formal requirement where a proponent is aware that their development activity has the potential to harm Aboriginal objects and/or places. The OEH also recommends that these requirements be used when the certainty of harm is not yet established but a proponent has, through some formal development mechanism, been required to undertake a cultural heritage assessment to establish the potential harm their proposal may have on Aboriginal objects and places.

Consultation for this Project has been undertaken in accordance with the ACHCRs as these meet the fundamental tenants of the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005), whilst also meeting current industry standards for community consultation.

The ACHCRs outline a four stage consultation process that includes detailed step by step guidance as to the aim of each stage, how it is to proceed and what actions are necessary for it to be successfully completed. The four stages are:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about the cultural significance.
- Stage 4 – Review of draft cultural heritage assessment report.

The document also outlines the roles and responsibilities of the OEH, Aboriginal parties including Local and State Aboriginal Land Councils, and proponents throughout the consultation process. To meet the requirements of consultation it is expected that proponents will (DECCW, 2010a):

- bring the Registered Aboriginal Parties (RAPs) or their nominated representatives together and be responsible for ensuring appropriate administration and management of the consultation process.
- consider the cultural perspectives, views, knowledge and advice of the RAPs involved in the consultation process in assessing cultural significance and developing any heritage management outcomes for Aboriginal objects and/or places.
- provide evidence to the OEH of consultation by including information relevant to the cultural perspectives, views, knowledge and advice provided by the RAPs.
- accurately record and clearly articulate all consultation findings in the final cultural heritage assessment report; and
- provide copies of the cultural heritage assessment report to the RAPs who have been consulted.

The consultation process undertaken for this Project to seek active involvement from relevant Aboriginal people followed the current NSW framework, namely, the ACHCRs and Clause 80C of the NSW *National Parks and Wildlife Regulation 2009*. Section 1.3 of the ACHCRs describes the guiding principles of the document. The principles have been derived directly from the Australian Heritage Commission's *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission 2002). Both documents share the aim of creating a system where free prior informed advice can be sought from the Aboriginal community.

The following sections outline the process and results of the consultation conducted during the preparation of this ACHA to ascertain and manage the Aboriginal cultural heritage values of the Subject Area.

[2] Now known as the Office of Environment and Heritage

5.1 The consultation process

The consultation process for the Tahmoor South Project has been undertaken twice. Once under the November 2012 DGR's and during the current assessment. Both consultation processes are outlined below.

5.1.1 Stage 1 - Notifications

This stage of the consultation process is used to identify, notify and register any Aboriginal people or groups who may have a cultural interest in and/or possess cultural knowledge relevant to determining the cultural significance of Aboriginal objects or places in the Study area.

In accordance with Section 4.1.2 of the ACHCRs, Project notifications were sent on 8 January 2013 and16 September 2017 to the following organisations (responses have been collated in Appendix 1):

Table 2: Stage 1 Agency Notifications

Notifications sent on 8 January 2013	Response received	Notifications sent on 16 September 2017	Response received
Hawkesbury Nepean Catchment Management Trust	Yes-10th January 2013	Greater Sydney Local Land Services	No response received
Office of Environment and Heritage Planning and Aboriginal Heritage Section (OEH)	Yes- 11th January 2013	Regional Operations Group, OEH	Yes-31st August 2017
Office of the Registrar, Aboriginal Land Rights Act, 1983	Yes—21st January 2013	Office of the Registrar, Aboriginal Land Rights Act 1983	Yes-24th September 2017
National Native Title Services Corporation Limited(NNTT)	Yes-16th January 2013	National Native Title Services Corporation Limited(NNTT)	No response received
Native Title Services Corporation Limited (NTS Corp)	Yes-14th January 2013	Native Title Services Corporation Limited (NTS Corp)	No response received
Sydney Catchment Authority	No response received	South East Local Land Services	Yes-21st August 2017
Tharawal Local Aboriginal Land Council	No response received	Tharawal Local Aboriginal Land Council	No response received
Wingecaribbee Shire Council	No response received	Wingecaribbee Shire Council	No response received
Wollondilly Shire Council	No response received	Wollondilly Shire Council	Yes-25th August 2017

As a result of the responses received from the 2013 Stage 1 Notification a total of 7 individuals and organisations were identified as potential knowledge holders for the Subject Area. A list of these groups are provided in Table 3.

Table 3: Potential knowledge holders for the Subject Area notified of the project in 2013.

Potential Stakeholders notified of the proposed project		
Name	**Name**	**Name**
Cubbitch Barta Native Title Services	Gundungarra Aboriginal Heritage Association Inc.	Indigenous Historical Research
Peter Falk Consultancy	Tharawal Local Aboriginal land Council	La Perouse/ Botany Bay Aboriginal Corporation
Gundungurra Aboriginal Corporation Inc.		

As a result of the responses received from the 2017 Stage 1 Notification a total of 109 individuals and organisations were identified as potential knowledge holders for the Subject Area. A list of these groups is provided in Table 4.

Table 4: Potential knowledge holders for the Subject Area notified of the Project in 2017

Potential Stakeholders notified of the proposed project		
Name	**Name**	**Name**
A1 Indigenous Services	Bidjawong Aboriginal Corporation	Gary Caines
Amanda Hickey Cultural Services	Bilinga (Murrin Clan/Peoples)	Gibbergunyah Aboriginal Association
Badu	Bilinga Cultural Heritage Technical Services	Ginninderra Aboriginal Corporation
Troy Tungai	Bilinga Cultural Heritage Technical Services (Mirramajah)	Goobah Development PTY LTD (Murrin Clan/Peoples)
Aboriginal Archaeology Service	Butucarbin Aboriginal Corporation	Gundungurra Aboriginal Heritage Association Inc
Corroboree Aboriginal Corporation	Cullendulla	Gundungurra Tribal Council Aboriginal Corporation
Cubbitch Barta Native Title Claimants	Coomaditchie Aboriginal Corporation	Gundungurra Tribal Council Aboriginal Organisation
Didge Ngunawal Clan	Cubbitch Barta	Gundungurra Tribal Technical Services
Duncan Falk Consultancy	Cullendulla (Murrin Clan/Peoples)	Gunyuu (Murrin Clan/Peoples)
Gulaga	D'harawal Mens Aboriginal Corporation	Gunyuu Cultural Heritage Technical Services
Gunjeewong Cultural Heritage Aboriginal Corporation	Darug Aboriginal Cultural Heritage Assessments	Holroyd City Council Advisory Committee
La Perouse Local Aboriginal Land Council	Darug Custodian Aboriginal Corporation	HSB Consultants
Muragadi Heritage Indigenous Corporation	Darug Land Observations	Illawarra Local Aboriginal Land Council

Potential Stakeholders notified of the proposed project		
Name	**Name**	**Name**
Murri Bidgee Mullangari Aboriginal Corporation	Darug Tribal Aboriginal Corporation	Jerringong
Phil Kahn	Deerubbin Local Aboriginal Land Council	Karrial (Murrin Clan/Peoples)
Three Ducks Dreaming Surveying and Consulting	Des Dyer	Kawul Cultural Services
Tocomwall	Dharug	Ken Foster
Woronora Plateau Gundungara Elders Council	Dhinawan-Dhigaraa Culture & Heritage Pty Ltd	Korewal Elouera Jerrungarugh Tribal
Tharawal Local Aboriginal Land Council	DJMD Consultancy	La Perouse Botany Bay Corporation
Tharawal Local Aboriginal Land Council	Eric Keidge	Leanne Tungai
Anthony Williams	Families Sharing Culture Aboriginal Corporation	Matthew and Andrew Coe
Guunama dreamn	Gadhu Dreaming	Merrigarn Indigenous Corporation
Bellambi Indigenous Corporation	Gandangara Local Aboriginal Land Council	Metropolitan Local Aboriginal Land Council
Biamanga (Murrin Clan/Peoples)	Garrara Aboriginal Corporation	South West Rocks Corporation
Minnamunnung	Walbunja (Murrin Clan/Peoples)	Tania Matthews
Munyunga	Walgalu	Thauaira
Munyunga Cultural Heritage Technical Services	Warra Bingi Nunda Gurri	Trevor Robinson
Murramarang	Warragil Cultural Services	Tungai Tongai
Murrumbul	Widescope Indigenous Group	Trish Levitt
Murrumbul Cultural Heritage Technical Services	Wingikara	Duncan Falk
Nerrigundah	Wingikara Cultural Heritage Technical Services	Kim Moran
Norma Simms	Wodi Wodi Traditional Owners Corporation	Nundagurri
Parramatta City Council Aboriginal Advisory Committee	Wurrumay Consultancy	Wullung (Murrin Clan/Peoples)
Pejar Local Aboriginal Land Council	Yamanda Aboriginal Association	Pemulwuy CHTS
Yerramurra	Peter Falk Consultancy	Yerramurra (Murrin Clan/Peoples)
Platypus Dreamin	Carolyn Hickey	Rane Consulting
Marilyn CARROLL-Johnson		

A full record of all correspondence received from and sent to the Aboriginal community is contained in Appendix 2, while all relevant correspondence is provided in Appendix 1.

The NNTT advised that the Gundungurra Tribal Council Aboriginal Corporation #6 have a current Native Title Claim registered for land surrounding the Subject Area. A register extract of NC97/7 Gundungurra Tribal Council Aboriginal Organisation #6 Native Title determination application is included in Appendix 1. No Indigenous Land Use Agreements exist within the Subject Area.

Advertisements inviting the registration of Aboriginal persons or groups who hold cultural knowledge relevant to, or who have a right or interest in, determining the cultural heritage significance of Aboriginal object(s) and/or place(s) in the Subject Area were published in the following newspapers (Appendix 1):

- *Macarthur Advertiser* (13 February 2013)
- *Macarthur Advertiser* (23 August 2017)

In accordance with Sections 4.1 and 4.2 of the consultation requirements outlined in the ACHCRs, all 7 individuals and organisations were contacted in writing on the 25 March 2013. Representatives of the following organisations registered their interest in the project, and as a result were involved in the original assessment:

- Cubbitch Barta Native Title Claimants
- Tharawal Local Aboriginal Land Council

For the current assessment all 109 individuals and organisations identified in Table 4 were contacted in writing on 31 August 2017 and were invited to register an interest in the Project.

As a result of the above consultation, 21 individuals and organisations became Registered Aboriginal Parties (RAPs) to the current project during the registration period (31th August – 13th September 2017). A copy of the list of the registered RAPs, along with a copy of the written notifications and advertisements, were provided to the Illawarra Regional OEH Environment Protection and Regulation Group Office and Tharawal Local Aboriginal Land Council (TLALC) on 21st September 2017, in accordance with Section 4.1.6 of the ACHCRs. A list of RAPs is provided in Table 5.

Table 5: Summary of Registered Aboriginal Parties for the Project

Registered Aboriginal Parties (registered during the registration period 16th August-31st August 2017)		
Name	**Name**	**Name**
A1 Indigenous Services	Aboriginal Archaeology Service	Amanda Hickey Cultural Services
Badu	Corroboree Aboriginal Corporation	Cubbitch Barta Native Title Claimants
Didge Ngunawal Clan	Duncan Falk Consultancy	Gulaga
Gunjeewong Cultural Heritage Aboriginal Corporation	Kamilaroi Yankuntjatjara Working Group	La Perouse Local Aboriginal Land Council
Muragadi Heritage Indigenous Corporation	Murri Bidgee Mullangari Aboriginal Corporation	Tharawal Local Aboriginal Land Council
Three Ducks Dreaming Surveying and Consulting	Troy Tungai	Tocomwall
Woronora Plateau Gundungara Elders Council		

5.1.2 Stages 2 and 3 – Presentation of project information and gathering information about Cultural Significance

5.1.2.1 Proposed Methodology and Information Sessions

During the initial assessment the RAPS were provided with a letter outlining the Project information and the proposed methodology on the 25 March 2013 (Appendix 3). During the current assessment the RAPs were provided with a letter outlining information about the Project, an invitation to attend an information session, a copy of the Proposed Methodology (Appendix 3), a request for valid insurances and to respond to a supplied questionnaire about their group's connection to the area for the ACHA for review and comment on 13th September 2017, in accordance with the ACHCRs (DECCW 2010a). A minimum of 28 days was allowed for RAPs to provide input in regards to the following aspects:

- the nature of the Proposed Methodology
- any Aboriginal objects or places of cultural value within the Subject Area, or issues of cultural significance.
- any restrictions or protocols considered necessary in relation to any information of sensitivity that may be provided; and
- any other factors considered to be relevant to the ACHA to be adopted into the information gathering process and assessment methodology.

An information session was held at Tahmoor Colliery on 6 October 2017. At the information session, Renée Regal provided a presentation on the nature and scale of the Project, an overview of the impact assessment process, critical timelines and milestones for the completion of assessment activities and delivery of reports, a discussion of the roles, functions and responsibilities of participants and protocols for the management of any sensitive cultural heritage information. The information session also provided RAPs with an opportunity to raise any cultural issues or comments/perspectives and assessment requirements (if any) regarding the Project or the Proposed Methodology.

A list of the RAPs who attended the information sessions is provided in Appendix 4.

The period for commenting on the Proposed Methodology closed on 12 October 2017. The methodology was also discussed at the information session. No comments were received on the methodology.

A completed questionnaire and valid insurances were received from the following RAPs outlined in Table 6:

Table 6: RAPS that provided insurances and a completed questionnaire

Registered Aboriginal Parties (registered during the registration period 16th August-31st August 2017)		
Name	**Name**	**Name**
Biamanga (Murrin Clan/peoples)	Cubbitch Barta Native Title Claimants	Cullendulla (Murrin clan/peoples)
Didge Ngunawal Clan	Goobah Development PTY LTD (Murrin Clan/people)	Gulaga
Illawarra Local Aboriginal Land Council	Kamilaroi Yankuntjatjaka Working Group	Gulaga
Murramarang (Murrin Clan/Peoples)	Warra Bingi Nunda Gurri	Woronora Plateau Gundungara Elders Council
Wurrumay Consultants		

5.1.2.2 Reponses to comments received on proposed methodology

There were no responses or comments received from the RAPs in regards to project methodology.

5.1.2.3 Aboriginal Cultural Heritage Assessment surveys

Survey engagement application process

During the current assessment representatives of Cubbitch Barta Native Title Claimants and Tharawal Local Aboriginal Land Council (the RAPs that were involved in the previous Tahmoor South Project Aboriginal Cultural Heritage Assessment) were invited to attend the current field assessment. The invitation described the requirements Tahmoor Coal needed applicants to satisfy for engagement in regards to fitness for work, drugs and alcohol policy, and personal protective equipment.

Engagement for surveys

Daniel Chalker of Cubbitch Barta Native Title Claimants attended all days of the field assessment. Tharawal Local Aboriginal Land Council were unable to provide a representative.

Aboriginal heritage surveys

Aboriginal cultural heritage surveys were conducted over 16 days during January and July 2013. This assessment was undertaken by Jamie Reeves and Renée Regal, archaeologists from Niche and Glenda Chalker, representative of Cubbitch Barta Native Title Claimants and Donna Whillock, representative of Tharawal Local Aboriginal Land Council. The sites identified during this assessment as well as a number of newly identified sites were revisited on the 19, 23 and 27 October 2017 by Renée Regal and Sam Richards, archaeologists from Niche, and Daniel Chalker, representative of Cubbitch Barta Native title Claimants. A representative of the Tharawal Local Aboriginal Land Council was not able to attend.

Further details regarding the survey and the survey coverage are provided in Sections 9, 10 and 11.

5.1.3 Stage 4 – Review of draft report

5.1.3.1 Provision of Draft ACHA and review period

A draft of this report (i.e. the draft ACHA) was provided to all RAPs for their review and comment on 28 December 2017 in accordance with Sections 4.3 and 4.4 of the ACHCRs (DECCW 2010a). RAPs were given 28 days to provide comment on the draft ACHA. The closing date for these comments was 31 January 2018. Prior to this closing date an information session was undertaken on the 24 January 2018 at Tahmoor Colliery. The purpose of the information sessions was to discuss the key findings of the draft ACHA and to provide an opportunity for RAPs and other community stakeholders and Elders to discuss, ask questions and/or provide comment on the draft ACHA. The following RAP groups attended this information session:

- Cubbitch Barta Native Title Claimants
- Woronora Plateau Gundungurra Elders Council
- Didge Ngunawal Clan

Details of this verbal comment is outlined in Table 7.

Table 7: Verbal comment made by RAPs in regards to the draft ACHA

Representative Group	Comment	Tahmoor Coal/ Niche Response
Cubbitch Barta Native Title Claimants	Can the Figures be more zoomed in and can the longwall layout please be put on the same figure as the AHIMS site.	Yes. Figures will be amended accordingly for the final report.
Woronora Plateau Gundingara Elders Council	How close do the subsidence predictions get?	The subsidence predictions as provided by MSEC are down to as low as 20mm.
Cubbitch Barta Native Title Claimants	The land owners should be advised of the location of Aboriginal objects/ sites within their properties, as well as their legal responsibilities in regards to these objects/ sites.	Recommendations of this assessment have been amended to include this.

All RAPs were provided with a printed copy of the main text of the draft ACHA, and a DVD containing an electronic copy of the full draft ACHA (including all supporting appendices). All RAPs were also advised if they wish to discuss anything within the report they could get in contact with Renée Regal (Niche) directly.

5.1.3.2 Comments received on draft report and consideration

Comments on the draft ACHA received during the 28 day review period (Section 5.1.3.1) included those from the following RAPs:

- Cubbitch Barta Native Title Claimants
- Woronora Elder Plateau Gundungara Elders Council

Copies of the submissions are included in Appendix 1. Responses to each submission received by the RAPs on the draft ACHA are provided in Appendix 2.

Table 8: Written comment made by RAPs in regards to the draft ACHA

Representative Group	Comment	Tahmoor Coal/ Niche Response
Cubbitch Barta Native Title Claimants	As well as what has been recommended previously in the 2014 report, I would like to add a further recommendation for future works. That is when any surface infrastructure is to take place there will be a need to test the areas, because of the significance of the area where the infrastructure may take place. This may require an ACHAR, or whatever the procedure will be when the new legislation is in place, as this will be some years in the future.	All of your previous recommendations have been included within the current assessment report. The further recommendation for subsurface testing has been addressed in Sections 10.3.6 and 13.2.1 and added to the recommendations of this assessment.
	Once again I must emphasis the cultural significance of the sites within this proposed project, without going into details. Perhaps one day the story will be told.	Many thanks for yours and Daniels assistance with the Aboriginal Cultural Heritage Assessment and survey efforts. Your feedback has been incorporated within the assessment report.
Woronora Plateau Gundungarra Elders Council (WPGEC)	A minimum of three RAP's to undertake the monitoring of the relevant sites in conjunction with a suitably qualified archaeologist. W.P.G.E.C recommend monitoring take place from 6-12 months.	Requirements for monitoring will be discussed with the RAP groups during the development of Subsidence Management Plans, post project approval.
	That all RAP's be involved and kept informed about the possible movements of longwall 101 and 102. If early detection of severe differential movement is found longwall 103 should be shortened.	Requirements of informing the RAP groups of subsidence movements within close proximity to Dogtrap Creek will be informed by the development of a Heritage Management Plan, post project approval.

5.1.4 Review of second draft report

5.1.4.1 Provision of Draft ACHA and review period

Due to the revision to the proposed ventillation shaft layout and undertaking additional field surveys, the Stage 4 Review of the draft report was undertaken a second time for this assessment. As a result, a revised draft report was sent to the RAPs on the 8 Novmeber 2018 and 28 days was provided for comment on the draft ACHA. The closing date for these comments was 6 Decemeber 2018.

5.1.4.2 Comments received on draft report and consideration

Comments on the draft ACHA received during the 28 day review period (Section 5.1.4.1) included those from the following RAPs and are :

- Cubbitch Barta Native Title Claimants
- Aboriginal Archaeology Services INC.
- Murra Bidgee Mullangari

Copies of the submissions are included in Appendix 1. Responses to each submission received by the RAPs on the draft ACHA are provided in Appendix 2 and in Table 9.

Table 9: Written comment made by RAPs in regards to the draft ACHA

Representative Group	Comment	Tahmoor Coal/ Niche Response
Cubbitch Barta Native Title Claimants	Dear Renee, Thank you for the opportunity of commenting on the above proposed project. This letter will not include other matters that had been raised in previous conespondence, and all comments will be further to other comments. 1: In regards to the proposed emplacement areas, I am still unsure whether these areas were surveyed. I note the confluence of what appears to be the headwaters of an unnamed creek, which flows into the Bargo River. 2: The location of TS2, has been relocated as to what appears to be in Crown Land, is this the case? 3: In relation to there being no artefact scatters adversely affected, would be unknown, as artefact scatters are not usually recorded as part of the survey process, and are definitely not monitored during the monitoring process. 4: There has been a shelter site affected by mine subsidence in Myrtle Creek, with cracking occurring on the outside corner of the shelter. If adverse is the key word, then it should be changed to "suffered impacts". An impact can	Hi Glenda, Thank you for your comments, please see our repsonses below: 1: As disussed on the phone previously, these areas were surveyed during the 2013 Aboriginal Cultural Hertiage Survey 2: Yes, TS2 is located on Crown Land 3: Comment noted. As previously discussed artefact sites cannot be assessed for subsisdence impacts as there are no landscape features 4: As previously discussed, Dr Ken Mills at SCT could not definatively attribute the the cracks at Mrtyle Creek to subsisdence. Inclusion of RAPs for baseline recording and monitoring will be discussed with the RAP groups during the development of Subsidence Management Plans and the development of a Heritage Management Plan, post project approval.

	be adverse, or just slightly damaged, but is still an impact. I agree with the recommendations that have been made in regards to the proposed management. The only other recommendation that I would like to make is the presence of RAP's whilst the detailed baseline recording is carried out, and at all times during the monitoring schedule. The sites within this area, are of high cultural significance, and should be protected at all costs, and hopefully there will be no damage to them by the mine subsidence. Yours faithfully, Glenda Chalker	
Aboriginal Archaeology Services INC.	Attention: Renee Regal - Aboriginal Cultural Heritage Assessment – Tahmoor South Project A.A.S agrees with the recommendations as documented by Niche Environment and Heritage Pty Ltd in the Aboriginal Cultural Heritage Assessment Report. AAS would like to see any artefacts collected displayed for all to see in the museum, local library or local government building or reburied in close proximity of the area. Any high significance areas needs to be recorded and managed by the Local Aboriginal Land Council – Tharawal Local Aboriginal Land Council. The axe grind groves and sandstone shelters needs to be segregated and clearly recorded to prevent any damage from proposed development works. Aboriginal Archaeology Service is seeking involvement in all consultation meetings and fieldwork for the above-mentioned project, as	Hi Andrew, Thank you for your comments in regards to this report. No arefacts are planned to be collected as part of this assessment. However if this changes, All RAPs will be consulted with to determine there deposition, post collection. All newly recorded shelters and axe grinding groove site will be managed by the Heritage Management Plan, post project approval.

	we are registered traditional owners of the area. AAS immediate family has lived in the area from 1897 and retains local and oral history on behalf of its first nation people. We have no objection to our information being provided to the Office of Environment and Heritage and the Local Aboriginal Land Council. AAS can assist with input that can be incorporated into a written assessment of cultural values of the area. We are also able to provide fit staff to assist with work that may involve physical labour. We can provide our schedule of rates and copies of relevant certificates of currency for business insurances on request. All correspondence should be emailed to AAS.info@bigpond.com The area is an important part of our culture and valued by our family. Thank You for Your Business Yours truly Andrew Williams	
Murra Bidgee Mullangari	Hi Renee, I have read the project information, ACHA report for the above project and endorse the recommendations made by Niche Environment Heritage, please feel free to contact me if you require further details. Thanks Ryan Johnson | Murra Bidgee Mullangari	Thank you for your comments on the draft report.

5.1.5 Review of final report

A copy of the final ACHA report will be made available by the DP&E to all RAPs during the public exhibition period for the Tahmoor South Project EIS. During this exhibition period all RAPs will have the opportunity to review and provide additional comment on the final ACHA report as well as any other part of the EIS (e.g. including the ecological and water assessments).

6. Investigators and Contributors

6.1 Research and Reporting

This investigation was managed by Renée Regal (BA Hons) Niche Team Leader- Heritage who has 13 years of experience as a professional archaeologist and heritage consultant. Sam Richards who has 4 years' experience as professional archaeologists and heritage manager assisted with the Aboriginal community consultation, research, field assessment and report writing.

The ACHA was reviewed internally by Jamie Reeves (BA Hons) Director of Niche who has 18 years' experience as a professional archaeologist and heritage consultant.

6.2 Fieldwork

In addition to the RAPs representatives listed in Section 5.1.2.3, the individuals listed in Table 10 attended and/or supported the surveys and assessment in various capacities.

Table 10: Aboriginal cultural heritage surveys and assessment – Other participants or support personnel

Name	Representing
Ben Streckeisen	Tahmoor Colliery
Samantha Beresford	Tahmoor Colliery
Fiona Robinson	Tahmoor Colliery
Belinda Treverrow	Tahmoor Colliery
Jamie Reeves	Niche Environment and Heritage
Renée Regal	Niche Environment and Heritage
Sam Richards	Niche Environment and Heritage

7. Landscape Context

7.1 Overview

Understanding the past and present environmental contexts of a Subject Area is requisite in any Aboriginal archaeological and cultural heritage investigation (DECCW, 2010a).

The following section provides details of the environmental characteristics of the Project Area. The section concludes by considering how the environmental character of the Project Area affects the way in which the area would have been occupied by Aboriginal people in the past, and how Aboriginal archaeological and cultural heritage sites will be distributed across the landscape.

The Project Area is located on the Cumberland Lowlands, in a transitional zone between two physiographic regions – the Cumberland Plain and the Woronora Plateau. The Cumberland Lowlands is largely underlain by the Triassic Wianamatta Group Shales, with portions of both the Liverpool and Hawkesbury Sandstone Subgroups being present. These subgroups are characterised by shale sandstone, conglomerates, tuff, chert and coal (Branagan and Packham 2000). Sandstone outcrops are found within erosional landscapes, primarily along the larger rivers and creeks, usually as steep, blocky scarps flanking the drainage lines. The region surrounding the subject area is generally characterised by rolling hills and ridges which are transected by minor tributaries of the Bargo and Nepean Rivers. Minor tributaries within the Subject Area include Dogtrap Creek, Eliza Creek, Carters Creek and Dry Creek to the east. The Nepean River runs to the east of the Subject Area, while the Bargo River flows through the north-east corner of the Project Area (Figure 5 and Figure 6).

There are six physiographic soil landscapes that have been defined as occurring in the Subject Area (Hazelton and Tille 1990). Each soil landscape has distinct morphological and topological characteristics, with the result that the occupational history and archaeological potential of the area varies greatly. The archaeological characteristics of an area are defined through a range of factors, including stability of the soil matrix, surrounding hydrology, underlying geology and land use history.

The soil landscapes are categorised as either erosional, residual or colluvial and are described in Table 11 (Figure 6).

Table 11: Soil landscapes within the Subject Area

Soil landscape	Characteristics
Erosional	Erosional soil landscapes are characterised by areas where soil and rock are being removed at a rate greater than they can be transported and deposited from other locations. Mechanisms for erosion commonly occurring within the Subject Area include wind and water; both through rain and stream wash (Hazelton and Tille 1990). These soil landscapes are considered to have archaeological potential, with older deposits more likely to be retained in-situ due to the rate of erosion in comparison to other soil landscape types. Soils of erosional formation within the Subject Area include the Gymea and Luddenham. Site types would likely include isolated artefacts, open camp sites and where suitable geology occurs, grinding groove sites and rock shelters.
Gymea	The Gymea soil landscape is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone, with broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps (Hazelton and Tille 1990). Local relief ranges between 20 – 80 m, with slopes between 10-25%. Soils are noted as including Yellow Earths, Earthy Sands, Siliceous Sands, Greyed Podzolic Soils, Yellow Podzolic Soils and Leached Sands (Hazelton and Tille 1990).
Luddenham	The Luddenham soil landscape is characterised by shallow (<100 cm) dark podzolic soils or massive earthy clays on crests. Moderately deep red podzolic soils are typically located on upper slopes, while moderately deep (<150 cm) yellow podzolic soils and prarie soils are found on lower slopes and drainage lines (Hazelton and Tille 1990). Landforms within the Luddenham soil landscape are typified by undulating to rolling low hills on Wianamatta Group shales, often associated with Minchinbury Sandstone (Hazelton and Tille 1990). Local relief ranges between 50m to 80m, with slopes commonly between 5%-20%. Landforms typically found within this soil landscape include narrow ridges, hillcrests and valleys (Hazelton and Tille 1990).
Residual	Residual soil landscapes are characterised by areas where soils are derived from the long term, in-situ weathering of parent materials. Examples of these types of soil landscapes are flats, plains and plateaus with poorly defined drainage lines (Hazelton and Tille 1990). Residual soil landscapes within the Subject Area comprise of the Blacktown and Lucas Heights.
Blacktown	The Blacktown Soil Landscape consists of Ashfield and Bringelly shale lenses. The topography associated with this soil landscape is typified by gently undulating rises,

Soil landscape	Characteristics
	with local relief ranging between 10 and 30 metres (Hazelton and Tille 1990). Gentle slopes predominate (5% - 10%). Crests and ridges within this landscape are broad and rounded with convex upper slopes grading into concave lower slopes and broad drainage depressions and valley flats, with little to no rock outcrops (Hazelton & Tille 1990: 27). The soil deposits are often shallow to moderately deep and consist of red, brown and yellow Podzolic soils (Hazelton and Tille 1990). The raw materials found within this soil landscape are considered to have archaeological potential.
Lucas Heights	The Lucas Heights Soil landscape is characterised by gently undulating crests, ridges and plateau surfaces, with local relief between 10 to 50 metres and slopes of less than 10% (Hazelton & Tille 1990). The soils are generally yellowed to lateritic podsolic, however, this landscape is known for rocky outcrops and limited deep soil bases (Hazelton & Tille 1990). Although this soil landscape generally consists of shallower soils, it is still considered to contain some Aboriginal archaeological potential. These site types are more likely to comprise isolated stone artefacts rather than more significant concentrations.
Volcanic	The volcanic soil landscape is characterised by gently inclined valley floors surrounded by steep colluvial side slopes formed on volcanic intrusions within the Hawkesbury Sandstone and Wianamatta Group shales. Soils on steep side slopes are described as deep (>150 cm) red podzolic soils, while undulating foot slopes feature both yellow and red podzolic soils (Hazelton & Tille 1990).
Colluvial	Colluvial deposits are loose, unconsolidated sediments deposited on foot slopes by mechanisms including rain-wash, sheet wash, slow continuous downslope creep, or a combination of these processes. Colluvium is often comprised of a heterogeneous range of sediments ranging from silt to rock fragments. Colluvial deposits are often deep due to the nature of their accumulative processes. As a result, thick accumulations of colluvium often contain well-preserved and sometimes deeply buried archaeological deposits. Site types associated with this soil landscape are likely to include isolated artefacts and open camp sites, due to the nature of the deposit formation and its associated stability. The Hawkesbury soil landscape is the only colluvial landscape within the Subject Area.
Hawkesbury	The Hawkesbury soil landscape is characterised by rugged, rolling to very steep hills on Hawkesbury Sandstone, with narrow crests and ridges, narrow

Soil landscape	Characteristics
	incised valleys, steep side slopes with narrow rocky benches, broken scarps and boulders. Local relief ranges between 100m - 200 m, with slopes generally greater than 25%. Soils include Lithosols/Siliceous Sands, Earthy Sands, Yellow Earths, Yellow and Red Podzolic Soil as and Siliceous Sands. Alluvial deposits along the banks of the Bargo River would also have provided sources of silcrete and quartzite cobbles which would have been used extensively by Aboriginal people.

7.2 Current environmental context

The climate at Tahmoor consists of mild summers with an average maximum of 29.3 degrees Celsius and minimum of 15.4 degrees Celsius in February, and cold, wet winters with an average minimum of 1.7 degrees Celsius and a maximum of 16.8 degrees Celsius in July (Bureau of Meteorology 2011, based on records taken between 1981-2010).

Recorded rainfall readings indicate an average annual rainfall of 802.7 millimetres (Bureau of Meteorology 2011, based on records taken at Picton between 1880 and 2010). Whilst conditions and temperatures are wide ranging, the conditions in the region of the subject area can be summarised as being mild and very suitable for year round hunter-gatherer occupation of all parts of the region.

7.3 Pre European vegetation

The Wollondilly region includes distinct ecological zones, including open forest and open woodland, with riparian vegetation extending along many of the watercourses. Each ecological zone hosts a different array of vegetation and animals, many of which would have been utilised according to seasonal availability. Aboriginal inhabitants of the region would have had access to a wide range of fauna and management of the vegetation would have opened up the landscape allowing ease of access through and between different resource zones.

Plant resources were used in a variety of ways. Fibres were twisted into string, uses of which include the weaving of nets, baskets and fishing lines, as well as 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 2010: 90-97).

Barrallier's 1802 descriptions of the Wollondilly River area noted that the Aboriginal people of the area were:

…mountaineers…exactly the same as at Sydney Parramatta, and Hawkesbury. They have the same customs, the same way of living; their food consists of different species of kangaroos, opossums, squirrels, wild dogs, river and swamp fish and shells, lizard eggs (which they find in the sand on the banks of the rivers at a depth of 1 foot{ca 30cm}), large ant eggs, colo, or monkey (a species of opossum different from the others), wombat, serpents, lizards with red bellies, and other species (Attenbrow 2010: 71).

The Subject Area supports a number of woodland and open forest plant communities, such as *Eucalyptus sclerophylla*, *Corymbia gummifera*, and *Eucalyptus globoidea*. Woodland areas in the eastern portion of the subject area have a high level of disturbance, with larger areas in an advanced state of regrowth. The southern areas supports an Endangered Ecological Community – Shale Sandstone Transitional Forest –

which is characterised by remnant and regrown *Eucalyptus fibrosa, Eucalyptus punctata*, and *Corymbia gummifera*.

Table 12: Local traditional resources and their occurrence within the Subject Area.

Resource	Traditional Uses	Information Reference
Silcrete, silicified wood, tuff, mudstone, quartz, quartzite and basalt	Flaked tools, grindstones, hammerstones, etc.	JMCHM 2007
Red Bloodwood (*Corymbia gummifera*)	The sap from this tree can be used for toothache and mouth wash, or used for mixing with paints to stain artefacts and rock art. It is also used to tan fishing ropes and nets.	DEC 2005b
Grey Ironbark (*Eucalyptus paniculata*)	The bark is mixed with bloodwood gum to tan fishing nets.	DEC 2005b
Thin-leaved Stringybark (*Eucalyptus globoidea*)	Bark was removed using various tool types, such as ground edge axes, and was used for a range of purposes such as coolamons, canoes and shields.	DEC 2005b
Yellow stringybark (*Eucalyptus muellerana*)	Bark was removed using various tool types, such as ground edge axes, and was used for a range of purposes such as coolamons, canoes and shields.	DEC 2005b
Prickly Leaved Paperbark (*Melaleuca styphelioides*)	Bark was removed using various tool types, such as ground edge axes, and was used for a range of purposes such as coolamons, canoes and shields.	DEC 2005b
Banksia (Banksia sp.)	When in flower, the Aboriginal people would collect the early morning nectar soaked dew in coolamons.	DEC 2005b
Long-necked Tortoise (*Chelondin longicollis*)	Eggs were collected, cooked and eaten.	DEC 2005b
Goanna (*Varanus varius*)	Eggs were collected and eaten. Goanna meat was also cooked and eaten.	DEC 2005b
Eastern Grey Kangaroo (*Macropus giganteus*)	The meat from the kangaroo was cooked and eaten. Bones were fashioned into barbs for fish spears, and the teeth were used as ornaments. The tail sinew and raw hide were used to bind the end of canoes, and to sew kangaroo and possum skin rugs.	DEC 2005b
Ringtail Possum (*Pseudocherius peregrinus*)	Possum meat was cooked and eaten.	DEC 2005b
Wombat (*Vombatus ursinus*)	The meat was cooked and eaten, while the fat was rubbed on the skin of newborns to keep them warm.	DEC 2005b

The wider Wollondilly area also generally provides a number of resources used by Aboriginal inhabitants including silcrete, silicified wood, tuff, mudstone, quartz, quartzite and basalt. Suitable pebbles of hard, igneous rock for axes also occur along the Nepean River (JMCHM 2007:17). Silcrete is the most common raw material type used for stone tool making recovered from archaeological sites within the greater

Wollondilly area and across the Cumberland Plain and the Cumberland Lowlands, with known sources including the St Marys Formation, Rickabys Creek gravels and terraces along the Nepean River.

7.4 Hydrology

The geology of the area has been described in depth as part of the Tahmoor South Project by Gipple (2013). The Subject Area is located in a region characterised by weakly developed soils on sandstone and shale. Some of the soils are highly susceptible to erosion by concentrated water flow, but this would be expected of weakly developed soils in steep environments. The streams comprise small headwater streams on relatively low gradient plateau landscapes and streams that have eroded into rocky gorges. The gorges are rimmed by cliffs of various lengths and heights, with densely vegetated talus slopes below the cliffs. These cliffs, and the talus slopes below them, are relatively stable (Gipple 2013: 33).

The landscape is therefore characterised as a plateau incised by streams in various states of development, from shallow gullies, through to steep sided rocky gorges. The nature of this landscape has a clear effect on how Aboriginal people would have used it in the past, and the kind of archaeological sites that will be present in the different topographic environments. The gentle slopes and hills of the plain, which are generally undifferentiated in terms of topography, may be expected to have been used in a transitory way by Aboriginal people – being visited for resource gathering, and possibly for some longer term camping. The waterways would have been an obvious focus for occupation, providing resources of their own, but also rockshelters which would have been lived in, and used for art and probably non-utilitarian activities.

7.5 Non-Aboriginal exploration of the Bargo area

Governor Hunter visited the country south of the Nepean River in 1795 in order to ascertain the truth in rumours of herds of cattle roaming the hills. Hunter found a herd of about 60 wild cattle. Four cows and two bulls had escaped from the Government Farm at Sydney Cove. The cattle had crossed the Nepean and bred into the wild herd sighted by Hunter. The Government, hopeful of future cattle breeding in the colony, prohibited anyone from crossing the Nepean River without a permit in order not to disturb the cattle (Jervis 1941:277; Vincent 1996: 3). The prohibited area of land was called 'Cowpastures' and extended from Camden to Picton.

Opening up settlement of the 'Cowpastures' and beyond was of no consequence without a road allowing access in and out of the settlements. John Warby established a track to the Nepean at Camden, which was the line of road surveyed by James Meehan in 1805, and became the first section of the Great Southern Highway. Meehan was instructed to survey grants at 'Cowpastures' and was instructed "*…to preserve a road as much as possible on the flat ground, so that the public may hereafter have a passage to Stonequarry Creek"* (Jervis 1939:412). In 1818 Meehan referred to "*the present Stonequarry Road*" (Jervis 1939:413).

In the 1850s efforts were made to have the road cross Broughton Pass (Jervis 1939:424-429). The continual construction and improvement of the Great Road South meant an increased number of settlers to Bargo and as the flow of travellers along the road increased so did the demand for accommodation and Inns along the way.

The Bargo Brush was a notorious hideaway for bushrangers during this period of early settlement. The construction of the Great South Road provided the bushrangers with easy grounds for hold ups and a quick getaway.

Travel along the Great South Road was at its peak with the discovery of gold in the southern fields. The activity along the Great South Road, also known as Argyle Road, resulted in the first stage of settlement in Bargo, initially settlement occurred in a concentrated area either side of the road.

This eventual opening up of the Cowpastures region and the area south of Sydney allowed for the Aboriginal occupants of the region to be increasingly disbursed as the landscape charged from the forest outlined in Section 6.3 to the open pastural plains that make up the area today.

For further details of the non-Aboriginal exploration of the Bargo area see Niche 2017b.

8. Aboriginal Archaeological Context

8.1 Ethnography and History

8.1.1 Tharawal country

The proposed Tahmoor South Project is located on the traditional country of the Tharawal people. Tindale (1940, 1974) has identified the Tharawal boundaries as being from the south side of Botany Bay to north of the Shoalhaven River, and running inland to the Campbelltown and Camden area (Attenbrow 2010: 34, SA Museum 2010). Attenbrow (2010:35) points out that such boundary mapping, undertaken as it was in the nineteenth century is indicative at best; however there appears to be reasonably strong agreement between those who have mapped language boundaries that the area is Tharawal country. The Wodi Wodi also spoke the Tharawal dialect, and they inhabited the coastal plains. Tharawal people distinguished themselves as Fresh Water, Bitter Water or Salt Water depending on where in the wider language boundary their traditional lands were – the inland hills and valleys, the plateaus and swamps or the coastal plain respectively (DEC 2005b: 6).

The records and histories of the Tharawal and their country at the time of contact with Europeans are subject to bias and are generally fragmented, providing nothing like a complete picture of the way Aboriginal people were living prior to European contact. Nevertheless, we know the Tharawal regularly communicated, moved, traded and participated in ceremonies between their country and neighbouring areas. It is most likely family groups or clans would 'intermingle and interact along both physical and social boundaries' rather than be strictly confined to the 'tribal' borders that were to be artificially imposed by European anthropologists (Organ 1990: xliii).

It is generally accepted that Aboriginal occupation of Australia dates back at least 40,000 years (Allen and O'Connell 2003). The result of this extensive and continued occupation of the Sydney Basin, of which the Woronora Plateau is a part, has left a vast amount of accumulated depositional evidence. The oldest date generally considered to be reliable for the earliest occupation around the region comes from excavations at Parramatta where archaeological material has been dated to 30,735 ± 407 BP (McDonald et al 2005), while the site of Bass Point at Shellharbour was occupied from 20,000 years ago, indicating a great antiquity of Aboriginal occupation in the region (Attenbrow 2010: 153, Flood 1995: 112).

The majority of reliably dated archaeological sites within the region are less than 5,000 years old, with previous excavations of rock shelters on the Woronora Plateau providing the oldest date of just over 2,000 years before present (Sefton 1998 a, 1998b). A combination of reasons has been suggested for this collection of relatively recent dates. There is an argument that an increase in population and 'intensification' of much of the continent took place around this time leading to a great deal more evidence being deposited than was deposited as a result of the sparser former occupation period. It is also the case that many archaeological sites along the former coastline may have been submerged as the seas rose to approximately their current level around 6,000 years ago. This would have had the effect of covering evidence of previous coastal occupation. In addition it is also true that the acidic soils that predominate around the Sydney region are not conducive to the long-term survival of sites (Hiscock 2008: 106).

The arrival of the First Fleet in Sydney Cove in 1788 was followed the next year by a smallpox epidemic, which spread to the neighbouring regions and, although the exact effects are not known, killed over half the Aboriginal population of the areas effected (Organ 1990: 5).

Early in the nineteenth century European graziers began taking land in the south of the Cumberland Plain and the coastal plains around Wollongong, with cedar getting being conducted in the narrower northern

coastal plain and rainforest areas of the Illawarra Escarpment (DEC 2005). Access to traditional and everyday resources (such as water) and clearing the land of trees would have had a major impact on the ways in which Aboriginal people would have been living, and also caused significant social disruption between Aboriginal groups, and pressure between Aboriginal people and the ever increasing European population. This period was a time of drought, and the competition for resources between the Europeans and the Tharawal, who were adapting to the massive changes that were so quickly upon them, led to several years of conflict. Organ (1990) documents the various skirmishes, killings and reprisals between Europeans and the Tharawal during the 1814 – 1815 period in the Cowpastures, Camden and Appin districts. Eventually this sporadic bloodshed would lead to larger scale conflict, with Governor Macquarie implementing a sustained punitive action against the Aboriginal population in the district. This resulted in the Appin Massacre of 17 April 1816, in which Aboriginal people were shot and driven over steep cliffs (probably near Broughtons Pass) to their death during a surprise attack by a detachment of the 46th Regiment, in the middle of the night.

Despite the massive changes that were so quickly brought to the Aboriginal people of the region, they maintained a sense of community, traditional customs and practices, cultural knowledge and continued to care for significant sites and the land in general. Today there are many thousands of Aboriginal people living in the Cumberland Plain and Illawarra. They continue to be custodians of the land, whilst traditional owners maintain cultural knowledge (DEC 2005).

8.2 Heritage Registers

8.2.1 AHIMS Register

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 21 August 2017 (AHIMS Client ID# 297166). Another AHIMS search was undertaken on 11 October 2018 (AHIMS Client ID #375906), as searches are no longer valid after 12 months. The results of this search remained the same. A total of 39 Aboriginal archaeological or cultural sites were identified within the Subject Area. The majority of Aboriginal sites recorded in the AHIMS dataset comprised of rock shelters with art (n=20, 49%) and stone artefact sites (n=14, 34%) being the most common (Figure 7, Table 13).

Table 13: Aboriginal site types within the Subject Area

Site features	Total Number	Total Percentage (%)
Shelter with Art	15	36%
Shelter with Art and Deposit	3	8%
Shelter with Art and Axe Grinding Grooves	2	6%
Shelter with Deposit and Axe Grinding Grooves	1	2%
Axe Grinding Grooves	4	8%
Stone Artefact	12	35%
Scarred Tree	1	3%
Aboriginal dreaming site	1	2%
Total	**39**	**100%**

[b] Totals may not add to 100% due to rounding.

The majority of the archaeological assessments that have been undertaken within close proximity to the Subject Area are the result of environmental impact assessments for proposed mining activities within the Southern Coalfield.

There are a number of limitations to the AHIMS dataset. These limitations include the following:

- the absence of reports identifying the survey coverage for a number of the above surveys
- duplication of site recordings
- some datum and locational errors within the AHIMS dataset; and
- a number of Aboriginal sites which are known to be present within the Subject Area that were not yet added into the AHIMS database at the time of the search.

Where possible, corrections to site location have been made and a revised Aboriginal site dataset for the Project have been created.

8.2.2 Other Registers

In addition to AHIMS, the following heritage registers were searched on 10th October 2017 for Aboriginal heritage items:

- National Heritage List and Commonwealth Heritage List (via the Australian Heritage Database)
- State Heritage Register
- The s170 Heritage and Conservation Register
- The National Trust Register

Two heritage items that are listed on the State Heritage Register are within the Subject Area of the proposed mining activity. These items (Place IDs: 1024 and 1508) are the Bargo Railway Viaduct and Wirrimbirra sanctuary. No Aboriginal items were identified within the Subject Area on any of afore mentioned heritage registers.

8.3 Local Archaeological Investigations

Archaeological studies provide material evidence of Aboriginal use of the landscape at times both before and after written history, and complements the oral histories and cultural knowledge held by the Aboriginal community.

Several Aboriginal archaeological assessments have been undertaken within the vicinity of the Subject Area (Dames and Moore 1979; Kembla Coal and Coke 1993; Sefton 1994; Dibden 2001, 2002; Biosis Research 2009, 2011; Kuskie 2009; Niche 2011, 2012a, 2012b). Many of these have been associated with mining lease explorations, housing developments and infrastructure projects. The majority of these studies resulted in the identification and assessment of previously unknown Aboriginal archaeological sites. The following section summarises these previous studies.

8.3.3 Summary of Local Archaeological Studies

A summary of local archaeological assessments undertaken within the Subject Area and surrounds is provided in **Table 14**.

Table 14: Summary of Archaeological Assessments within and within close proximity to the Subject Area

Assessment and date	Summary of findings
Dames and Moore (1979) and Kembla Coal and Coke (1993)	Dames and Moore (1979) and Kembla Coal and Coke (1993) undertook surface survey studies of the area currently under Tahmoor Coal lease as a Reject Emplacement Area

Assessment and date	Summary of findings
	(REA). Neither study identified any Aboriginal archaeological sites or areas of Aboriginal archaeological sensitivity. North Tahmoor Coal Project Archaeological Survey: Caryll Sefton (archaeologist) and Glenda Chalker (Cubbitch Barta Native Title Claimants) carried out an assessment north of the current subject area as part of the original Development Application that was made for the proposed ventilation shaft (Sefton 1994). There were no Aboriginal archaeological sites identified during this assessment and no constraints identified that would affect the proposed noise mound being developed.
Dibden (2001)	Dibden (2001) undertook the first archaeological and heritage assessment for the Camden Coal Bed Methane project, locating a total of 13 Aboriginal archaeological sites (three low density artefact scatters and ten isolated artefacts). All sites were identified on low gradient simple slopes or valley flats associated ephemeral streams.
Dibden (2002)	Dibden (2002) completed an archaeological assessment for a proposed gas gathering system at Kay Park. The assessment identified two low density artefact scatter sites (KPS1:52-2-2267 and KPS2:52-2-2268) along the proposed gas pipeline corridor. Both sites were assessed as being of low-moderate archaeological significance as they were situated on previously disturbed paddocks.
Biosis Research (2009)	Tahmoor Colliery Longwalls 27 to 30 Impacts of subsidence on cultural heritage: An archaeological assessment was carried out north of the current subject area (Biosis Research 2009). The survey area contained a large area of cleared undulating paddocks and Redbank Creek. There were four previously unregistered Aboriginal sites identified during this survey. These sites consisted of open stone artefact scatters and one area of potential archaeological deposit.
Kuskie (2011)	Redbank tunnel/Main Southern Railway Track deviation Aboriginal Heritage Impact Assessment: An archaeological assessment was carried out north of the proposed Tahmoor South subject area (Kuskie 2011). There were no previously unregistered sites located during this assessment.
Biosis Research (2011)	Biosis Research (2011) undertook a Due Diligence Aboriginal archaeological assessment for the proposed expansion to the Reject Emplacement Area operated by Tahmoor Coal. This included a detailed surface survey of cleared and uncleared areas of bush adjacent to the current emplacement area. No Aboriginal archaeological sites were identified.
Niche Environment and Heritage (2011)	Niche Environment and Heritage (2011) were commissioned by Tahmoor Coal to undertake a desktop assessment of seven proposed exploration borehole locations. This desktop assessment concluded that each of the seven proposed borehole locations should be inspected by a qualified archaeologist prior to any proposed earth works on site. These site inspections were carried out between 2011 and 2012, and no Aboriginal sites were identified
Niche Environment and Heritage (2012a)	Niche Environment and Heritage (2012a) was commissioned by Tahmoor Coal to undertake a desktop assessment of twenty proposed seismic lines. This desktop assessment concluded that areas of archaeological sensitivity as defined by the code of practise should be inspected by a qualified archaeologist prior to any proposed earth works on site; these inspections were carried out in 2012, and no Aboriginal sites were identified.
Niche Environment and Heritage (2012b)	Niche Environment and Heritage (2012b) were engaged to carry out a due diligence assessment on behalf of Tahmoor Coal. This assessment of two proposed exploration seismic lines and one proposed exploration borehole location concluded there would be no adverse effects to any Aboriginal or non-Aboriginal archaeological sites.

Several Aboriginal heritage assessments and surveys have been conducted in the vicinity, and within, the Subject Area since the 1990s. These assessments have generally been situated on the rolling hills or smaller drainage lines of the area. The most common type of Aboriginal heritage site located during these previous assessments have been open sites containing stone artefacts, although it is known from the AHIMS results that where sandstone is exposed in drainage lines axe grinding grooves and shelter sites are present. The area has been largely cleared for pasture, and scarred trees are rare.

8.3.4 Dogtrap Creek

Dogtrap Creek is notable for the area as it features a high concentration (54% of all sites within the Subject Area) and diversity of site types. Site types include axe grinding grooves (2, 9.5%), lithic sites (isolated finds [2, 9.5%] and open camp sites [2, 9.5%]), a modified tree (1, 4.8%) and shelters with art (14, 66.7%). The majority of these sites are associated with moderately step slopes reflecting the high number of sandstone rock shelter sites along the creek line.

Density analysis of sites currently registered with AHIMS for the region surrounding the Subject Area was conducted using a GIS (Figure 12). The density analysis showed Dogtrap Creek to be a significant archaeological complex, with no similar site concentrations currently known in the surrounding area. Factors which have contributed to this complex are the presence of the creek line itself, the sandstone geology allowing the formation of shelter sites suitable for habitation and the surrounding topography. As discussed below, it is notable that the art sites contain a distinctive and representative assemblage of anthropomorphic motifs, and art assemblages that are locally notable for the number of stencils and motifs present.

8.3.5 Eliza Creek

During this assessment three further Aboriginal shelter sites were identified along Eliza Creek: Eliza Creek 2013.1, Eliza Creek 2013.2 and Eliza Creek 2013.3. As part of this assessment these newly registered sites have been identified as having low scientific significance. The type, number, density and nature of the sites in Eliza Creek are not at all comparable to the site cluster of Dogtrap Creek.

8.4 Regional Archaeological Studies

The review of the AHIMS search results in conjunction with the previous archaeological investigations presented in section 8.3 show that the material traces of past Aboriginal land use in the Tahmoor South Project area comprise:

- Stone artefact sites in open contexts on the plains and hills
- Scarred trees in areas of remnant vegetation;
- Axe Grinding Grooves; and
- Sandstone rockshelters containing art, axe grinding grooves and/or occupation deposits.

Generally, the stone artefact sites are small in area and the number and density of artefacts they contain. Overall investigators have focused on questions of presence/absence of archaeological sites as there has not been sufficient data or scope of investigation to consider more detailed models of past Aboriginal land use.

On the Cumberland Plain at Rouse Hill, west of Sydney, White and McDonald (2010) have analysed the distribution of stone artefacts across the Rouse Hill development Area, which measures around 5 km x 5 km. This is the first such peer reviewed and published analysis and predictive model. White and McDonald analysed several landscape variables against the results of sub-surface investigations (a database containing 4429 stone artefacts) and concluded that the stream order (the size of a drainage line) and

landform were the most important factors in determining artefact density and distribution. In summary they conclude:

- stream order, with higher order streams tending to have higher artefact densities and more continuous distributions than lower order streams;
- landform, with higher densities occurring on terraces and lower slopes, and with sparse discontinuous scatters on upper slopes;
- aspect on lower slopes associated with larger streams, with higher artefact densities occurring on landscapes facing north and northeast; and,
- distance from water, with higher artefact densities occurring 51–100m from 4th order streams, and within 50m of 2nd order streams. (White and McDonald 2010: 36)

Although the Tahmoor South Project area is one of greater relief than Rouse Hill, White and McDonald's observation about the importance of landform (point 2 above) is noteworthy and aptly describes the known distribution of stone artefact sites in the Tahmoor and Bargo areas. A major difference between the areas is that higher order streams in the Tahmoor South Project Area (such as Dogtrap, Dry and Eliza Creeks as well as Teatree Hollow and the Bargo River) are deeply incised, rugged, almost vertically sided sandstone gullies and gorges and thus not generally likely to have high artefact densities 50 m – 100 m from them.

The Tahmoor South Project Area occurs in landforms that comprises of incised sandstone creek lines; that produce suitable rockshelters for use by past Aboriginal inhabitants of the area. It is likely that number of large sandstone benches that would have been suitable for axe and food grinding activities would be present within the landscape. Considering the characteristics of the Cumberland Plain in general, and the specific results of previous investigations in the Tahmoor and Bargo areas the following predictive statements can be made:

- Open stone artefact sites may occur anywhere in the landscape, but are most likely to occur on flats, lower slopes and hill crests.
- Higher density stone artefact sites will occur on lower slopes or flats in close (50 m – 100 m) proximity to the upper reaches of larger drainage lines (i.e. where the drainage lines have not yet formed deeply incised cliff and gorge landforms).
- Sandstone shelters will occur in drainage lines that have formed deep incised cliff lines and gorge landforms. These shelters may contain art and/or deposit comprising of stone artefacts.
- Axe Grinding Grooves will occur in drainage lines that have large sandstone benches present in their bases that would be suitable for axe and food resource grinding activities.

The predictive statements are limited to the open stone artefact, sandstone shelter and axe grinding groove site types, as these are the only types with a predictable likelihood to occur in the project area.

8.5 Synthesis and Predictive Model

This section summarises the landscape and archaeological context of the Project Area to provide predictive statements about the likelihood and nature of archaeological evidence in the Project Area.

The predictive model developed for the Subject Area included the consideration of previous archaeological surveys and assessments in the local area and wider surrounds, the distribution and patterning of known sites within the Subject Area and surrounds, the land form units and landscape context of the Subject Area and the previous known land uses in the area. A summary of the known Aboriginal heritage sites listed in the AHIMS database is provided in Section 8.2.1.

This predictive model has been developed based on a review of geological (Figure 6), geomorphological, hydrological and archaeological data (Figure 5 and Figure 7). While previous archaeological work has suggested that the location of Aboriginal archaeological sites is greatly related to the presence of permanent water (JMCHM 1999), recent studies have demonstrated that this does not correlate to increasing site complexity (ENSR/AECOM 2009).

The following criteria have been used to determine the archaeological potential (for both surface and subsurface deposits) for the subject area:

- Patterns of Aboriginal land use and occupation of the region, to identify those landscape areas where cultural material was likely to have been deposited.
- Distribution of known sites within the Subject Area and broader region, to identify the landforms known to contain archaeological materials (and patterning of those materials).
- Geomorphological evolution of the Subject Area, to identify those natural processes that may have affected the archaeological resource.
- Terrain integrity of the subject area, considering the impact of post-contact land use history on the potential of archaeological site survival; and,
- Likely detection of archaeological materials within the Subject Area, considering the nature of the resource (surface/subsurface materials/sandstone rockshelters with art/sandstone platforms with grinding grooves) and ground surface visibility constraints.

Based on these criteria, the following predictive model has been formulated specific to the Subject Area.

- Open lithic sites (artefact scatters and isolated artefacts) are the most likely site type to occur, being most commonly associated with water-related landforms and gentle slopes less than 100m from natural watercourses. Site sizes and densities may vary, increasing proportionally to the decreased distance from natural watercourses.
- The geological characteristics of the Subject Area are consistent with those required for sandstone shelters. Potential exists for bedrock exposure, consequently increasing the potential for sites such as axe grinding grooves or quarries.
- Scarred trees exhibit scars caused by the removal of bark or wood. Scar trees may occur in the areas of the subject area which feature native bush which has been previously cleared.
- Aboriginal burials are unlikely to occur within the Subject Area due to the lack of suitable soils landscapes (deep, soft sediments, such as Aeolian or alluvial deposits).
- No post-contact sites with shared significance by Aboriginal and European people are known to be located within the Subject Area.
- Aboriginal places are places of cultural significance to Aboriginal people. No Aboriginal places have been declared within the subject area (November 2011) or listed on AHIMS: (http://www.environment.nsw.gov.au/conservation/AboriginalPlacesNSW.htm).

Previously unidentified sandstone shelters are likely to occur along Dogtrap, Eliza and Dry Creeks as well Teatree Hollow as systematic assessment has previously not occurred at these locations previously.

9. Survey Methodology

Two survey methodologies for the Project ACHA were developed by Niche. Both methodologies have been presented in Appendix 3. The methodologies follows the:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005); and
- ACHCRs (DECCW, 2010a).

As part of the development of the methodologies, a sampling strategy for an archaeological survey of the Subject Area was developed.

9.1 Approach to the project

The approach to the archaeological assessment design process used the following methods:

- Review previous archaeological survey methods and assess their usefulness.
- Consult the local Aboriginal community as to how the archaeological ground survey should be carried out and at what scale.
- Consider the rarity of the type of landform/ land unit to be assessed.
- Consider the scale of the project are and location of mining areas and infrastructure within the project area and the relationship to creeks and sandstone formations.
- Consult with the local Aboriginal community on how a cultural assessment should be conducted.

9.2 Sampling Strategy

The field surveys for the assessment concentrated on the areas of that will be disturbed by the proposed ventilation shaft locations, and a sample of landforms – especially creek lines known or likely to contain rockshelters – above the proposed underground mining area. Previously registered sites that fall within the Project Area were also relocated (where possible) and recordings updated from their original site cards. Further to this rivers, creek lines and large sandstone rock platforms that have the potential to be effected by subsidence within the Subject Area were assessed.

The results of the survey are presented in Section 10.

10. Results

10.1 Cultural Heritage Survey

As described in Section 5.1.2.3, an Aboriginal cultural heritage survey was conducted over 16 days in 2013 and the reassessment of the condition of sites was conducted over three days - 19th, 20th and 23rd October 2017. An additional day's survey was undertaken on 4 October 2018 to assess the proposed carpark extention and the revised location of the ventillation shaft sites. Each survey program was conducted using a single survey team. This team comprised of two archaeologists and between one and two representatives from the RAPs.

10.2 Survey Coverage

Table 15 summarises the survey coverage in general accordance with Requirements 9 and 10 the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010). The survey program achieved a high level of effective survey coverage, owing to the 100% coverage of the areas of Eliza, Dogtrap, Dry creeks and Teatree Hollow that may be affected by the proposed works. The dominant form of archaeology in these areas are sandstone shelters, where art and occupation areas are the most common traces of past Aboriginal land use (OEH 2010:17), which also assisted in the survey coverage. There was also comprehensive survey coverage of each of the proposed surface infrastructure proposed locations.

10.2.1 Visibility

Navin Officer Heritage Consultants (2000:49-50) provide a discussion on considerations for assessing visibility and site obtrusiveness in sandstone gorge environments, which was used to assist with assessing visibility for the Tahmoor South Project. The obtrusiveness of sandstone rock shelter and overhang sites, even in heavily vegetated areas is always high, and so these sites are most likely to be detected during survey irrelevant of vegetation cover. In comparison surface sites such as axe grinding grooves, engraved motifs and channels on sandstone platforms as well as open camp sites, which can occur anywhere were difficult to detect during this assessment due to limited ground surface visibility due to vegetation coverage. The concept of visibility is also applicable to the surface of shelter sites when considering archaeological potential or looking for artefacts exposed in driplines (Biosis Research 2009: 48).

10.2.2 Exposure

Referring to the geomorphic conditions of the landform being assessed, exposure attempts to describe the relationship between those conditions and the likelihood of the conditions to provide for the exposure of archaeological materials. Exposure differs from the aforementioned visibility in that it is in part a summation of geomorphic processes, as opposed to a ground surface observation (Burke and Smith 2004: 74-80, NPWS 1999 and OEH 2010: 16). The majority of the Subject Area is colluvial and residual landscape types, which are not very likely to reveal buried artefacts, although residual will accumulate archaeological material over long periods of time. Disturbance within the subject area is associated with human activities such as farming and camping in some of the shelters. Natural influences; such as heavy rain falls, animal and insect interaction as well as vegetation growth within shelters and along the top of shelters, which can cause tree root jacking has caused some disturbance within the Subject Area.

Table 15: Summary of survey results and coverage

Survey Units/ Land System	Survey Unit (km)	Survey Unit x 4 survey attendees	Average of Visibility (%)	Average of Exposure (%)	Effective Coverage Area (km)	Effective Survey Coverage (%)	Site Count
Dogtrap Creek	94.4	377.6	70	10	26.432	7	16
Eliza Creek	13.03	52.12	70	10	3.65	11.46	3
Dry Creek	7.96	31.84	70	10	2.23	7	3
Teatree Hollow	8.35	33.4	30	10	1	2.99	1
Survey Units/ Land System	**Survey Unit (km)**	**Survey Unit x 2 survey attendees**	**Average of Visibility (%)**	**Average of Exposure (%)**	**Effective Coverage Area (km)**	**Effective Survey Coverage (%)**	**Site Count**
TSC 1	1.39	2.78	50	40	0.556	0.2	0
TSC 2	0.409	0.818	30	10	2.45	9	1
Carpark extension area	0.823	1.65	0	0	0	0	0

10.3 Aboriginal Cultural Heritage Sites

The survey campaigns and desktop assessment undertaken for this ACHA identified a total of 40 sites within the Subject Area, and one Aboriginal Dreaming Story. Of the forty (40) Aboriginal sites within the Subject Area, twenty seven (27) were confirmed during this assessment. Twelve (12) artefact sites in the form of isolated stone artefacts and open camp sites have not been reassessed as part of this assessment because of access and as mine subsidence does not constitute harm to this registered site type. The last site, an Aboriginal dreaming story, was not visited as it has no physical location. Seven of these sites registered on AHIMS were relocated during the initial assessment for the Tahmoor South Project.

Further to this it should be noted that thirty one (31) of the Aboriginal sites registered within the Subject Area fall within the Subsidence Study Area. It is only these sites that have been assessed as part of the impact assessment of this project as they have a potential to be impacted by subsidence as a result of the Tahmoor South extension.

Detailed descriptions of all sites within the Subject Area are provided in Appendix 5.

Table 16 provides a summary of the sites recorded in the Subject Area; survey effort and coverage is shown on Figure 8. The relocated AHIMS sites are outlined in Figure 9, with newly recorded sites presented on Figure 11.

Table 16: Summary of Aboriginal sites located within the Subject Area (including those newly identified during the 2013 and 2018 surveys for this assessment).

Site Type	Number of Sites Recorded in the Subject Area
Axe Grinding Groove	4
Open Camp Site – Artefact scatters	7
Open Camp Site - Isolated Artefact	6
Sandstone shelter with art	13
Sandstone shelter with art and deposit	4
Sandstone shelter with axe grinding groove and deposit	1
Sandstone shelter with art and axe grinding groove	3
Sandstone shelter with deposit	1
Modified tree	1
Aboriginal dreamtime story	1
Total	**41**

10.3.3 Axe Grinding Groove Sites

A total of four (4) axe grinding groove sites are recorded in the Subject Area, across a broad spread of simple slopes, gullies and depressions in very gently inclined to steep terrain. Photographs of typical axe grinding groove sites are represented in Plate 1 and Plate 2. Further photographs and plans of each of the axe grinding grooves within the Subject Area are produced in Appendix 5.

Plate 1: Example of an axe grinding groove located at Dogtrap Creek (52-2-1529)

Plate 2: Example of two grinding grooves at Dogtrap Creek (52-2-1524)

Table 17: Axe grinding groove sites within the Subject Area

Figure Reference	AHIMS ID	Site Name	No.	Recorded	Description
Figure 9	52-2-3921	Dogtrap Creek AGG-1	1	Niche 2013	This site comprises of a single axe grinding groove located on a sandstone platform on Dogtrap Creek. This site can be accessed off private property.
Figure 9	52-2-3944	Dry Creek GG 1	4	Niche 2013	This site comprises of a four axe grinding grooves on a large rock platform situated at the headwaters of Dry Creek. This site can be access off a dirt trail on private property.
Figure 9	52-2-4194	BDTC-GGO1	27	Artefact Cultural Heritage Management 2017	The site comprises of 27 axe grinding grooves on a large sandstone platform in an unnamed tributary of Dogtrap Creek, 220 m east of Government Road. There may be a number of further axe grinding grooves located under the vegetation which has started to grow across the sandstone platform, this is evidenced by a number of grooves being half visible under the vegetation.
Figure 9	52-2-4395	Government Road AGG-1	1	Niche 2017	This site comprises of a single faded axe grinding groove on a sandstone platform located on private property just off Anthony Road.

10.3.4 Modified Tree (Scarred or Carved)

A total of one Modified Tree (Scarred or Carved) site is recorded in the Subject Area. Further photographs and plans of the Modified Tree (Scarred or Carved) within the Subject Area are produced in Appendix 5.

Table 18: Modified tree site within the Subject Area

Figure Reference	AHIMS ID	Site Name	No.	Recorded	Description
Figure 9	52-2-1530	Dogtrap Creek;	1	Warren Bluff 1990	Registered in 1990 as a scarred tree this site was located less than 5 metres off Dogtrap Creek on the "right side of the creek approximately 100 m past the second major junction coming from the east." The tree was described as 2.70 m in diameter, with less than 5 metres of regrowth at the scar.

10.3.5 Sandstone shelter sites

There are twenty one (21) sandstone shelter sites identified within the Subject Area. These shelter types comprise of shelters with art, shelters with art and deposit, shelters with axe grinding grooves and deposit and shelters with art and axe grinding grooves. Further details and photographs of each registered site are outlined in Appendix 5.

Plate 3: An example of a sandstone shelter formation along Dogtrap Creek

Table 19: Summary of Rock Shelter Site within the Subject Area

Figure Reference	AHIMS ID	Site Name	Recorded	Description
Records of Shelter with Art				
Figure 9	52-2-1520	Dogtrap Creek	Warren Bluff 1990	A large shelter located off Dogtrap Creek has been formed via block fall and cavernous weathering processes (15m x 4m x4m). The shelter has two hands, and a foot red ochre stencils on the back wall of the shelter. There were no artefacts relocated either during the initial registration or during this assessment; this may be due to this shelter having been heavily disturbed as there is evidence of recent camping having occurred with the shelter having been swept out, the construction of a small wall and fire wood being stockpiled on the shelter floor. An access track from the creek to the shelter has also recently been cleared.
Figure 9	52-2-1521	Dogtrap Creek	Warren Bluff 1990	This Shelter is located approximately 4 m off Dogtrap Creek on the western bank and has formed through cavernous weathering (30m x 1.5m x 1m). There was one charcoal infill macropod located on ceiling of this shelter. There were no artefacts relocated during the initial registration or during this assessment of this shelter, as there is no deposit.
Figure 9	52-2-1522	Dogtrap Creek	Warren Bluff 1990	This shelter was formed through cavernous weathering (6m x 2m x 1.25m). This site is located less than 3 m off Dogtrap Creek. The shelter's art is located on the roof and consists of two charcoal indeterminates.
Figure 9	52-2-1525	Dogtrap Creek	Warren Bluff 1990	Located approximately 70 meters off Dogtrap Creek this sandstone shelter (22m x 5m x 6m) was formed through blockfall. The art consists of 10 infill charcoal men, 3 charcoal infill women, 3 charcoal infill anthromorphs, 1 charcoal outline bird, 1 charcoal outline fish, one charcoal circular pattern, 10 indeterminate charcoal lines and 1 unidentifiable charcoal solid area. The large charcoal men, women and anthromorphs are visible on the opposite bank of Dogtrap creek. Several of the human figures are drawn upside down, which is interpreted to mean these figures had a particular cosmological or utilitarian meaning to the artists. There has been some water seepage through the vertical bedding planes and joints at this shelter and as a result silica has formed over a number of the art panel's graffiti. There were no artefacts identified during this inspection. There is some graffiti present on the rock shelter roof at the northern end of the shelter, this comprises of some engraved letters and charcoal letters.
Figure 9	52-2-1526	Dogtrap Creek	Warren Bluff 1990	This shelter is located directly west of 52-2-1524, on the junction of Dogtrap Creek and one of its tributaries (16m x 4m x 2m). Formed through cavernous weathering and blockfall, this shelter is still actively weathering. The art consists of two small red ochre hand stencils. There were no artefacts identified during this assessment.
Figure 9	52-2-1527	Dogtrap Creek	Warren Bluff 1990	Formed through cavernous weathering and block fall this sandstone shelter is located less than a meter off Dogtrap Creek (24m x 3m x 5m). There were 63 stone artefacts relocated within the shelters dripline; comprising of quartzite, basalt and silcrete as well as 8 small bone fragments. Further to those artefacts relocated there are two large areas of Potential

Figure Reference	AHIMS ID	Site Name	Recorded	Description
				Archaeological Deposit (PAD) at the northern end of the shelter. The shelter also contains a 38 red ochre hand stencils or varying sizes, across three panels and the roof. There is also a charcoal infill macropod and some charcoal indeterminate lines along the back wall. There are a number of orange ochre lines drawn over the hand stencils at the southern end of the shelter. Some sections of the shelter have suffered some exfoliation and there has been significant case hardening noted over the art.
Figure 9	52-2-1528	Dogtrap Creek	Warren Bluff 1990	This shelter is located within the bank and bed of Dogtrap Creek; and as a result has suffered some water damage. The floor of the shelter is now visible after a large flood occurred and washed away all the dead trees and branches in the creek bed and over the floor of the shelter. The shelter was formed via weathering and blockfall. It has one large art panel whose charcoal art is layered suggesting different use patterns and artists. The most significant and rare of the motifs represented at this site are the three charcoal anthromorphic figures that have been infilled using hatching techniques, rarely seen in art of this region. The anthromorphs themselves comprise of two side on goanna like bodies with bird like heads with long ibis like beaks; and as well one frontal goanna like body with its arms raised and rays rising out of its human like head. As well as the anthromorphs there are 22 representations of men, 2 women, 4 kangaroos- one of these kangaroos is facing over its right shoulder, this form of depiction is considered rare to the region and has often been attributed as a result of the local Aboriginal communities contact with white settlers – a similar style of kangaroo is present at a well-documented post-contact art site at Wilton (Lambert 1994: 96), 1 bird, 12 charcoal indeterminate infills, and 14 indeterminate charcoal lines. There has been some graffiti drawn over the art panels with the word BLACK written in charcoal infill block letters. There has been substantial case hardening to the art that is present in this shelter.
Figure 9	52-2-1533	Dog Trap Creek	Warren Bluff 1990	This sandstone shelter was formed by cavernous weathering and blockfall (20m x 5m x 4m) processes and is in a poorly preserved condition; except for one of the charcoal infill anthromorphs, due to water damage. Water appears to have flown over the art panels through the shelters horizontal bedding planes. The southern end of the shelter appears to have collapsed just prior to a relocation inspection in February 2013 made by Ken Mills, Jamie Reeves and Renée Regal due to a significant rain event and root jacking from the trees growing above it.
Figure 9	52-2-1534	Dog Trap Creek	Warren Bluff 1990	Formed by cavernous weathering (6m x 3m x 2m) this shelter contains little floor space and one art panel with four red ochre hand stencils, the stencils have case hardened and are actively weathering.
Figure 9	52-2-1540	Bargo	Warren Bluff 1990	This sandstone shelter (10m x 4m x 0.75m) is located in the bed of a tributary of Dogtrap Creek. There is one charcoal indeterminate line in poor condition present at the northern

Figure Reference	AHIMS ID	Site Name	Recorded	Description
				end of the site. The shelter is eroding out due to water flow from the creek during heavy rain events.
Figure 9	52-2-3960	Dog Trap Creek 2013.1	Niche 2013	Dogtrap Creek 2013.1 consists of a sandstone shelter formed via cavernous weathering processes (17m x 2m x 3m) on the first ridgeline above Dogtrap Creek. The shelter has charcoal drawings comprising of one indeterminate line, two whole macropods, one partial macropod and one side facing human.
Figure 9	52-2-3971	Dogtrap Creek 2013.2	Niche 2013	Dogtrap Creek 2013.2 consists of a sandstone shelter formed via cavernous weathering processes (14m x 4m x 5m) on the first ridgeline above Dogtrap Creek. The shelter is actively weathering, and there is evidence of animal movement along the floor of the shelter. The floor comprises of weathering roof surfaces. The shelter has charcoal drawings comprising of one indeterminate line. Mould is growing over the art panel.
Figure 9	52-2-3969	Eliza Creek 2013.3	Niche 2014	Eliza Creek 2013.3 comprises of a cavernously weathered sandstone shelter on the top ridge line above Eliza Creek (9m x 3m x 3m). The shelter has three small child size red ochre hand stencils located in a hollowed out section of the roof. There were no artefacts located during this assessment.
Records of shelter with art and deposit				
Figure 9	52-2-1523	Dogtrap Creek	Warren Bluff 1990	Formed through cavernous weathering this sandstone shelter (10m x 5m x 3m) is located less than 5 metres off Dogtrap Creek. The art at this shelter is located on the ceiling and is layered, suggesting different periods of use and artists at the site. There were 24 red ochre hand stencils and 1 white ochre hand stencil as well as 1 women, 1 man, 2 kangaroos, 1 snake, 5 fish and 1 eel charcoal infill depictions. There were also 2 charcoal infill indeterminates and 22 charcoal indeterminate lines identified during this assessment. An Axe Grinding Groove is viable on a sandstone platform at one end of the Rock Shelter. As well as the art there were 23 artefacts relocated during this assessment made from chalcedony, chert, rose and white quartz; however they appear to have been disturbed possibly by the goats that have been using the shelter. There is some graffiti present on the rock face adjoining the northern end of the shelter, this comprises of some engraved letters as well as a charcoal depiction of a duck and a kangaroo. A change in seepage is visible at one end of rock shelter, but this is not effecting the art surfaces.
Figure 9	52-2-1538	Bargo	Warren Bluff 1990	Located on a tributary of Dogtrap Creek; behind the Bargo waste disposal facility this shelter has been formed by cavernous weathering (12m x 6m x 2.5m). The art of this shelter comprises of two hand and one foot red ochre stencils; as well as one charcoal anthromorph, which is in very poor condition. There was one quartz flake located within the shelter dripline.

Figure Reference	AHIMS ID	Site Name	Recorded	Description
Figure 9	52-2-3970	Eliza Creek 2013.2	Niche 2014	Eliza Creek 2013.2 is located on the first ridge line off Eliza Creek, at the back of a private property. This shelter is situated right next to Eliza Creek 2013.3. This sandstone shelter has been formed by cavernous weathering (8m x 3m 1.5m). This shelter is quite wet as there is a small water fall flowing off the northern end of the ridgeline. The site has been heavily disturbed with a hammock being hung at the front of the shelter; as well as the remains of a camp fire and number of names, words and dates being engraved into the sandstone, under this graffiti are three charcoal indeterminate lines. The second art panel comprises of three red ochre hand stencils. There was one white quartz stone artefact located in the dripline.
Figure 9	52-2-4471	Teatree Hollow 2013.1	Niche 2914	Teatree Hollow 2013.1 is located on the Wirrimbirra Sanctuary, off Remembrance Drive Bargo NSW. The site is a sandstone shelter formed by cavernous weathering and blockfall (14.3m x 3m x 4m), its floor is almost level with Teatree Hollow and comprises of very little soil deposit. There are three deposits of artefacts located in the dripline of this shelter. These artefacts have been constructed using white and clear quartz, chert, as well as grey, red and brown silcrete. The shelter also has three art panels. The first panel includes 1 red ochre foot stencil, 3 red ochre hand stencils as well as 4 indeterminate red stencils. The second panel is made up of 1 indeterminate red ochre line and 1 indeterminate charcoal line. The final panel comprises of I infill charcoal fish as well as well as 3 indeterminate charcoal infill lines.
Records of shelter with art and axe grinding grooves				
Figure 9	52-2-1524	Dogtrap Creek	Warren Bluff 1990	This large sandstone shelter (20m x 4m x 2m) is located at the junction of Dogtrap Creek and a tributary of the creek. Formed my cavernous weathering, the shelter is actively weathering. There are three axe grinding grooves located at its southern end on a large rock. Due to the layered nature of the art located at the shelter it has been concluded that occupation or visits occurred at this site over varying periods. The art consists of seven charcoal men, five macropods, a snake, 1 bird, 1 eel, three white ochre hand stencils, four charcoal infill possums as well as ten indeterminate charcoal lines.
Figure 9	52-2-1539	Bargo	Warren Bluff 1990	Located on the same tributary of Dogtrap Creek as Bargo (52-2-1538) this sandstone shelter (18 m x 4m x 5m) has been formed by blockfall and cavernous weathering and is located less than 5 meters off Dogtrap Creek and contains two charcoal, two yellow ochre and one red ochre indeterminate drawings that are in a poor condition. There is also a worn grinding groove on a rock in the floor of the shelter at its southern end.
Records of shelter with axe grinding groove and deposit				
Figure 9	52-2-1529	Dogtrap Creek	Warren Bluff 1990	Located along Dogtrap Creek this sandstone shelter (20m x 4m x 2m) was formed via weathering and blockfall and contains three grinding grooves, as well as five quartz

Figure Reference	AHIMS ID	Site Name	Recorded	Description
				artefacts. Further to this a stone axe head was located within the floor of the shelter. This axe head looks to have been made at the shelter as it fits into one of the axe grinding grooves located at the northern end of the shelter. The shelter was in the same condition as that which it was described when initially registered.
Records of shelter with deposit				
Figure 9	52-2-4473	Eliza Cree 2013.1	Niche Environment and Heritage	Eliza Creek 2013.1 is a large sandstone shelter (17.5m x 7m x 5m) formed by cavernous weathering and block fall, its floor is almost level with Eliza Creek and comprises of very little soil deposit. Due to its close proximity to the creek the shelter is very wet, with twenty artefacts being visible at the time of inspection within the shelters dripline. These artefacts were made from red silcrete, white quartz, brown silcrete and mudstone.

10.3.6 Artefact sites

There are 13 open camp sites, 6 of which are Artefact scatters and 7 are isolated finds sites identified within the Subject Area. It was noted throughout the survey that the distribution of artefacts in areas of exposure indicated the likely presence of further artefacts in areas with low visibility. It has previously been generally theorized (i.e. not specific to the Study area) that relatively intact archaeological deposits may be present in the transitional zones between the flats and simple slopes (i.e. footslopes), alluvial and transferal and/or erosional soils and in association with creeks and tributaries, such as those associated with Dogtrap Creek.

Table 20: Artefact sites within the Subject Area

Figure Reference	AHIMS ID	Site Name	No.	Recorded	Description
Figure 9	52-2-3872	Bargo Sports Ground - AFT001	1	Niche 2013	This site is registered as an open camp site in AHIMS. The open camp site is located on an elevated rise above a floodplain. The low rise is situated between a 1st order and 2nd order tributary of Hones Creek. The site is 150m from the closest water course. Site dimensions are inclusive of the crest landform, encompassing an area of approximately 60 x 45m.
Figure 9	52-2-3922	Dogtrap Creek IA-1	1	Niche 2013	This site is registered as an open camp consisting of an isolated artefact site in AHIMS. The single artefact located within a recently developed power transmission line
Figure 9	52-2-3938	ELIZA CREEK OAS 1	11	Niche 2012	This site is registered as an open camp consisting of eleven artefacts in AHIMS. The artefacts associated with the site appear to be eroding from the topsoil to the east of the sandstone outcrop, being retained on the depressed surface of the sandstone after rains.
Figure 9	52-2-3942	DRY CREEK OAS 1	1	Niche 2012	This site is registered as an open camp consisting of six artefacts in AHIMS. The artefacts associated with the site appear to be eroding from the topsoil and exposed after rains.
Figure 9	52-2-3943	Dry Creek IA 1	1	Niche 2013	This site is registered as an open camp consisting of an isolated artefact site in AHIMS. The single artefact site appear to be eroding from the topsoil to the west of the sandstone outcrop, being retained on the depressed surface of the sandstone after rains.
Figure 9	52-2-3968	Remembrance Drive 2013.1	2	Niche 2013	Remembrance Drive 2013.1 is located on private property on the western side of Remembrance Drive, Tahmoor NSW. The site comprises of two red silcrete artefacts. These artefacts were located on a small knoll measuring 150m x 50m. Within this knoll there is potential for further undisturbed artefacts.
Figure 9	52-2-3972	Dry Creek 2013.1	1	Niche 2013	Dry Creek 2013.1 is an isolated quartz artefact located on a dirt access track private property off Dry Creek. No further surface artefacts were identified during this inspection at this location.
Figure 9	52-2-3973	Bargo Artefact Scatter 1	4	Artefact 2013	Bargo Artefact Scatter 1 is an Open Camp Site the site comprises of three silcrete and 1 quarts artefact. These artefacts were located on private property at the western side of the southern termination of Kader Street Bargo.

Figure Reference	AHIMS ID	Site Name	No.	Recorded	Description
Figure 9	52-2-3975	Bargo Artefact Scatter 3	6	Artefact 2013	Bargo Artefact Scatter 1 is an Open Camp Site the site comprises of 1 silcrete and 5 quarts artefact. These artefacts were located on private property at the western side of the southern termination of Kader Street Bargo.
Figure 9	52-2-3976	Bargo Isolated Find 1	1	Artefact 2013	Bargo Isolated Find-1 comprises of a single quartz artefact. This artefact was located on private property at the western side of the southern termination of Kader Street Bargo.
Figure 9	52-2-4195	BDTC-AS01	1	Artefact 2013	BDTC-AS01 is an isolated silcrete artefact located on a tributary 600 m east of the Great Southern Road, on private property.
Figure 9	52-2-4034	SW CORNER BARGO SPORTSGROUND	12	Kabaila 2013	SW CORNER BARGO SPORTSGROUND is located in an exposure measuring 50m x 20m to the south west of the existing Bargo Sportsground.
Figure 10	52-2-TBC	Charlies Point Road OCS-1	2	Niche 2018	Charlies Point Road OCS-1 consists of a pink silcrete distal flake and a chert medial flake. This site is located on the proposed location of TCS 2.

11. Analysis and Discussion

11.1 Site distribution, terrain landform type and land elements

Approximately 74% of all of the newly identified Aboriginal sites and objects are sandstone shelter sites located within Dogtrap and Eliza Creeks. The remaining 26% comprise of artefact scatters; one of which is located within close proximity to Dry Creek, and a further site (Charlies Point Road OCS-1) is located within the disturbance footprint of TSC 2. It s also noted that the site Remembrance Drive 2013.1 was located during the initial assessment of proposed ventilation shaft TSC 1; however the location of TSC 1 has since been amended. The most common site types recorded in the Subject Area are sandstone shelter sites with art and/or deposit as well as axe grinding groove sites. The rarest site types recorded are scarred trees, with only one example identified within the Subject Area.

The results of the survey sit comfortably within previously suggested models of past Aboriginal land use for the Cumberland Plain/Cumberland Lowlands and the Woronora Plateau, with some distinct local characteristics. On the plateau and rolling hills away from major drainage lines in the Subject Area the archaeological record consists primarily of open sites containing stone artefacts (open camp sites) and occasional scarred trees. A limitation to this characterisation is that sites containing stone artefacts are dependent on there being exposure and erosion to enable them being detected, and extensive clearing of the timber on the plains will have removed the majority of scarred trees. Nevertheless, the general observation that larger sites containing stone artefacts (these are interpreted to be representative of more intensive or more repeated use of particular areas by Aboriginal people in the past) are only found in close proximity to drainage lines is relevant and confirmed by the results of this assessment (Figure 7)(White and McDonald 2010). Where there are exposed sandstone platforms within the subject area grinding grooves sites are present, and this is typical for the region, representing a utilitarian use of these areas by Aboriginal people in the past. Notably, however, many of the rock shelters also contain axe grinding grooves.

The most notable cultural heritage within the Subject Area is the cluster of rock art and occupation sites within Dogtrap Creek. This type of site clustering is not evidenced elsewhere within the local area, and is rare in the region. The clustering of sites can be explained partly by the fact that Dogtrap Creek presents a unique feature in the region, being larger than most drainage lines, but smaller than the massive gorges and cliffs of the Bargo and Nepean Rivers. As such, Dogtrap Creek would have been readily accessible to Aboriginal people in the past, and contains rock shelters that were still large enough for occupation and artistic expression. However, the fact that suitable rock shelters were present is only part of the story of past Aboriginal land use for the Subject Area and Dogtrap Creek. The density and diversity of sites and motifs within Dogtrap Creek suggests the area was a significant cultural precinct for Aboriginal people in the past, including the recent past during the first contacts with European people based on interpretation of some of the motifs present.

The assemblage of motifs at Dogtrap Creek is typical of the application methods (clay and ochre stencils, charcoal outline and/or infill drawing/painting) and motif types (indeterminant motifs/lines, humans, anthropomorphic figures, animals) present within the region, and includes a relatively high number of human and anthropomorphic figures in the dramatic landscape setting of the deeply incised creek within an otherwise undifferentiated, tree covered plateau, although human and anthropomorphic motifs are recognised as the most common identifiable motifs in the region (at least on the Woronora Plateau, which contains abundant art sites – see Sefton 1991). While human and anthropomorphic figures are common and represented elsewhere in the region, their density and frequency at Dogtrap Creek suggests the area may have had cosmological and cultural significance to past Aboriginal people, beyond just being

occupation places. In conclusion, it appears that within the Subject Area past Aboriginal land use was focused on the creek lines, and indeed especially focused at Dogtrap Creek. The nature of this past Aboriginal land use would have included both utilitarian and day-to-day activities on the plains and within the creek lines (as evidenced by sites containing stone artefacts, grinding grooves and scarred trees), and it is very likely that other cultural activities with cosmological value may have taken place within Dogtrap Creek (as evidenced by the high proportion of rock art sites).

12. Cultural Heritage Values and Significance Assessment

12.1 The Burra Charter

The Burra Charter (Australia ICOMOS 2013) defines the basic principles and procedures to be observed in the conservation of important heritage places. It provides a primary and 'best-practice' framework within which decisions about the management of heritage sites in Australia should be made. The Burra Charter and the OEH policy Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) define cultural significance as being derived from the following four values:

Table 21: Values of the Burra Charter

Value	Description
Aesthetic	This value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.
Historic	This value 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.
Scientific	The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.
Social	This value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

12.2 Scientific (Archaeological) Significance Assessment of Aboriginal Heritage Sites

The NSW Aboriginal cultural heritage regulatory framework supports the significance assessment of Aboriginal archaeological sites and provides guidelines for this ACHA within the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011). The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) outlines two main themes in the overall Aboriginal cultural heritage significance assessment process, namely, the identification of the cultural/social significance of Aboriginal objects and/or places to Aboriginal people and the identification of the scientific (archaeological) significance to the scientific/research community. These themes encapsulate

those aspects of the Burra Charter that are of particular relevance to Aboriginal objects and places. The guidelines specify that information about scientific values will be gathered through archaeological investigation carried out according to the Code of Practice for Archaeological Investigation of Aboriginal Object in New South Wales (DECCW 2010b). The Code of Practice for Archaeological Investigation of Aboriginal Object in New South Wales (DECCW 2010b) itself does not specify criteria for assessment of Aboriginal objects, but rather suggests to "identify the archaeological values and assess their significance …" The assessment must be supportable and the assessment criteria must reflect best practice assessment processes as set out in the Burra Charter.

Notwithstanding the circularity of this advice, the scientific values described in the Burra Charter (above) were considered further by the then NSW National Parks and Wildlife Service in their Aboriginal Cultural Heritage Standards and Guidelines Kit (DEC 1997).

In lieu of specific criteria, the advice from the Aboriginal Cultural Heritage Standards and Guidelines Kit (DEC 1997) is summarised and paraphrased below to provide guidance to the assessment of scientific values presented below:

Table 22: Advice of the Aboriginal Cultural Heritage Standards and Guidelines Kit

Scientific value	Description
Research Potential	It is the potential to elucidate past behaviour which gives significance under this criterion rather than the potential to yield collections of artefacts. Matters considered under this criterion include the intactness of a site, the potential for the site to build a chronology and the connectedness of the site to other sites in the archaeological landscape.
Representativeness	As a criterion, representativeness is only meaningful in relation to a conservation objective. Presumably all sites are representative of those in their class or they would not be in that class. What is at issue is the extent to which a class of sites is conserved and whether the particular site being assessed should be conserved in order to ensure that we retain a representative sample of the archaeological record as a whole. The conservation objective which underwrites the 'representativeness' criteria is that such a sample should be conserved.
Rarity	This criterion cannot easily be separated from that of representativeness. If a site is 'distinctive' then by definition, it will be part of the variability which a representative sample would represent. The criteria might best be approached as one which exists within the criteria of representativeness, giving a particular weighting to certain classes of site. The main requirement for being able to assess rarity is to determine what is common and what is unusual in the archaeological record, but also the way that archaeology confers prestige on certain sites because of their ability to provide certain information. The criterion

Scientific value	Description
	of rarity may be assessed at a range of levels including local, regional, state, national, and global.
Educational Potential	This criterion relates to the ability of the cultural heritage item or place to inform and/or educate people about one or other aspects of the past. It incorporates notions of intactness, relevance, interpretative value and accessibility. Where archaeologists or others carrying out cultural heritage assessments are promoting/advocating the educational value of a cultural heritage item or place it is imperative that public input and support for this value is achieved and sought. Without public input and support the educative value of the items/places is likely to not ever be fully realised.
Aesthetics	In relation to heritage places, aesthetic significance is generally taken to mean the visual beauty of the place. Aesthetic value is not inherent in a place but arises in the sensory response people have to it. The guidelines provide no expectation for archaeologists to consider aesthetic values, it is often the case that the aesthetics including the physical setting of an archaeological site or a landscape contributes to its cultural heritage significance. Examples of archaeological sites that may have high aesthetic values include rock art sites or sites located in environments that evoke strong sensory responses.

The scientific significance assessments for each site are presented in Table 23Table 25. Educational potential and aesthetic values are not considered to be criteria against which scientific values and significance can be assessed. Aesthetic values should be considered as a distinct category (rather than a criteria that contributes to scientific value) in accordance with the Burra Charter and the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011). Educational potential is considered to be a criterion that contributes to social value, rather than scientific value, and hence this is considered below in the overall cultural significance assessment.

Table 23: Scientific Significance Assessment – Individual Sites

Site Number	Site name	Figure Code	Site Features	Research Potential	Representative-ness	Rarity	Significance
52-2-1520	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1521	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1522	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1523	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art, Axe grinding groove and artefacts	High High intactness High density of art and motifs High density of artefacts High potential to provide evidence of local chronology	High Uncommon- layering of art motifs. Threatened archaeological resource	High Uncommon- layering of art motifs Large number of artefacts	High, Local
52-2-1524	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art and axe grinding grooves	Moderate Moderate intactness. Moderate potential to provide evidence of local chronology.	Moderate Uncommon layering of art motifs. Threatened archaeological resource	Moderate Uncommon layering motifs	Moderate, Local
52-2-1525	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	High High intactness of art motifs High density of motifs with potential to provide evidence of local chronology	High Uncommon large human and anthromorphic motifs. Threatened archaeological resource	High Uncommon large human and anthromorphic motifs.	High, Local
52-2-1526	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1527	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	Moderate Moderate densities of artefacts.	Moderate Uncommon use of ochre hand stencils.	Moderate Uncommon use of ochre hand stencils.	Moderate, Local

Site Number	Site name	Figure Code	Site Features	Research Potential	Representative-ness	Rarity	Significance
				Moderate potential to provide evidence of local chronology. Moderate to high intactness.	Threatened archaeological resource.	Uncommon artefact density.	
52-2-1528	Dogtrap Creek	Figure 7 and Figure 9	Shelter with Art	High High intactness. Uncommon motifs and art technique for the local area.	High Uncommon, threatened archaeological resource.	High Uncommon motifs and art techniques for the area.	High, Local
52-2-1529	Dogtrap Creek	Figure 7 and Figure 9	Shelter with deposit and axe grinding groove	High High intactness due to archaeological deposit	High Uncommon, threatened archaeological resource	High Uncommon deposit	High, Local
52-2-1530	Dogtrap Creek	Figure 7 and Figure 9	Scarred Tree	Low	Low	Low	Low
52-2-1532	Dog Trap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1533	Dog Trap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1534	Dog Trap Creek	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-1538	Bargo	Figure 7 and Figure 9	Shelter with Art and Deposit	Low	Low	Low	Low
52-2-1539	Bargo	Figure 7 and Figure 9	Shelter with Art and axe grinding groove	Low	Low	Low	Low
52-2-1540	Bargo	Figure 7 and Figure 9	Shelter with Art	Low	Low	Low	Low
52-2-3921	Dogtrap Creek AGG 1	Figure 7 and Figure 9	Axe Grinding Groove	Low	Low	Low	Low
52-2-4473	Eliza Creek 2013.1	Figure 7, Figure 9 and Figure 11	Shelter with deposit	Low	Low	Low	Low
52-2-3970	Eliza Creek 2013.2	Figure 7, Figure 9 and Figure 11	Shelter with Art and Deposit	Low	Low	Low	Low

Site Number	Site name	Figure Code	Site Features	Research Potential	Representative-ness	Rarity	Significance
52-2-3969	Eliza Creek 2013.3	Figure 7, Figure 9 and Figure 11	Shelter with Art	Low	Low	Low	Low
52-2-3960	Dogtrap Creek 2013.1	Figure 7, Figure 9 and Figure 11	Shelter with Art and Deposit	Low	Low	Low	Low
52-2-3971	Dogtrap Creek 2013.2	Figure 7, Figure 9 and Figure 11	Shelter with Art	Low	Low	Low	Low
52-2-3972	Dry Creek 2013.1	Figure 7, Figure 9 and Figure 11	Isolated Artefact	Low	Low	Low	Low
52-2-3968	Remembrance Drive 3013.1	Figure 7, Figure 9 and Figure 11	Open Camp Site	Low	Low	Low	Low
52-2-3872	Bargo Sports Ground-AFT001	Figure 7 and Figure 9	Isolated find	Low	Low	Low	Low
52-2-3922	Dogtrap Creek IA-1	Figure 7 and Figure 9	Isolated artefact	Low	Low	Low	Low
52-2-3938	ELIZA CREEK OAS 1	Figure 7 and Figure 9	Open Camp Site	Low	Low	Low	Low
52-2-3942	DRY CREEK OAS 1	Figure 7 and Figure 9	Open Camp Site	Low	Low	Low	Low
52-2-3943	Dry Creek IA 1	Figure 7 and Figure 9	Isolated artefact	Low	Low	Low	Low
52-2-4194	BDTC-GG01	Figure 7 and Figure 9	Axe grinding grooves	Low	Low	Low	Low
52-2-4195	BDTC-AS01	Figure 7 and Figure 9	Open Camp Site	Low	Low	Low	Low
52-2-4034	Bandibong	Figure 7 and Figure 9	Dreaming story	Low	Low	Low	Low
52-2-4034	SW CORNER BARO SPORTSGROUND	Figure 7 and Figure 9	Isolated find	Low	Low	Low	Low
52-2-4395	Government Road AGG-1	Figure 7 and Figure 9	Axe grinding groove	Low	Low	Low	Low
52-2-4471	Teatree Hollow 2013.1	Figure 7 and Figure 9	Shelter with Art and Deposit	Low	Low	Low	Low
52-2-TBC	Charlies Point Road OCS-1	Figure 10	Open Camp Site	Low	Low	Low	Low
52-2-3944	Dry Creek GG 1	Figure 7 and Figure 9	Axe grinding groove	Low	Low	Low	Low

12.2.1 Assessment of Significance

The assessment of significance has been completed based on the results of the current survey, and in consideration of previous assessments.

12.2.1.1 Statement of Significance

The individual significance assessments for each site, with consideration given to each criterion, are summarised in Table 23. There were no observations or finds made at any previously recorded sites that would alter their previously determined significance.

12.3 Cultural Significance Assessment of Aboriginal Heritage Sites

The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011: 18) requires that a "clear description of the heritage values present across the area of the proposed activity" be presented, and be articulated back to the information collected during the assessment process, in particular to any submissions received from RAPs. The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011: 18) advises that "the assessment of values is a discussion of what is significant and why". The purpose of the statement of significance is to create a comprehensive assessment of values and significance by considering and stating the values identified under each of the value categories defined by the Burra Charter, namely, social values, historic values, scientific values, and aesthetic values. The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011:10) states:

> *"The assessment and justification in the statement of significance must discuss whether any value meets the following criteria (NSW Heritage Office 2001):*
>
> - *does the subject area have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons? – social value*
> - *is the subject area important to the cultural or natural history of the local area and/or region and/or state? – historic value*
> - *does the subject area have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state? – scientific (archaeological) value*
> - *is the subject area important in demonstrating aesthetic characteristics in the local area and/or region and/or state? – aesthetic value."*

12.3.1 Grading Values and Significance

The following gradations, where a site or zone satisfies at least one criterion, have been applied to provide a measure of the values/significance for Aboriginal objects identified within the Subject Area, and to provide an overall assessment of the significance of each of the zones used that define the Subject Area.

Table 24: Grades of values and significance

Grade of value	Description of grade
Low	The site or object contains only a single or limited number of features, and has no potential to meaningfully inform our understanding of the past beyond what it contributes through its current recording (i.e. no or low research potential). The site or object is a representative but unexceptional example of

Grade of value	Description of grade
	the most common class of sites or objects in the region. Many more similar examples can be confidently predicted to occur within the Subject Area, and in the region.
Moderate	The site or object derives value because it contains features, both archaeological and contextual, which through further investigation may contribute to our understanding of the local past. These features include, but are not limited to: the relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a relatively large assemblage of stone artefacts. The presence of a diverse artefact and feature assemblage, and connectedness with landscape features and other notable sites provide relatively higher representative and rarity values than sites of low significance.
High	The site or object has value because it contains archaeological and/or contextual features which through further investigation may significantly contribute to our understanding of the past, both locally and on a regional scale. These features include, but are not limited to: Aboriginal ancestral remains; the site's relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a very large assemblage of stone artefacts associated with other features such as oven remains or shell midden. Such sites will be relatively rare, and will be representative of a limited number of similar sites that make up this class; hence they derive high representative and rarity values.

12.4 Statement of Significance

Statements of significance for the Subject Area are presented in the following sub-sections. These statements of significance have been prepared in consideration of comments received from the RAPs during the consultation process, including those comments relating to the cultural significance of all sites and the interrelationships between the cultural and spiritual values with the natural landscape. All comments received from RAPs are considered in Section 5.

12.4.1 Social Value

There were no social values identified by the RAPs.

12.4.2 Aesthetic Value

The Project Area contains some aesthetic values. These values associate with the art sites, particularly in Dogtrap Creek where the sites occur within a relatively undisturbed context. These representative localities within the Project Area can provide a strong sense of place, and this is in some contrast to the surrounding

broader landscape which has seen significant historical development, fragmenting the Aboriginal cultural landscape.

12.4.3 Historic Value

The Project Area contains no identified historic values.

12.4.4 Scientific (Archaeological) Value

The Subject Area has moderate scientific value; however, this is extremely variable across the landscape. The sandstone shelter sites clustered along Dogtrap Creek are of a moderate to high scientific significance due to their location, deposit, motif representation and the rarity of these motifs within the region.

Whilst similar art motifs and techniques are recorded elsewhere in the region; these sites (52-2-1523, 52-2-1524, 52-2-1525, 52-2-1527 and 52-2-1528) being clustered and having what appears to be extensive periods of use from looking at the layered nature of their art motifs, suggests a significant contributory value at a local level.

52-2-1529 is also considered to be of high scientific value due to the relocation of an axe that may have been made at the shelter, as it fits into one of the grinding grooves located on a stone outcrop. This type of find is a rarity within the region.

The location of these shelter sites is also important, as it is not the escarpment of a plateau proper, but a large creek in otherwise flat shale plains, dominated by the Nepean River.

12.4.4.1 Dogtrap Creek (52-2-1523)

This sandstone shelter is assessed as having high research potential, high representativeness, high rarity and significance due to the sites intactness and integrity. The art has changed very little since its initial AHIMS registration in 1990; however the deposit has been disturbed by goats. The art as outlined in Appendix 5 is extensive and layered with a large amount of red ochre hand stencils, of varying sizes are still visible.

Shelters of this size with large numbers of art motifs and artefact deposit, with limited disturbance are uncommon within the local region

Reasoning

If artefact densities are high enough, the site could provide a statistically adequate number to achieve a better understanding of the chronological, geomorphological and intactness of the archaeological deposit.

The art if assessed in conjunction with 52-2-1524, 52-2-1525, 52-2-1527 and 52-2-1528 may provide details on periods of use as well as application techniques and numbers of individuals present at the shelter, though further assessment of the hand stencils.

The site may provide information on local stone and ochre sourcing connecting the site to a wider context.

12.4.4.2 Dogtrap Creek (52-2-1524)

This sandstone shelter is assessed as having moderate research potential, moderate representativeness, moderate rarity and significance due to the sites art as outlined in Appendix 5 is extensive and layered. Due to its location on the corner of Dogtrap Creek and a tributary it has suffered some disturbance and is weathering more rapidly than the aforementioned Dogtrap Creek (52-2-1523).

Shelters of this size with large numbers of art motifs within close proximity to other shelters of a similar size are uncommon within the local region

Reasoning

The art if assessed in conjunction with 52-2-1523, 52-2-1525, 52-2-1527 and 52-2-1528 may provide details on periods of use as well as application techniques and numbers of individuals present at the shelter, though further assessment of the drawing techniques and the three white ochre hand stencils.

The site may provide information on ochre sourcing connecting the site to a wider context.

12.4.4.3 Dogtrap Creek (52-2-1525)

This sandstone shelter is assessed as having high research potential, high representativeness, high rarity and significance due to its connectedness to the other sites of similar significance rating along Dogtrap Creek. The art as outlined in Appendix 5 is extensive and layered with the large charcoal infill men, women and anthromporphs being of particular interest. Such motif are rare in a regional context.

Reasoning

The art if assessed in conjunction with 52-2-1523, 52-2-1524, 52-2-1527 and 52-2-1528 may provide details on periods of use as well as application techniques.

The site may provide information on local ochre sourcing connecting the site to a wider context.

12.4.4.4 Dogtrap Creek (52-2-1527)

This sandstone shelter is assessed as having moderate research potential, moderate representativeness, moderate rarity and significance due to the sites intactness and integrity. The site has suffered little disturbance since its initial registration in 1990. The art as outlined in Appendix 5 is extensive and layered with a large amount of red ochre hand stencils, of varying sizes are still visible.

Shelters of this size with large numbers of art motifs and artefact deposit, with limited disturbance are uncommon within the local region

Reasoning

If artefact densities are high enough, the site could provide a statistically adequate number to achieve a better understanding of the chronological, geomorphological and intactness of the archaeological deposit.

The art if assessed in conjunction with 52-2-1524, 52-2-1525, 52-2-1526 and 52-2-1528 may provide details on periods of use as well as application techniques and numbers of individuals present at the shelter, though further assessment of the hand stencils.

The site may provide information on local stone and ochre sourcing connecting the site to a wider context.

12.4.4.5 Dogtrap Creek (52-2-1528)

This sandstone shelter is assessed as having high research potential, high representativeness, high rarity and significance due to the sites anthromorphic art motifs and drawing techniques. The site has changed very little since its initial AHIMS registration in 1990. The art as outlined in Appendix 5 is extensive and of particular interest due to the infill techniques used on the three anthromorphic beings.

These art techniques and motifs are uncommon within the region.

Reasoning

The art, both as individual motifs and as an assemblage, when assessed in conjunction with 52-2-1523, 52-2-1524, 52-2-1525, and 52-2-1527 has the potential to provide details on periods of use as well as application techniques.

12.4.4.6 Dogtrap Creek (52-2-1529)

This sandstone shelter is assessed as having high research potential, high representativeness, high rarity and significance due to the relocation of a stone axe head and its associated axe grinding groove within the shelter floor.

Reasoning

The stone axe head relocated within the shelter floor can be refitted into one of the axe grinding grooves located on a sandstone rock outcrop within the shelter. This type of find within the region is rare.

12.4.5 Summary

Based on the scientific significance assessment of 40 sites (Table 23), a majority of sites recorded for the project area are assessed to be of either low (34 sites (85%)) or moderate significance (2 sites (5%)). Only 4 sites (10%) were assessed to be of high archaeological significance. All of the sites recorded as high scientific significance are located within Dogtrap Creek (52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529). A list of Aboriginal sites in the Subject Area, their scientific significance rating and a statement of significance is presented in Table 24.

Table 25: Summary of Scientific Significance Ratings for Aboriginal Sites in the Subject Area

Investigation Area/Scientific Significance Rating	Site Count	Percentage of Sites	Sites
Tahmoor South	**40**	**100%**	
Low Significance	*34*	85%	Dogtrap Creek (52-2-1520), Dogtrap Creek (52-2-1521), Dogtrap Creek (52-2-1522), Dogtrap Creek (52-2-1526), Dogtrap Creek (52-2-1530), Dog Trap Creek (52-2-1533), Dog Trap Creek (52-2-1534), Bargo (52-2-1538), Bargo (52-2-1539), Bargo (52-2-1540), Bindibong (52-2-1599),Bargo Sportsground AFT 001 (52-2-3872), Dogtrap Creek AGG-1 (52-2-3921),Dogtrap Creek IA-1 (52-2-3922), ELIZA CREEK OAS 1 (52-2-3938), Dry Creek IA 1 (52-2-3943),Dry Creek GG 1 (52-2-3944), Eliza Creek 2013.2 (52-2-3970), Eliza Creek 2013.3 (52-2-3969), Dogtrap Creek 2013.1 (52-2-3960), Remembrance Drive 2013.1 (52-2-3968), Eliza Creek 2013.1 (52-2-4473),Dogtrap Creek 2013.2 (52-2-3971), Dry Creek 2013.1 (52-2-3972), DRY CREEK OAS 1 (52-2-3942)Dry Creek IA 1 (52-2-3943), Dry Creek AGG 1 (52-2-3944), Bargo Artefact Scatter 1 (52-2-3973),Bargo Artefact Scatter 3 (52-2-3975), Bargo Isolated Find 1 (52-2-3976), BDTC-GG01 (52-2-4194), BDTC-AS-01 (52-2-4195). SW CORNER BARGOSPORTSGROUND (52-2-4034), Government Road AGG-1 (52-2-4395), Teatree Hollow 2013.1 (52-2-4471) and Charlies Point Road OCS-1 (52-2-TBC).
Moderate Significance	*2*	5%	Dogtrap Creek (52-2-1524) and Dogtrap Creek (52-2-1527).
High	*4*	10%	Dogtrap Creek (52-2-1523), Dogtrap Creek (52-2-1525) Dogtrap Creek (52-2-1528) and Dogtrap Creek (52-2-1529).
Total	**40**	**100.00%**	

12.4.6 Significance Assessment of Aboriginal Heritage Sites

As part of the cultural assessment process, each RAP participating in the survey or who identified as an Aboriginal stakeholder was asked what cultural landscape values the Subject Area may contain. Of the registered Aboriginal stakeholder groups consulted the following groups provided feedback into this process: Cubbitch Barta Native Title Claimants, Peter Falk Consultancy and Historical Indigenous Research.

12.4.6.1 Aboriginal Cultural and Social Significance Assessment and registered Aboriginal Stakeholder Feedback

In a broad sense, Aboriginal cultural significance may involve a number of significance criteria that cut across different sets of values, for example as Pearson and Sullivan (1995) explain, Aboriginal significance may be:

- traditional: the place may be sacred or important religious site; for example, a place that has an important association with a cultural hero, or place where a ceremony is or was held.
- historic: the place may be important in a post European Aboriginal history-it may tell the story of Aboriginal contact with Europeans, or their subsequent history-a massacre site like Myall Creek (NSW) or a cemetery or an Aboriginal mission may be such a place.
- contemporary: the place may be a site with no traditional associations-it may be an archaeological site unknown to the contemporary community; but it may when discovered, acquire importance to the community because of what it symbolizes, and because it tells the community about their past.

Tahmoor Coal has undertaken to consult directly with all RAPs and individuals about the Tahmoor South Project and has sought their views about cultural significance. RAPs were invited to attend the site inspections.

To date general Aboriginal community consultation advice has stated that all sites (archaeological or cultural) are of value to the community.

Following the field assessment and review of the draft report, RAPs will be asked to provide written comments and feedback on a draft of the Aboriginal Cultural Heritage Assessment Report (see Section 5 and Appendix 1).

From the initial assessment undertaken for the Tahmoor South Project the following comments were received from the RAPs:

Mrs Glenda Chalker of the Cubbitch Barta Native Title Claimants wrote (Cubbitch Barta Native Title Claimants 2014):

> *Every one of those sites that has been recorded, including those which don't appear to be anywhere at the moment is culturally significant. They are all part of the landscape within this area. Without one the others would not be there. They might not all be appealing to the eyes as some are, but they are all connected to each other in some way. They all collectively tell the whole story, and therefore cannot simply be discounted, because of their either high, moderate or low scientific significance.*
>
> *To me personally, I knew of some of these sites, but had never visited them before, and some of them are unique within the landscape, but once again they are all connected. They all have an extremely high cultural significance to my family, and some of them are on my own property. The area still has potential to contain more Aboriginal sites, particularly artefact scatters, as the creek lines were concentrated on, and not the open areas that surround them. Two of the artefact*

scatters were from my own knowledge of the place on Eliza and Dry Creeks, and there must be many more yet unknown.

Any baseline recording and monitoring should include Aboriginal representatives, not just the Archaeologists. This is our heritage and our culture and we should always be a part of the process, and should not have to wait to be told whenever, if there has been impacts. We should be there, not just "CONSULTED" later, and I use the word loosely.

It is difficult to manage Aboriginal sites from over the fence, these places are all on someone's private property, and as land managers they should all be made aware of their responsibilities under the Act, so as to not harm or destroy the site that they each have on their properties. This includes their understanding that we as Aboriginal people do not want to take their land from them, because these places exist. Without the help from land owners these places will not exist in the future, so that all Australians can know of these places, and we can teach our grandchildren of them.

I would like to note also that not all of the sites within the longwall development were visited by TLALC and CBNTCAC during the field work. Although we inspected a lot of them, it was not the entire number of sites.

There are sites other than the 21[3], that from my experience are in danger of damage from mine subsidence, that are not being included in the ACHMP, because of their low archaeological significance. I do not believe that is appropriate. Every site within the proposed longwall area and outside of, within the area of possible impact should be included in the ACHMP. It is difficult for me to make that determination of exactly how many, as the mapping is incomplete for the longwall plan to the east and west in figure 4. There should be a map of the whole longwall area with every single site overlayed, not just Dogtrap Creek. I do commend the mine for avoiding the larger number of the Dogtrap Creek cluster, but there are many others that will not be avoided, both on Dogtrap and the larger area.

There should be no baseline recording or monitoring taking place by anyone without Aboriginal representation present at all times!'

Further to this letter of recommendations Mrs Chalker and the Tharawal Local Aboriginal Land Council have requested that a community education program be carried out for those private landholders who have registered Aboriginal sites located on their land, after the approval of the Tahmoor South Project.

Mr Peter Falk of Peter Falk Consultancy wrote (Peter Falk Consultancy 2014:1):

'All Bore Hole and Vent Shafts prior to any drilling to be done, all Aboriginal Stakeholders must be present to monitor the sites and to ensure that NO disturbance of Aboriginal sites and also if any artifacts are uncovered.

Any and all Aboriginal Sites within the state of NSW are of significance to all Aboriginal Peoples.

Cultural and Social Value:

[3] During the previous assessment there were only 21 sites identified for inspection.

The sites along Dogtrap Creek are or an undisturbed condition and are of Aboriginal Cultural Significance and must be protected to the fullest, including the relocation of the long wall mining to protect these sites from subsidence.

The value of the cultural heritage for these art sites is high for Aboriginal people. As these sites were used not only for occupation but also for ceremonial uses and because of this they must be protected.'

Adrian Schaeffer of Historical Indigenous Research 11 March 2014 contacted Renée Regal at 2:41pm by telephone to discuss his concerns and comments on the report as he was having computer issues he thought he would verbally express his concerns:

'I am concerned that the scarred tree located within Dogtrap Creek could not be relocated by those present at the field assessment.

I am also concerned about the clearance of the native vegetation at the proposed TSE1/ TSC2 ventilation shaft site at Dogtrap Creek.

I also suggest that those sites along Dogtrap Creek where naked men are depicted in charcoal are "mens business sites".'

In regards to cultural significance during the current Tahmoor South assessment Glenda Chalker made the following comment:

Once again I must emphasis the cultural significance of the sites within the proposed project, without going into the details. Perhaps one day the story will be told.

12.4.6.2 Conclusion

There were a total of 40 Aboriginal archaeological sites and one Dreaming Story identified during this assessment through previous registrations with AHIMS and from the field work component of this assessment. Two of these sites were assessed to be of moderate archaeological or scientific significance. Four of these sites were assessed to be of high archaeological or scientific significance. The remaining 34 are considered to be of low archaeological significance.

Whilst it is unlikely that there will be adverse effects to any of the shelter and axe grinding groove sites within close proximity to the proposed longwalls and surface infrastructure it is the conclusion of this assessment that an Aboriginal Cultural Heritage Management Plan be developed for the shelter sites along Dogtrap and Eliza Creeks to ensure this is the case.

13. Impact Assessment

13.1 Overview of Potential Impacts

The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) requires that both direct and indirect harm to Aboriginal objects and Aboriginal places be considered. Generally direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as an indirect consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area as a result of an activity.

As described in Section 10.3, a total of 40 physical Aboriginal heritage sites were identified within the Subject Area, including 6 newly recorded sites and 34 previously recorded sites. None of these sites were within close proximity to any of the proposed infrastructure.

This section provides an impact assessment for the Aboriginal heritage sites located within the Subject Area including potential surface disturbance impacts from both surface infrastructure (Section 13.2) as well as potential subsidence impacts from underground mining activities (Section 13.3). Section 13.3.4 provides a summary of the potential impacts and harm from the Project, while Section 13.5 considers potential cumulative impacts on Aboriginal heritage sites.

The potential impacts of the Project have been evaluated in consideration of comments received from the RAPs during the consultation process. These comments include those relating to the archaeological potential of landforms and the likelihood of occurrence and distribution of sites. All comments received from the RAPs are considered in Section 5.

13.2 Potential Impacts from Surface Disturbance

13.2.1 Surface Infrastructure

A detailed description of the surface infrastructure components of the Project is provided in Section 4 of this report, including the development of the two ventilation and fan shafts (TSC 1, TSC 2), extension of the existing carpark and the REA extension Area.

The surface infrastructure components of the Project (Section 4) will only disturb a total area of 54.4 ha (Section 9.2). Whilst the precise layout and detailed design of the infrastructure components is not yet finalised, disturbance will only occur within this footprint and not all areas would be subject to disturbance. For the purposes of this ACHA it is therefore assumed that the development of surface infrastructure for the Project would be wholly within the determined footprint and would be of a nature that would cause direct harm to any Aboriginal objects or areas of cultural value located within the footprint.

The direct harm associated with surface disturbance activities is anticipated to cause wholeloss of heritage value at effected sites, and would have a cumulative or landscape impact of partial loss of values for the area as a whole. The activities that may cause harm to Aboriginal objects or areas of cultural value would include:

- vegetation clearance and topsoil stripping
- disturbance of soil units or the ground surface with Aboriginal objects on the surface or within the soil profile

- changes to a site or place's context that has secondary impacts to the site or place, resulting in the loss of cultural values; and
- excavation works and the removal and redistribution of soil by heavy machinery during site regrading or development of suitable surface conditions for various construction activities.

The surface infrastructure avoids all grinding grooves, rock shelters and therefore there would be no potential surface disturbance impacts to any of these site types or any sites with moderate or high scientific significance. A single Open Camp Site (Charlies Point Road OCS-1 AHIMS ID# 52-2-TBC) falls within the footprint of proposed ventilation shaft site TCS2. The development could potentially harm this site.

13.2.2 Ancillary Infrastructure

In addition to the proposed surface disturbance works located within the Subject Area (Figure 2, Figure 3 and Figure 4) the Project also includes ancillary infrastructure. Ancillary infrastructure comprises minor surface infrastructure, although the location of such infrastructure cannot be determined at this stage in the Project. Ancillary infrastructure includes, for example, the following activities:

- Transmission line
- SIS Drill holes
- SIS surface pipeline
- The construction and/or maintenance of access tracks (e.g. for the installation and/or maintenance of surface infrastructure).
- Internal Project power infrastructure.
- Minor water infrastructure such as pipelines.
- Surface works associated with PED emergency communication system.
- Subsidence monitoring.
- Subsidence remediation works (where required).
- Surface rehabilitation works (where required).
- Other associated minor infrastructure, plant, equipment and activities.

The location and design of ancillary infrastructure would be flexible and would be located in an attempt to avoid Aboriginal heritage sites and areas of cultural sensitivity as far as practicable. The location of the ancillary infrastructure would be determined as required over the life of the Project.

13.3 Potential Impacts from Subsidence

Subsidence predictions for the Project Area (including specific predictions for Aboriginal heritage sites) have been provided by Mine Subsidence Engineering Consultants (MSEC997 2018-Appendix 8). The subsidence predictions are informed by previous experience of underground mining in the region as well as an understanding of the geological formations in the Subject Area.

The area that has been assessed for the proposed extent of underground mining areas is identified in Section 10 of this assessment and highlighted in Figures 1 to 12.

Longwall Mining

Longwall mining involves removing rectangular sections of coal from between supported underground roadways by cutting a wide, continuously retreating panel of the coal (the longwall). The roof of the mine is

held up by hydraulic jacks, which are moved behind the retreating face where coal is cut. Once moved the jacks no longer support the roof and the roof collapses into the void left behind. This process can result in the subsidence of the ground surface above the mine (NSW Minerals Council 2013).

Impacts of Subsidence on Aboriginal Heritage

The potential for mine subsidence induced ground movements to harm Aboriginal objects or areas of Aboriginal cultural value is dependent on many factors, including the nature of the Aboriginal objects or areas of cultural value themselves. MSEC (201833) describes how longwall mining can result in the cracking, heaving, and stepping at the ground surface. The magnitude of these effects is largely dictated by factors such as the mine's geometry, the depth of cover (how deep the coal is below the ground surface), the extracted seam thickness, the geology above the mine, and the presence of geological features such joints or faults, especially near the ground surface.

In the case of Aboriginal cultural heritage, the nature of the heritage sites and features is also a very important consideration in the potential effects of subsidence induced ground movements. Whether a site is an open site with stone artefacts, or a culturally significant area, or whether the site is a rock shelter or grinding groove platform are important considerations in determining the likely impact, if any.

In the case of open sites that occur in an area with a soil profile, further to the above possible results of subsidence induced ground movements, it can be reliably noted that for deeper longwall mines (such as the Project) any stresses and strains exerted by the ground movement will generally be within the tolerance limits of the soil profile (therefore showing little impact to no impact on the surface), although isolated cracking of soils at the surface may occur (MSEC 201834). If this cracking is coincident with a surface Aboriginal heritage site or object, then it could be argued that the site is harmed. This is considered a low risk and the greater risk to sites in this instance may be from remediation measures, such minor earthworks as described below. Other possible impacts may be from changes to surface or sub-surface drainage, which may alter local erosion and potentially expose, slump or bury sites. Such cases, especially in respect of isolated objects, would be very difficult to predict. MSEC (201833) note that whilst cracks can occur above the longwall as the subsidence trough develops, larger cracks that may require remediation generally only occur on the surface at an area coincident with the perimeters of the longwalls. In some cases, where steep slopes are present, large surface cracks can develop due to downslope mass movement triggered by subsidence related ground movements.

For sites which occur on bedrock platforms, or in areas where the landscape is comprised of rock formations (such as sandstone and rock outcrops) the risks of harm to the sites are greater than for open sites with artefacts or cultural features. These sites are mostly grinding groove platforms. When observed as surface effects bedrock or rock formations will behave differently than soil to the strains and pressures associated with subsidence induced ground movements. For rock platforms there is a risk that the rock will buckle and deform, and the types of changes that can occur in this case are cracking or delamination of the surface strata (MSEC 2018). For rock-shelters the types of changes can include cracking, delamination of surface rock, exfoliation, block fall and in extreme cases overhang collapse (although this has never been documented) or slumping of rock.

For rock-shelters the types of changes will be similar or identical to those that would be expected due to natural weathering processes, but exacerbated by subsidence. For example, a naturally weathering block which will have detached and fallen at some point in time may be detached and fall sooner due to differential movements of the rock strata induced by subsidence (Biosis Research and The Ecology Lab 2007: 29).

Monitoring of the effects of subsidence induced ground movements to Aboriginal heritage sites (such as rock shelters and grinding groove platforms) has been conducted since the 1990s (see Sefton 2000, Biosis Research 2007, Biosis Research 2009, ERM 2010, Kayandel 2008, Niche Environment and Heritage 2013 to 2017). Previous experience shows that approximately 1 in 10 rock-based sites that have been subjected to subsidence induced ground movements show demonstrable changes that can be attributed to subsidence. These changes take the form of block fall, exfoliation, cracking, opening and/or closing of existing faults and fissures (Biosis Research 2009).

Preventative management measures can sometimes be implemented, but for the most part the management of Aboriginal heritage sites relies on monitoring of the sites and implementing pre-arranged management responses should they be triggered by harm. For most Aboriginal heritage sites there are often no suitable remediation measures as these can often be more intrusive and harmful to heritage value than the effects of the subsidence, which as described above is usually an extension or acceleration of pre-existing natural weathering processes. As an example, the process of accessing a site, cutting stress relief slots, which requires heavy drilling or sawing machinery, in close proximity to a grinding groove platform would be likely to be more damaging to the site and its cultural context than the subsidence induced cracking or shearing of surface strata.

For the Project, the consideration of potential harm to Aboriginal heritage sites from subsidence induced ground movements falls into three distinct categories:

- sites relatively more susceptible to harm from subsidence (e.g. grinding groove platforms, rock shelters);
- sites relatively less susceptible to harm from subsidence (open artefact sites) and
- other sites of cultural value where landscape changes (such as mass movement) may impact heritage values.

Table 25 to Table 27 present the subsidence predictions for each of the Aboriginal heritage sites located within the Subject Area that would not otherwise be impacted by surface disturbance works associated with the surface and ancillary infrastructure described in Section13.2.2.

13.3.1 Artefact Scatters and Isolated Finds

There are a total of thirteen open sites located within the Project Area (which comprise of stone artefacts). Four of these sites are located within the Subsidence Study Area.

The maximum predicted final tilt for the Open Camp Sites is 7.5 mm/m, which represents a grade change in 1 in 135. It is unlikely that these sites would experience any adverse impacts resulting from mining induced tilts.

The maximum predicted curvatures for the Open Camp Sites are 0.11km^{-1} hogging and 0.20km^{-1} sagging, which represents minimum radii of curvature of 9 km and 5 km respectively. The maximum predicted conventional strains for these sites, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 1.7 mm/m tensile and less than 3 mm/m compressive.

These open camp sites can potentially be affected by cracking of the surface soils as a result of mine subsidence movements. It is unlikely however that scattered artefacts or isolated finds themselves would be impacted by surface cracking. It is possible, however, that if any remediation of the surface was required after mining, that these works could potentially impact the open camp sites.

If the proposed longwalls were to be shifted, reorientated, extended or shortened within the extents of longwalls boundary, the predicted subsidence movements would change. Isolated Find 52-2-3968 may be directly mined beneath if the longwalls are extended to the northwest. The impact assessments are, however, unlikely to change substantially and the same management measures would apply (MSEC997:169).There have been no recorded instances where artefact scatters have been adversely affected due to longwall mining.

13.3.2 Rock Shelter Sites

There are nineteen (19) rock shelter sites identified within Subsidence Study Area. The majority of these sites are located along Dogtrap Creek, between proposed longwalls 101 and 102.

The maximum predicted tilt for the rock shelter is 9.0 mm/m which represents a change in grade from 1 to 110. It is unlikely that these sites would experience any adverse impacts resulting from mining induced tilt.

The maximum predicted curvatures for the rock shelters are 0.12km-^{1} hogging and 0.05km-^{1} sagging, which represent minimum radii of curvature of 8 km and 20 km, respectively. The maximum predicted conventional strains of these sites, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 2mm/m tensile and 1 mm/m compressive.

The predicted closures at the rock shelter sites vary between 150m and 650 mm. The compressive strains resulting from valley related movements are more difficult to predict than conventional strains. It has been observed in the past that compressive strains due to valley related movements between 10 mm/m and 20 mm/m (over a standard 20 metre bay length) have occurred above previously extracted longwalls, where the magnitudes of closure were similar to those predicted at the sandstone shelters.

It is extremely difficult to assess the likelihood of instabilities for the sandstone shelters based upon predicted ground movements. The likelihood of the shelter becoming unstable is dependent on a number of factors which are difficult to fully quantify. These factors include jointing, inclusions, weaknesses within the rock mass, groundwater pressure and seepage flow behind the rock face. Even if these factors could be determined, it would still be difficult to quantify the extent to which these factors may influence the stability of the shelter naturally or when it is exposed to mine subsidence movements (MSEC 2018: 170).

Mills (2014:4) further notes that 'Notwithstanding the expected impacts from mining subsidence, it is noted that relatively high levels of natural ground movement and impacts from high intensity rainfall events early in 2013 were observed during the site visits, especially in the vicinity of Dogtrap Creek. These impacts included natural rock falls, block movements opening up cracks in the ground, tree root invasion, and sediment rich water flowing out from the back of overhanging rock formations depositing sediment and causing discolouration at the back of the walls. These natural changes have potential to degrade the archaeological sites irrespective of any mining activity.'

The predicted conventional and valley related movements at rock shelters are similar to the typical movements in the Southern Coalfield. Beneath 52 monitored shelters, approximately 10% of the shelters have been effected by fracturing of the strata or shear movements along bedding planes and that none of the shelters have collapsed (Sefton 2000).

The experience from the Southern Coalfield indicates that the likelihood of significant physical impacts on rock shelters within the subject area is relatively low.

For the sites located directly above the proposed longwalls, If the proposed longwalls were to be shifted, reorientated, extended or shortened within the extent of longwalls boundary, the predicted subsidence movements would change. The impact assessments are, however, unlikely to change substantially and the same management measures would apply (MSEC997:171)(MSEC, 2013: 161-162).

As referred to in section 12.2 of this report there are four rock shelter sites along Dogtrap Creek with artwork that is of high cultural and archaeological significance (52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529). These sites are located beyond the end of Longwall 102 and side of Longwall 103 and will not be mined beneath by the proposed Tahmoor South Project.

The closest distance of site 52-2-1523 to longwall 203 is 170 metres. The closest distance of site 52-2-1525 to Longwall 202 is approximately 220 metres. The closest distance of site 52-2-1528 to Longwall 203 is 260 metres. The closest distance of site 52-2-1529 to longwall 103 is 145 metres.

The sites are predicted to experience between 125 mm and 175 mm of vertical subsidence due to the extraction of the proposed longwalls. As outlined in drawing no. MSEC997(MSEC, 2018) the predicted conventional subsidence contours are more widely spaced around the staggered ends of the proposed longwalls and, as a result, the predicted valley closure in the section of Dogtrap Creek where the sites are located is in the order of 250mm.

The sites are located along small cliffs and a detailed visual inspection has been undertaken by Dr Ken Mills of Strata Control Technologies (SCT 2013). The small cliffs are orientated in a roughly north-south direction and consist of relatively short lengths of intact rock faces (less than 50 metres).

Given the setback distances of the proposed longwalls to the sites, it is considered that the likelihood of impacts is low. It is extremely unlikely that major cliff instabilities will occur based on the experience of mining near cliffs at similar depths of cover in the Southern Coalfield. It is possible that minor deformations of the cliff faces could occur. It is possible that particular bedding planes could slide relative to each other as the valley closes. While the chances are very low, if these bedding planes were to coincide with where the artwork is located, some impacts could occur to an archaeological site (MSEC 2018:171).

The sites of high archaeological significance will not be mined directly beneath even if the proposed Tahmoor south longwalls were shifted, reorientated, extended or shortened within the extents of longwalls boundary. For reasons discussed in Section 10.1.5 of MSEC997, while the offset distances and predicted movement would change, the impact assessments are unlikely to change substantially and the same management measures would apply (MSEC 2018171).

Table 26 provides the subsidence predictions for the sandstone shelter site within the Subject Area.

Table 26: Subsidence Predictions for the Rock Shelter within the Subsidence Study Area

AHIMS ID	Site Name	Scientific Significance	Predicted total vertical subsidence (mm)	Predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km-1)	Maximum predicted total sagging curvature (km-1)
52-2-1520	Dogtrap Creek	Low	550	5.5	0.09	0.02
52-2-1521	Dogtrap Creek	Low	750	9.0	0.12	0.03
52-2-1522	Dogtrap Creek	Low	200	0.5	0.01	<0.01
52-2-1523	Dogtrap Creek	High	175	<0.5	<0.01	<0.01

AHIMS ID	Site Name	Scientific Significance	Predicted total vertical subsidence (mm)	Predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km-1)	Maximum predicted total sagging curvature (km-1)
52-2-1524	Dogtrap Creek	Moderate	60	0.5	<0.01	<0.01
52-2-1525	Dogtrap Creek	High	125	<0.5	<0.01	<0.01
52-2-1526	Dogtrap Creek	Low	100	<0.5	<0.01	<0.01
52-2-1527	Dogtrap Creek	Moderate	80	<0.5	<0.01	<0.01
52-2-1528	Dogtrap Creek	Low	150	<0.5	<0.01	<0.01
52-2-1529	Dogtrap Creek	High	90	<0.5	<0.01	<0.01
52-2-1530	Dogtrap Creek	Low	80	<0.5	<0.01	<0.01
52-2-1532	Dog Trap Creek	Low	100	<0.5	<0.01	<0.01
52-2-1533	Dog Trap Creek	Low	550	7.5	0.07	0.01
52-2-1534	Dog Trap Creek	Low	225	1.5	0.02	<0.01
52-2-1538	Bargo	Low	1350	8.0	0.11	0.05
52-2-1539	Bargo	Low	1250	7.5	0.09	0.05
52-2-1540	Bargo	Low	1050	3.5	0.05	0.03
52-2-3971	Dogtrap Creek 2013.2	Low	80	0.5	<0.01	<0.01
52-2-3960	Dog Trap Creek 2013.1	Low	200	0.5	0.02	<0.01
52-2-4471	Teatree Hollow 2013.1	Low	850	5.5	0.06	0.03

13.3.3 Axe Grinding Grooves

Table 27 provides the subsidence predictions for axe grinding groove sites within the Subsidence Study Area.

The predicted maximum tilt for the axe grinding groove sites is 8.0 mm/m, which represents changes in grade of 1 in 125. It is unlikely that these sites would experience any adverse impacts resulting from the mining induced tilt of this magnitude.

The predicted maximum curvatures at the grinding groove sites are 0.06km^{-1} hogging and 0.19km^{-1} sagging, which represents minimum radii curvature of 17 kilometre's and greater than 5 kilometres, respectively. The maximum predicted conventional strains for these sites, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 0.9mm/m tensile and 2.9 compressive.

Fracturing in bedrock has been observed in the past, as a result of longwall mining, where tensile strains were greater than 0.5mm/m or where compressive strains were greater than 2 mm/m. The predicted conventional strains are of sufficient magnitude to potentially result in fracturing of the bedrock (MSEC 2018: 170).

The predicted closures at the axe grinding groove sites vary between 145 mm and 420 mm. The compressive strains resulting from valley related movements are more difficult to predict than conventional strains, but based on the predicted magnitude of valley closure, it is possible that fracturing could occur in the bedrock in the vicinity of grinding groove sites as a result of proposed mining. Minor and isolated fracturing has been observed in streams up to around 400 metres outside previously extracted longwalls in the Southern Coalfield (MSEC 2018:170).

If the proposed longwalls were to be shifted, reorientated, extended or shortened within the extents of longwall boundary, the predicted subsidence movements would change. The impact assessments are, hoever, unlikely to change substantially and the same management measures would apply (MSEC997:170).

Table 27: Subsidence Predictions for Grinding Groove Sites within the Subsidence Study Area

AHIMS ID	Site Name	Scientific Significance	Predicted Total Subsidence (mm)	Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km^{-1})	Maximum Predicted Sagging Curvature (km^{-1})
52-2-3921	Dogtrap Creek AGG-1	Low	250	<0.5	0.01	0.01
52-2-4194	BDTC-GG01	Low	1450	5.5	0.06	0.05
52-2-4395	Government Road AGG-1	Low	1550	8.0	0.06	0.19

13.3.4 Modified Trees

Table 28 provides the subsidence predictions for modified trees within the Subsidence Study Area.

There is one scarred tree (52-2-1530) which is located within approximately 150 m east of the proposed longwall 102.

It has been found from past longwall experience that the incidence of impacts on trees is extremely rare. Impacts on trees have only been previously observed where the depths of cover were extremely shallow, in the order of 50 metres or less, or on very steeply sloping terrain, in the order of 1 in 1 grade or greater.

Even if the proposed longwalls were to be shifted, reorientated, extended or shortened within the extents of longwalls boundary, the scarred tree within the Subsudence Study Area will be located away from the proposed longwalls. It is unlikely, therefore, that thiw site would be adversely impacted by the proposed mining (MSEC, 2018:169).

Table 28: Subsidence Predictions for the modified tree within the Subject Area

AHIMS ID	Site Name	Scientific Significance	Predicted Total Subsidence (mm)	Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km^{-1})	Maximum Predicted Sagging Curvature (km^{-1})
52-2-1530	Dogtrap Creek	Low	80	<0.5	<0.01	<0.01

13.4 Summary of potential impacts

For the purposes of this ACHA (and as described in Section 13.3 above), some Aboriginal heritage sites located within the underground investigation areas have the potential to be impacted by subsidence.

13.4.1 Potential impacts

Table 31 provides a summary of the potential impacts of the Project on Aboriginal heritage sites within the Subject Area, including the potential type of impact on each site (i.e. surface impacts, subsidence impacts or no impacts).

One Aboriginal cultural heritage site (an open camp site) has the potential to be impacted by surface disturbance works and subsurface works as a result of construction of a proposed new ventilation shaft. Twenty five (25) sites have the potential to be impacted by subsidence impacts. Thirteen (13) sites identified within the wider Project/Subject Area are considered to be unlikely to experience any potential impacts as a result of the Project, as they are outside both the Subsidence Study Area and proposed surface infrastructure footprint (**Figure 7**.

13.4.2 Potential harm

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) requires that both direct and indirect harm be considered. Generally direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as a consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area.

The Project has the potential to harm Aboriginal objects and Aboriginal cultural values during both the development phase and the operational phase. During the development phase potential harm and impacts may result from the development of surface infrastructure, which will involve (as examples) land clearing and ground disturbance for the establishment of transport corridors and facilities, storage and stockpile areas. During the operational phase of the Project potential harm and impacts may be derived from subsidence induced ground movements and may also be derived from any earthworks associated with subsidence remediation or ancillary infrastructure such as SIS drill holes or environmental monitoring locations.

As required by the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b), the likely impacts (and partial loss of value) to Aboriginal heritage sites as a result of the Project is presented in Table 31.

13.5 Potential Cumulative Impacts

The Project would cause a minor increase to the cumulative development impact on the Aboriginal cultural heritage of the region and local area. The Aboriginal heritage of the area has experienced some impacts in recent years due to the use of the majority of the Subject Area for agricultural purposes. Generally within the Southern Coalfield Caryll Sefton conducted a long term monitoring program that reviewed the effects of longwall mining to sandstone shelter sites over a ten year period, the results of which were highlighted in Sefton 2000. During her assessment Sefton monitored fifty two (52) Aboriginal sites; prior to, during and after longwall mining had been completed (Sefton 2000:15). The results of this study were:

- Only five of the fifty two sites had evidence of impacts that related to longwall extraction methods.
- Impacts associated with longwall mining can be grouped into four distinct categories:

  - cracking
  - movement along existing joints and/or bedding planes
  - changes to the water seepage patterns through the sandstone
  - blockfalls
- Elements of shelters that were associated with the most change were:
  - Size of the overhang, including the length of the ridgeline
  - Wetness of the overhang
  - Location in regards to the valley base
  - Location of the shelter, in regards to the goaf
  - Shelters formed through blockfall.
- During Sefton's monitoring program, there were no collapsed shelters identified.
- No shelters with an area of less than 50m³ had suffered due to subsidence
- Not all shelters that were identified as being larger then 50m³ had suffered impacts
- Any impacts caused by subsidence were not observed until at least three months after the completion of extraction.
- 'the over-riding factor which appears to be significant is overhand size, where large overhangs are at greater risk (Sefton 2000:38).'

The Southern Coalfields Inquiry report (2008) was developed due to concerns that the government had in regards to both past and potential impacts of mine related subsidence on significant natural features within the Southern Coalfield. The objectives of the inquiry were to:

- Undertake a review of the impacts of longwall extraction within the Southern Coalfields significant natural features (rivers, significant streams, swamps and cliff lines), concentrating on risks to water flow, quality and ecosystems.
- Provide advice on best practise in regards to subsidence impacts, avoidance and/or minimising impacts on significant natural features; as well as the management, monitoring and remediation of any adverse effects.
- Report on the social and economic significance of the coal resources within the region.

In relation to Aboriginal heritage the summary of the report states that 'Aboriginal heritage sites are most at risk of subsidence impacts where they are located in cliff lines and/or rock overhangs. The Panel was not made aware of any significant impacts having occurred on Aboriginal heritage features in the Southern Coalfields since the 1980s (NSW 2008: 2).'

Impacts on natural features such as cliff lines, water course and valleys were described during the inquiry as having been associated with 'non-conventional' subsidence (NSW 2008: 82) the measures for predicting valley closure and upsidence were judged to be the most valuable when determining impacts on these landforms.

The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) defines ecologically sustainable development and inter-generational equity as follows, "the principle of inter-generational equity holds that the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations." When considered against the principles of inter-generational equity and ecologically sustainable development the potential impacts of the Project can be considered relatively minor because they directly harm only a relatively small number of sites, all of low scientific value. There is no significant detrimental effect to quality or benefit that the Aboriginal history and archaeology of the Study area may provide to future generations. There is reciprocal cumulative growth of the understanding

of the Subject Area's history and prehistory which provides some amelioration of any adverse impacts, and which provides knowledge and information for future generations.

13.5.1 Potential Cumulative Impacts- Within the Southern Coalfields

Aboriginal cultural heritage site monitoring programs and have been developed and implemented across the Southern Coalfields in the past 17 years (Biosis 2013, Biosis 2015, 2916, Biosis Research 2008, 2009a, 2009b 2009c, 2011, Gun, R.G and Kayandel Archaeological Services 2007, Kayandel Archaeological Services 2012, Niche Environment and Heritage 2010, 2011, 2012, 2012, 2013a, 2013b, 2013c, 2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2016a, 2016b, 2016c, 2017a and 2017b and Sefton 2000, 2002a, 2002b, 2002c). The methodology of these programs is very similar to that outlined in Sefton 2000. Initial baseline recording is completed on those sites that are identified by the MSEC as having potential to be effected by subsidence. Site types that are baseline recorded include sandstone shelter sites with art and/or potential archaeological deposit, stone artefacts, deposit, midden and axe grinding grooves. Sandstone platforms that include engravings- often of animals, humans, anthromorphic figures and ancestral beings- and/ or axe grinding grooves are also monitored. These sites as demonstrated in Appendix 5 of this assessment can be located within creek and river beds on large plateaus, often within or at the edge of swamps on platforms that make up shelter roofs. Stone artefact scatters, isolated artefacts and scarred trees as outlined in Section 10.3.6 of this assessment are not monitored as they are highly unlikely to be effected by subsidence, and hence the risk attributed to these site types is negligible.

At the completion of baseline recording Aboriginal cultural heritage sites are often monitored a second time in line with the individual projects Trigger Action Response Plan (TARP) within 6 months of the completion of a longwalls extraction. Monitoring programs will continue in this fashion until the Aboriginal cultural heritage site is no longer within the angle of draw of the set of longwalls for extraction.

Within the Southern Coalfields a total of 206 Aboriginal cultural heritage sites have been monitored since 1990. The types that have been monitored are outlined in Table 29 below. Of these sites two are located within Tahmoor Colliery.

Table 29: Aboriginal cultural heritage site types monitored within the Southern Coalfields

Site type	Number of type	Percentage
Sandstone shelter with art	114	52%
Sandstone shelter with deposit	27	12%
Sandstone shelter with art and deposit	25	21%
Single axe grinding groove	4	2%
Axe grinding grooves	15	6%
Engraving	1	0.5%
Engraving and axe grinding groove	1	0.5%
Sandston shelter with art, deposit and axe grinding grooves	2	1%
Shelter with art and PAD	2	1%
Sandstone shelter with PAD	14	5%

Site type	Number of type	Percentage
Sandstone shelter with art, PAD and Deposit	1	0.5%
Totals	**206**	**100%**

Of the 206 Aboriginal heritage sites monitored a total of 32 sites were identified as having changes attributable to subsidence (Table 30). This number equates to a total of 15% of all the Aboriginal cultural heritage sites monitored (Regal and Reeves 2017).

Of the 32 sites assessed as having changes, a total of 2 are noted as having adverse effects as a result of mining. These adverse effects are outlined within the individual projects TARPS as being cracking that has occurred across or adjacent to the art panels. Those cracks adjacent to panels have caused changes to water seepage above the panel, causing flow to redirect over the art. The total percentage in this instance is 1%, which is considerably less then then 10% originally predicted by Sefton in 2000. Those sites which have suffered adverse effects to their structure (either the sandstone shelter or rock platform) number 20, which equates to 9% of all of the Aboriginal site monitored within the Southern Coalfields (Regal and Reeves 2017).

The smaller number of impacts could be an indicator of a number of things; that were not originally considered by Sefton. Sefton's initial sample size was a lot less, as she removed sandstone shelter sites with PAD and/or deposit due to the lack of impacts on this site type. Further to this sandstone platforms with engravings and/or axe grinding grooves were not considered for monitoring. The smaller sample size coupled with a community expectation that all Aboriginal cultural heritage sites would be effected by subsidence of a similar if not worse degree to those impacts present at Whale Cave (52-2-0754), which is a sandstone shelter with art that has been adversely effected by subsidence through the pillar extraction of coal at a depth of 340m. Effects at this site include the movement along joint planes, which have led to a more permeable surface. Water seepage within the shelter has altered and as a result the art panels have been effected.

Anumber of the collieries within the Southern Coalfields are moving west, away from ridgelines and landforms that would have been suitable for Aboriginal transient use or occupation and that have the highest number of sandstone shelter sites with art and/or deposit. As outlined within Appendix 5 the majority of the shelter sites suitable for occupation are located within a slope gradient of between 20 and 35 degrees (Biosis Research 2007: 68). As with previous assessments within the Tahmoor Colliery Aboriginal land use of the area focuses on moderate to steep slopes where sandstone shelter sites are suitable for occupation, due to their accessibility.

In terms of potential cumulative impacts to Aboriginal cultural heritage values within the Southern Coalfields the results and conclusions made by the analysis of the aforementioned monitoring programs must be assessed in conjunction with the data provided by MSEC (Section 13.3). There are 39 Aboriginal cultural heritage sites located within the Tahmoor South Subject Area. Of these sites two sites are located directly above Longwall 104 (52-2-4194) and 52-2-4395, above Longwall 103. Both of these sites comprise of axe grinding grooves on sandstone platforms, and as a result of longwall mining may suffer some adverse effects.

MSEC recognises that the archaeological sites located along Dogtrap Creek are located within close proximity to the Nepean Fault and increased subsidence could occur directly above the commencing ends of Longwalls 101 and 103 as a result. The majority of the sites, however are not proposed to be directly

mined beneath, including the four sites identified to be of high archaeological significance. Whilst increased subsidence could affect the sites located directly above the proposed longwalls. As a result of the 2013 site inspections and recommendations Tahmoor Colliery have amended the current proposed mine layout of the Tahmoor South Area to reduce the subsidence movements and impacts on the sites located on Dogtrap Creek that have been given a high archaeological significance rating. Whilst this has lowered the potential impacts to the sites from longwall mining, the possibility of impacts cannot be completely ruled out. It is recommended that adaptive management techniques be applied. In the case of 52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529 it will be possible to monitor the ground movements and the conditions of the sites during the extraction of Longwalls 101 and 102. If monitoring detects the early development of potentially severe differential movements at the archaeological sites, the commencing position of Longwall 103 could be shortened (MSEC 2018: 173). As the 27 Aboriginal cultural heritage sites comprising of sandstone shelters or sandstone platforms with axe grinding grooves are identified within the angle of draw for Subject Area it has been assumed that these sites will be added to future monitoring programs in the Southern Coalfield.

This will bring the total number of sites monitored to 266 sites. Assuming that the MSEC predictions are correct that two Aboriginal sites (52-2-4194 and 52-2-4395) will be impacted by subsidence then this would bring the total number of sites within the Southern Coalfields as being effected under their TARPS to a total of four sites, which equates to a total of 1.5% of all shelters and axe grinding groove sites monitored in the Southern Coalfields.

Table 30: Aboriginal sites within the Southern Coalfields observed to have subsidence related changes, during monitoring programs

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel effected	Reference
52-2-0094	Flat Rock Creek 4	Sandstone shelter with Art	Opening of existing bedding planes a roof/ rear wall and minor roof fall.	No	Kayandel Archaeological Services 2008
52-2-0106	Flat Rock Creek 10	Sandstone shelter with Art	Cracks in rear wall, potential for altered seepage to impact art-mitigated with an artificial drip-line.	No	Kayandel Archaeological Services 2008
52-2-0089	Flat Rock Creek 11	Sandstone shelter with Art	Exfoliation and block fall at rear wall.	No	Kayandel Archaeological Services 2008
52-2-0154	Flat Rock Creek 49	Sandstone shelter with Art	Minor block fall from rear wall and ceiling.	No	Kayandel Archaeological Services 2008
52-2-0258	Flat Rock Creek 57	Sandstone platform with engraving and axe grinding grooves	Crack in sandstone platform.	No	Kayandel Archaeological Services 2008

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel effected	Reference
52-2-0176	Flat Rock Creek 152	Sandstone shelter with Art	Cracking and minor block fall at rear wall.	No	Sefton 2000 and Kayandel Archaeological Services 2008
52-2-1638	Browns Road Site 24	Sandstone shelter with Art	Minor block fall at rear wall.	No	Sefton 2000
52-2-1625	Browns Road Site 10	Sandstone Shelter with Art	Cracking and minor blockfall at rear wall.	No	Sefton 2000
52-2-1299	Wedderburn Road 1	Sandstone shelter with Art	Cracking in floor and rear wall.	No	Sefton 2000
52-2-1300	Wedderburn Road 2	Sandstone Shelter with Art	Opening of crack in back wall.	No	Sefton 2000
52-2-1162	Stokes Creek Site 67	Sandstone Shelter with Art	Opening of the bedding plane above the art and increased water seepage as a result	No	Sefton 2000
52-2-2252	Dendrobium 4	Sandstone Shelter with Art	Opening of crack along the back wall	No	Biosis Research 2008b
52-2-0195	Flat Rock Creek 34	Sandstone shelter with Art	Horizontal cracking is visible on the ceiling of the shelter. Cracking has occurred over the most southern hand stencil on the back panel. Crack across hand stencil is 40cm long. Crack along the roof of the shelter is 1-.2.5 m off ground, and 5 m long.	Yes	Niche 2017b
52-2-3083	Flat Rock Creek 281	Sandstone Shelter with Art	Thin cracking adjacent to the hand stencil at the northern end of the shelter.	Yes	Kayandel Archaeological Services 2012
52-2-3086	Flat Rock Creek 284	Sandstone Shelter with Art	Fractured a corner of a buttress-like formation on the rear wall	No	Kayandel Archaeological Services 2012

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel effected	Reference
52-2-2243	Georges River No. 2	Sandstone shelter with Art	Thin vertical cracking in the shelter ceiling, adjacent to the art panel.	No	Niche 2013a
52-2-0396	Flat Rock Creek 15	Sandstone shelter with Art	The large vertical fissure in the central back wall had increased in width (opened) and shifted laterally	No	Niche 2013b
52-2-2244	Georges River No.3	Sandstone shelter with Art and axe grinding grooves	Opening of the horizontal bedding plane. Cracking and exfoliation along the back wall.	No	Niche 2014
52-2-	MET 1	Sandstone Shelter with Art	Vertical cracking and cracks along the roof.	No	Niche 2015a
52-2-0826	Flat Rock Creek 176	Sandstone Shelter with Art	Vertical cracking at the northern and southern ends of the shelter.	No	Niche 2015b
52-2-3077	Flat Rock Creek 275	Sandstone Shelter with Art	The horizontal bedding plane joins along the back of the shelter have been noted as opening, three hairline cracks have formed, running vertical from the bedding plane	No	Niche 2016
52-2-3486	Flat Rock Creek 301	Sandstone platform with axe grinding groove	A large crack was observed running east to west along the entire rock platform. Crack is approximately 3.08 m to the north of the grinding groove and is approximately 25m long and	No	Niche 2017

AHIMS number	Site name	Site type	Observed changes/ impacts	Is the art panel effected	Reference
			continues past the rock platform.		

The sites highlighted within Table 30 have experienced changes as a result to mining that are highlighted in their individual projects TARP. This means that the art panels at these sites have experienced cracking. Fifteen of the Aboriginal heritage sites have just suffered structural effects to either the sandstone shelter or the sandstone platform. Eight of the sites have suffered environmental effects, whilst the effects at a further two sites could not be attributed decisively to either subsidence or environmental factors. It should be noted here that none of the sites outlined in Table 30 are located within the Tahmoor Colliery footprint.

13.5.2 Potential Cumulative Impacts- within the Tahmoor Coal domain

As demonstrated in Table 30 within the larger Tahmoor mining lease domain, of the 2 Aboriginal cultural heritage sites monitored by the colliery there have been no Aboriginal cultural heritage sites that have suffered adverse effects as a result of subsidence.

Adding the current Subject Areas 25[4] Aboriginal cultural heritage sites to the list of sites monitored within the Tahmoor domain there will be a total of 27 sites monitored. Taking MSECs predicted two sites that may be impacted by the Tahmoor South Project into account, this will bring the total number of sites effected by subsidence at Tahmoor to remain at two. In terms of cumulative impacts this means that 6.9% of Aboriginal cultural heritage sites monitored within Tahmoor Colliery have the potential to be impacted by subsidence.

[4] Site types that will be added to the monitoring program include shelters with art, shelters with deposit, shelters with art and deposit, shelters with art and axe grinding grooves and axe grinding grooves.

Table 31: Summary of Potential Impacts of the Project on Aboriginal Heritage Sites and Summary of Potential Harm

AHIMS ID	Site Name	Site Type	Scientific Significance	Impact Type	Type of Harm (Direct/Indirect/ None)[5]	Degree of Harm (Total/Partial /None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value)[6]
52-2-1599	Bandibong	Aboriginal dreaming story	Low	None	None	None	No loss of value
52-2-1520	Dogtrap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-1521	Dogtrap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1522	Dogtrap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1523	Dogtrap Creek	Sandstone shelter with art and deposit	High	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-1524	Dogtrap Creek	Sandstone shelter with art and axe grinding grooves	Moderate	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1525	Dogtrap Creek	Sandstone shelter with art	High	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1526	Dogtrap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1527	Dogtrap Creek	Sandstone shelter with art	Moderate	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1528	Dogtrap Creek	Sandstone shelter with art	High	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)

[5] Sites located outside the predicted 20mm subsidence contour, with the exception of those located near or within valley bases for example axe grinding grooves are unlikely to experience direct or indirect impacts. Sites located near valley bases could potentially be effected by valley closure effects. Minor and isolated fracturing have been observed up to 400 m away from mining within the Southern Coalfield. The likelihood of the fracture to be conincidenced with the sites located outside the Subject Area is considered to be very low. As a result indirect harm is attributed in this case as it is an impact to the surrounding landscape as opposed to the actual Aboriginal cultural heritage site.

[6] The code does not provide definitions for these categories, however they are taken to mean:
Type of harm: Direct- the object will be subject to direct physical disturbance. Indirect- there may be secondary consequence's from the activity, resulting in harm. None- neither the object nor its context will be altered.
Degree of harm: Total: the object(s) will be directly harmed in their entirety. Partial- some objects will be directly or indirectly harmed, however a portion of a site may remain unaffected. None- there will be no harm.
Consequence of harm: Total loss of value- no heritage values will remain subsequent to the harm. Partial loss of value- some heritage values will remain subsequent to the harm. No loss of value- there will be no harm, and no loss of value.

AHIMS ID	Site Name	Site Type	Scientific Significance	Impact Type	Type of Harm (Direct/Indirect/ None)[5]	Degree of Harm (Total/Partial /None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value)[6]
52-2-1529	Dogtrap Creek	Sandstone shelter with art and axe grinding grooves	High	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1530	Dogtrap Creek	Modified tree	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-1532	Dog Trap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-1533	Dog Trap Creek	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1534	Dog Trap Creek	Sandstone shelter with art and deposit	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1538	Bargo	Sandstone shelter with art and deposit	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1539	Bargo	Sandstone shelter with art and axe grinding groove	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-1540	Bargo	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-3872	Bargo Sports Ground-AFT001	Isolated find	Low	Potential subsidence	None	None	No loss of value
52-2-3921	Dogtrap Creek AGG-1	Axe Grinding Grooves	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-3922	Dogtrap Creek IA-1	Isolated find	Low	None	None	None	No loss of value
52-2-3938	ELIZA CREEK OAS 1	Open camp site	Low	None	None	None	No loss of value
52-2-3944	Dry Creek GG 1	Axe Grinding Groove	Low	None	None	None	No loss of value
52-2-3942	DRY CREEK OAS 1	Open camp site	Low	None	None	None	No loss of value
52-2-3943	Dry Creek IA 1	Isolated find	Low	None	None	None	No loss of value
52-2-3968	Remembrance Drive 2013.1	Isolated Find	Low	Potential subsidence	None	None	No loss of value
52-2-3969	Eliza Creek 2013.3	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)

AHIMS ID	Site Name	Site Type	Scientific Significance	Impact Type	Type of Harm (Direct/Indirect/ None)[5]	Degree of Harm (Total/Partial /None)	Consequences of Harm (Total Loss of Value/Partial Loss of Value/No Loss of Value)[6]
52-2-3970	Eliza Creek 2013.2	Sandstone shelter with art and deposit	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-3971	Dogtrap Creek 2013.2	Sandstone shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-3972	Dry Creek 2013.1	Isolated find	Low	None	None	None	No loss of value
52-2-3960	Dog trap Creek 2013.1	Shelter with art	Low	Potential subsidence	Indirect	Partial	Partial loss of value(aesthetic/ visual)
52-2-4194	BDTC-GG01	Axe grinding groove	Low	Potential subsidence	Direct	Partial	Partial loss of value(aesthetic/ visual)
52-2-4195	BDTC-AS01	Open Camp Site	Low	Potential subsidence	None	None	No loss of value
52-2-4034	SW CORNER BARGO SPORTSGROUND	Isolated find	Low	Potential subsidence	None	None	No loss of value
52-2-4395	Government Road AGG-1	Axe grinding groove	Low	Potential subsidence	Direct	Partial	Partial loss of value(aesthetic/ visual)
52-2-3975	Bargo Artefact Scatter 3	Open Camp Site	Low	Potential subsidence	None	None	No loss of value
52-2-3976	Bargo Isolated Find 1	Isolated Find	Low	Potential subsidence	None	None	No loss of value
52-2-4471	Teatree Hollow 2013.1	Shelter with art and deposit	Low	Potential subsidence	Indirect	Partial	Partial loss of value (aesthetic/ visual)
52-2-4473	Eliza Creek 2013.1	Shelter with deposit	Low	None	Nonr	None	Partial loss of value (aesthetic/ visual)
52-2-TBC	Charlies Point Road OCS-1	Open Camp Site	Low	Surface disturbance	Direct	Total	Total loss of value

14. Management and Mitigation Measures

14.1 Conservation Principles and Management Framework

The two founding principles behind the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011:12) are ecologically sustainable development and intergenerational equity. These principles hold that "the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations".

The strong emphasis, as in the Burra Charter, is to quantify and understand the heritage values of a place, a site, or an object and exhaust avenues of avoiding harm to those values. If harm cannot be avoided then there must be consideration and implementation of strategies to minimise harm (OEH 2011:13).

It follows that the hierarchy for consideration in regards to management strategies available for surface stone artefacts and subsurface stone artefacts and areas of archaeological potential, fall into four general categories, in order of preference from a conservation perspective:

- avoidance and *in-situ* conservation
- partial avoidance and partial *in-situ* conservation (includes partial harm)
- harm caused with mitigating circumstances such as collection or salvage; and
- unmitigated harm.

The four general categories (described above) have been considered in the following subsections with regard to both direct impacts (e.g. surface disturbance) and indirect impacts (e.g. subsidence impacts).

The management and mitigation measures have been prepared in consideration of comments received from the RAPs during the consultation process. These comments include those related to cultural considerations surrounding salvage works and the handling of artefactual materials, as well as the cultural significance of all sites. All comments received from the RAPs are considered in Section 5.

14.1.1 Detailed design to avoid harm

During detailed design of proposed ventilation shaft site locations and the location of any ancillary infrastructure, it is recommended the proponent give consideration to the known Aboriginal heritage sites identified by this study. This process should include a consideration of whether or not surface infrastructure can be designed in a way that avoids harm, and if harm cannot be avoided that harm be caused to as few sites as possible, within existing design and operational constraints. Depending on the site type (e.g. artefact scatter or grinding groove) and scientific significance rating, further management measures such as archival recording and fencing may be undertaken prior to harm, in consultation with a suitably qualified archaeologist and representatives of the RAPs.

This approach is consistent with the OEH requirements of ecologically sustainable development and intergenerational equity.

14.1.2 Sites that cannot be avoided

Charlies Point Road OCS-1 (52-2-TBC) is an Open Camp Site located within the proposed footprint TCS 2. The site was determined to be of low scientific significance due to the site comprising of three stone artefacts. This site should be avoided by the final footprint. In the event that direct impact to this site is required and

cannot be avoided, further management should be undertaken in consultation with a suitably qualified archaeologist and in accordance with an Aboriginal Heritage Management Plan (AHMP).

14.1.3 Subsidence Monitoring

Subsidence monitoring prior to and after longwall mining should be implemented for Aboriginal heritage sites within the underground investigation area subject to impacts from mining induced subsidence. The subsidence monitoring program should be in accordance with the relevant approved Extraction Plan and AHMP. Monitoring should be undertaken by a suitably qualified archaeologist and representatives of the RAPs.

14.1.4 Impact assessment for the Tahmoor South Project

Figure 2, Figure 3 and Figure 4 show the extent of longwalls for the Tahmoor South Project as well as the proposed surface infrastructure including the proposed changes to the REA and two new ventilation shafts.

The location of known Aboriginal sites has been overlain with the structure plan and proposed longwall layout (Figure 9 and Figure 10) to assess the impact of the proposed activities on the project areas archaeological and cultural resources.

The Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) requires that both direct and indirect harm be considered. Generally direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as a consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion of an area.

A number of Aboriginal shelter and axe grinding groove sites lay within close proximity of the proposed Tahmoor South Project longwalls.

Table 32: Aboriginal girinding groove and shelter sites and their proximity to the proposed Tahmoor South Project longwalls

Aboriginal site name	Longwall proximity
Dogtrap Creek GG-1 (52-2-3944)	Lies over the goaf of longwall 203
Dogtrap Creek (52-2-1540)	Lies between longwall 102 and 103
Dogtrap Creek (2-2-1538)	Lies over the goaf of longwall 102
Dogtrap Creek (52-2-1539)	Lies over the goaf of longwall 102
Dogtrap Creek (52-2-1520)	The eastern end of longwall 103
Dogtrap Creek (52-2-1521)	The eastern end of longwall 103
Dogtrap Creek (52-2-1522)	The eastern end of longwall 103
Dogtrap Creek (52-2-1524)	The eastern end of longwall 103
Dogtrap Creek (52-2-1531)	Longwall 109
Dogtrap Creek (52-2-1532)	Longwall 109
Dogtrap Creek (52-2-1528)	Lies within close proximity to longwall 106.
Dogtrap Creek (52-2-1523)	170m off longwall 103.
Dogtrap Creek (52-2-1525)	220m off longwall 103.

Aboriginal site name	Longwall proximity
Dogtrap Creek (52-2-1528)	260m off longwall 203.
Dogtrap Creek (52-2-1540)	Lies between longwall 102 and 103
Dogtrap Creek (2-2-1538)	Lies over the goaf of longwall 102
Dogtrap Creek (52-2-1539)	Lies over the goaf of longwall 102
Dogtrap Creek (52-2-1520)	The eastern end of longwall 103
Dogtrap Creek (52-2-1521)	The eastern end of longwall 103
Dogtrap Creek (52-2-1522)	The eastern end of longwall 103
BDTC-GGO1 (52-2-4194)	Along tributary 1 to Dogtrap Creek, located above longwall 104
Government Road AGG-1 (52-2-4395)	Along tributary 2 to Dogtrap Creek, located above longwall 103

The predicted conventional subsidence, tilts and curvatures for the archaeological sites within the Subject Area have been provided by MSEC997 2018. A summary of these predicted conventional subsidence parameters have been provided in this report.

The maximum predicted conventional strains for the archaeological sites, based on applying a factor of 15 to the maximum predicted conventional curvatures, are 2.0mm/m tensile and 1.5mm/m compressive. Non-conventional movements can also occur as a result of, among other things, anomalous movements. The analysis of strains provided in Section 10.3 includes those resulting from both conventional and non-conventional anomalous movements.

The archaeological sites are at discrete locations and, therefore, the most relevant distributions of strain are the maximum strains measured in individual survey bays from previous longwall mining. The grinding groove sites and rock shelters are located along the valleys of the streams and as a result could experience valley related movements. A summary of the maximum predicted upsidence and closure movements for the streams in the locations of these sites is also provided in this report.

It is extremely difficult to assess the likelihood of instabilities for the rock shelters based on predicted ground movements. The likelihood of the shelter becoming unstable is dependent on a number of factors which are difficult to quantify. These factors include jointing, inclusions, weaknesses within the rock mass, groundwater pressure and seepage flow behind the rock face. Even if these factors could be determined, it would still be difficult to quantify the extent to which these factors may influence the stability of the shelter naturally or when it is exposed to mine subsidence movements (MSEC 2018: 170-171).

The impacts to four of the sites that have been given a high significance rating (52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529) is predicted to be between 125 and 175 mm of vertical subsidence due to the extraction of the proposed longwall 102. As shown in Drawing No. MSEC997-22, the predicted conventional subsidence contours are more widely spaced around the staggered ends of the proposed longwalls, and as a result the predicted conventional differential movements of tilt and curvature are very low at the sites. The predicted valley closure in that section of Dogtrap Creek is in the order of 200 mm (MSEC 2018: 174).

Given the setback distances of the proposed longwalls to the sites, it is considered that the likelihood of impacts is low. It is extremely unlikely that major cliff instabilities will occur on experiences of mining near cliffs at similar depths of cover in the southern coal field. It is possible, however, that minor deformations of the cliff faces could occur. For example, bedding planes could slide relative to each other as the valley closes. While chances are very low, some impacts could occur to an archaeological site if a sliding bedding plane was to coincide with where the art work is located (MSEC 2018: 173).

14.1.5 Impact assessment – Ventilation shaft sites

In relation to the proposed surface infrastructure, Aboriginal site 52-2-TBC is located within the footprint of ventilation shaft TCS 2. Whilst this site may not be directly impacted by the development of this ventilation shaft site there may be some indirect and partial loss of value due to the partial loss of site context from the proposed vegetation clearance.

14.1.6 Impact assessment – Registered Aboriginal Stakeholder Feedback and cultural significance assessment

This has been completed and included in Section 12.4 of this report.

15. Recommendations

Based on the scientific significance of the Aboriginal heritage sites presented in Section 12, the impact assessment presented in Section 13 and the suggested management and mitigation measures outlined in Section 14, the following recommendations are made regarding the Aboriginal heritage sites within the Subject Area.

A Heritage Management Plan (HMP) should be developed for the Project that details and schedules (for the life of the Project) the mitigation and management measures presented in the report. The HMP should be developed in consultation with the RAPs.

The HMP should include the following:

- Protocols that prescribe the involvement of the RAPs in cultural heritage works conducted under the HMP. This protocol should focus on members of the RAPS identified during this assessments consultation process.
- A communications protocol that describes clear methods of communication, including expectations of suitable notification and response time, between the proponent and the RAPs.
- Subsidence monitoring program to be implemented progressively over the life of the mine. The subsidence monitoring program should include monitoring of all Aboriginal sandstone shelter sites and grinding groove sites located within the 35° angle of draw of the project The program should include (but not be limited to) the following
  - A schedule for undertaking the subsidence monitoring at the nominated sites.
  - Appropriately detailed baseline and archival site recordings, including high resolution digital photographs.
  - An impact Trigger and Action Response Plan (TARP) specific to each of the sites being monitored.
- In addition to this monitoring program it is recommended that adaptive management techniques be applied. In the case of 52-2-1523, 52-2-1525, 52-2-1528 and 52-2-1529 it will be possible to monitor the ground movements and the conditions of the sites during the extraction of longwalls in the vicinity. If monitoring detects the early development of potentially severe differential movements at the archaeological sites, the commencing position of Longwall 103 could be shortened (MSEC 2018: 175).
- Subsurface test excavation is recommended at TSC 2 Ventillation shaft and fan site location, after the confirmation of its final location.
- A protocol to allow for reasonable access to identified significant Aboriginal heritage sites.
- Procedures to establish, maintain and update a current GIS database of Aboriginal heritage sites identified within the Subject Area (i.e. the Project Sites Database).
- A protocol for the determination of the final location of ancillary infrastructure, systematic survey of the relevant area(s) (in consultation with the RAPs) if the area has not already been surveyed. Any previously unidentified sites should be managed in accordance with the management measures described in Section 14.
- A protocol for the discovery and management of human remains, including stop work provisions and notification protocols.

- Procedures for the management and reporting of previously unknown Aboriginal heritage sites that may be identified during the life of the Project, consistent with the management measures described in Section 14.
- Protocols for heritage awareness training to be incorporated into the mine site inductions for both employees and sub-contractors who may be conducting works that have the potential to impact on any Aboriginal heritage sites. Consideration should be given to involving the RAPs in the development and presentation of the cultural awareness training.
- Landholders should be made aware of any Aboriginal objects or sites located within their properties and their legal responsibilities.
- A regular review process for the HMP.

Glossary

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present day Aboriginal communities.
Aboriginal object(s)	The legal definition for material Aboriginal cultural heritage under the NSW *National Parks and Wildlife Act 1974.*
Aboriginal stakeholders	Members of a local Aboriginal land council, registered holders of Native Title, Aboriginal groups or other Aboriginal people who may have an interest in the Project.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Archaeological deposit	A layer of soil material containing archaeological remains.
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.
Archaeological site	A site with material evidence of past Aboriginal or non-Aboriginal activity in which material evidence (artefacts) of past activity is preserved.
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	1. A group of stone artefacts found in close association with one another. 2. Any group of items designated for analysis - without any assumptions of chronological or spatial relatedness.
Avoidance	A management strategy which protects Aboriginal sites within an impact area by avoiding them totally in development.
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
Development	The operations involved in preparing a mine for extraction, including cutting roadways and headings. Also includes tunnelling, sinking, crosscutting, drifting, and raising.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Exploration	The work done to prove or establish the extent of the coal resource.
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Harm	With regard to Aboriginal objects this has the same meaning as the NSW *National Parks and Wildlife Act 1974*.
HMP	Heritage Management Plan
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Impact area	An area that requires archaeological investigation and management assessment.

Term	Definition
In situ	Latin words meaning 'on the spot, undisturbed'.
Isolated find	A single artefact found in an isolated context.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Land unit	An area of common landform, and frequently with common geology, soils and vegetation types, occurring repeatedly at similar points in the landscape over a defined region. It is a constituent part of a land system.
Landform	Any one of the various features that make up the surface of the earth.
Management plans	Conservation plans which identify short and long term management strategies for all known sites recorded within a (usually approved) Subject area.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
Open camp site	An archaeological site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill, etc.).
PAD	Potential archaeological deposit. A location considered to have a potential for subsurface archaeological material.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	A place where past human activity is identifiable.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.
Subsidence Study Area (SSA)	The extent of the SSA was derived by combining the areas bounded by the following limits: • The predicted limit of vertical subsidence as a result of the extraction of coal from within the extent of longwalls. The limit of vertical subsidence was taken as the 20 mm subsidence contour determined using the Incremental Profile Method (IPM); and • A minimum distance of 600 m from the nearest edge of the proposed longwalls (longwall length based on original Mine Plan), as recommended by the independent Inquiry into underground coal mining in the Southern Coalfields of NSW (SCI, 2008). In some instances, the predicted limit of vertical subsidence (20 mm contour) extends beyond the recommended 600 m. Therefore, to ensure a conservative assessment, the SSA has been defined based on whichever delineation is furthest from the proposed longwalls. The SSA defines the limit of main development workings proposed. Main development roadways are the only form of mining that is proposed to be undertaken within the area between the extent of longwalls boundary and the SSA boundary.

References

Allen, J. and. J. F. O'Connell 2003. *'The long and the short of it: Archaeological approaches to determining when humans first colonised Australia and New Guinea'*, Australian Archaeology Number 57: pp.5 – 19.

Attenbrow, V. 2010. *Sydney's Aboriginal Past: Investigating the archaeological and historical records*. University of New South Wales Press, Sydney.

Australia ICOMOS 2013. The Burra Charter. Australia ICOMOS, Burwood.

Biosis Research 2007. *Dendrobium Area 3 Archaeological and Cultural Heritage Assessment.* An unpublished report for BHP Billiton-Illawarra Coal.

Biosis Research (2012) *Bulli Seam Operations Aboriginal Cultural Heritage Assessment.* An unpublished report for BHP Billiton Illawarra Coal.

Bragnan, D & G Packham (2000) *Field Geology of NSW.* NSW Department of Mineral Resources

DEC 2005a. *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation.* New South Wales Department of Environment and Conservation, Hurstville.

DEC 2005b. *A History of the Aboriginal People of the Illawarra 1770 to 1970.* New South Wales Department of Environment and Conservation, Hurstville.

DECCW 2010a. *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. New South Wales Department of Environment, Climate Change and Water, Sydney.

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

Flood, J. 1995. *Archaeology of the Dreamtime: the story of prehistoric Australia and its people*. Angus and Robertson, Sydney.

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

Heritage Office 1996. *Regional Histories of New South Wales.* NSW Heritage Office and Department of Urban Affairs and Planning, Sydney.

Hiscock, P. 2008. *Archaeology of Ancient Australia*. Routledge, Oxon.

Kayandel Archaeological Services 2008 *Aboriginal Cultural Heritage Assessment, Metropolitan Coal Project, Metropolitan Colliery, Helensburgh, NSW*. An unpublished report for Helensburgh Coal Pty Ltd.

Kayandel Archaeological Services 2012 *Longwall subsidence impact monitoring January and March 2012 Metropolitan Colliery, Helensburgh, NSW*. An unpublished report for Helensburgh Coal Pty Ltd

McDonald J.J 1994. *Dreamtime Superhighway: An analysis of Sydney Basin Rock Art and Prehistoric Information Exchange.* An unpublished thesis, Australian National University.

Navin Officer 2000. *Dendrobium Coal Project: Cultural Heritage Assessment*. A report prepared for Olsen Environmental Consulting on behalf of the collieries division of BHP Steel.

Niche Environment and Heritage 2013a *West Cliff Longwall 35 End of Panel Heritage Assessment*. An unpublished report prepared for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2013b *Longwalls 20-22 Subsidence Impact Monitoring of Aboriginal Cultural Heritage Sites: Metropolitan Coal July 2013*. An unpublished report prepared for Metropolitan Coal.

Niche Environment and Heritage 2014 *West Cliff Colliery Longwall 36 End of Panel Heritage Assessment*. An unpublished report prepared for BHP Billiton Illawarra Coal.

Niche Environment and Heritage 2015a *Metropolitan Coal Longwall 22: Monitoring of Aboriginal Heritage Sites*. An unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2015b *Metropolitan Coal Longwall 23: Monitoring of Aboriginal Heritage Sites*. An unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2016 *Metropolitan Coal Longwall 25: Monitoring of Aboriginal Heritage Sites*. An unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2017 *Metropolitan Coal Longwall 26: Monitoring of Aboriginal Heritage Sites*. An unpublished report prepared for Peabody Energy and Metropolitan Coal.

Niche Environment and Heritage 2017b Tahmoor South Project: Historical Heritage Assessment. An unpublished report for Tahmoor Coal Pty Ltd

NPWS 1999. *Aboriginal Cultural Heritage Standards and Guidelines Kit.* NSW National Parks and Wildlife Service, Hurstville.

Office of Environment and Heritage 2011 *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW.*

Organ, M. 1990. *Illawarra and South Coast Aborigines 1770-1850.* Aboriginal Education Unit, University of Wollongong, Wollongong.

Regal, R and Reeves, J. 2017 '*Overview of the monitoring of sandstone overhangs for the effects of mining subsidence in the Southern Coalfields*.' In Mine Subsidence Technological Society 10th Triennial Conference proceedings Mine Subsidence: Adaptive Innovation for Managing Challenges.

SA Museum 2010. Tribal Boundaries in Aboriginal Australia, Norman S Tindale. Available at http://www.samuseum.sa.gov.au/page/default.asp?site=2&page=TIN_Tribal Accessed 12 December 2010.

Sefton, C. 1988 *Prehistory of the Illawarra*. Unpublished MA Thesis, University of Sydney, Sydney.

Sefton, C. 1998a. *Site and Artefact Patterns on the Woronora Plateau*. M.A Thesis, University of Wollongong, Wollongong.

Sefton, C. 2000. *Overview of the monitoring of sandstone overhangs for the effects of mining subsidence in the Illawarra Coal Measures.* An unpublished report for Collieries Division, BHP Coal.

Sefton, C. 2002. *Archaeological Survey of longwall 9 and 10 Application Elouera Colliery.* An unpublished report for BHP Billiton Illawarra Coal Holdings Pty Ltd

Tindale, N. 1940. “Distribution of Australian Aboriginal Tribes: A field survey” In *Transactions of the Royal Society of South Australia*. Vol 64 (1): 140-230.

Tindale, N. 1974 *Aboriginal Tribes of Australia*. Australian National University, Canberra

Appendix 1. Aboriginal community consultation

Removed due to cultural sensitivities

Appendix 2: Aboriginal community consultation log

Removed due to cultural sensitivities

Appendix 3 Tahmoor South: Proposed Methodologies

Removed due to cultural sensitivities

Appendix 4. Information Session Attendance Records

Removed due to cultural sensitivities

Appendix 5: Aboriginal Heritage Site Information

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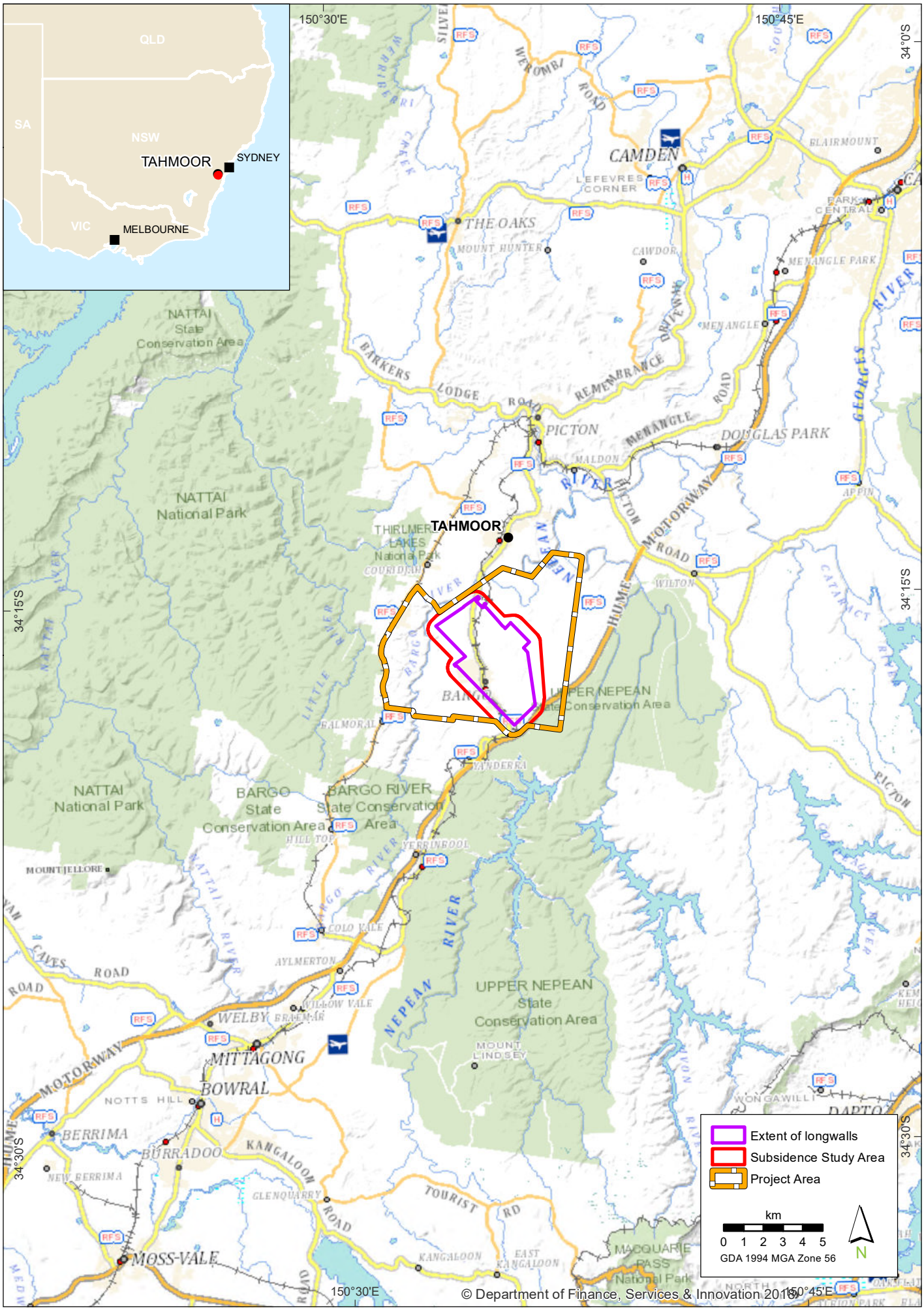
Appendix 6: Supporting Figures

Some figures removed due to cultural sensitivities



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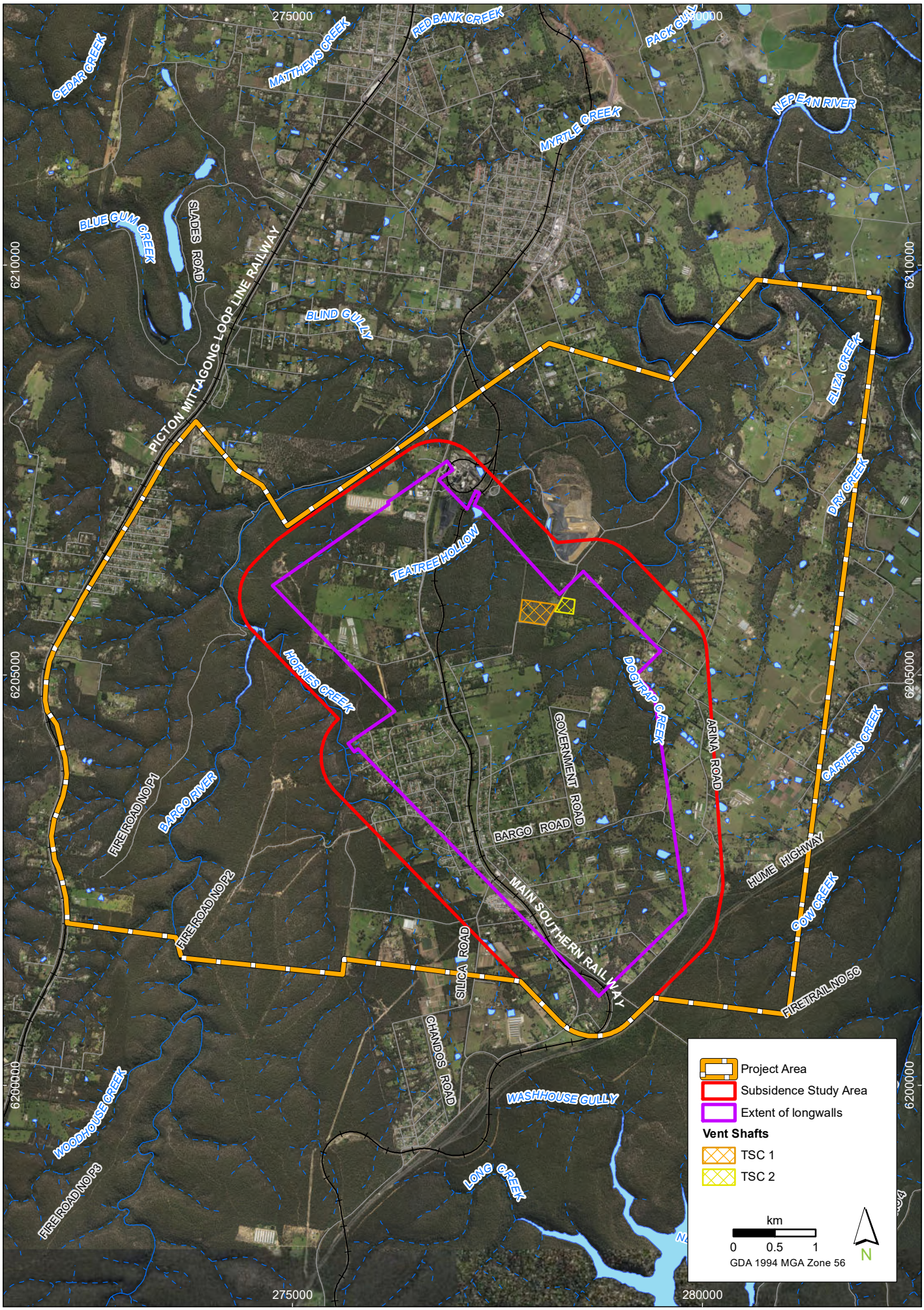
Regional Project Location

Tahmoor South Aboriginal Cultural Heritage Assessment

FIGURE 1

Source: Tahmoor Coal and Niche

niche Environment and Heritage



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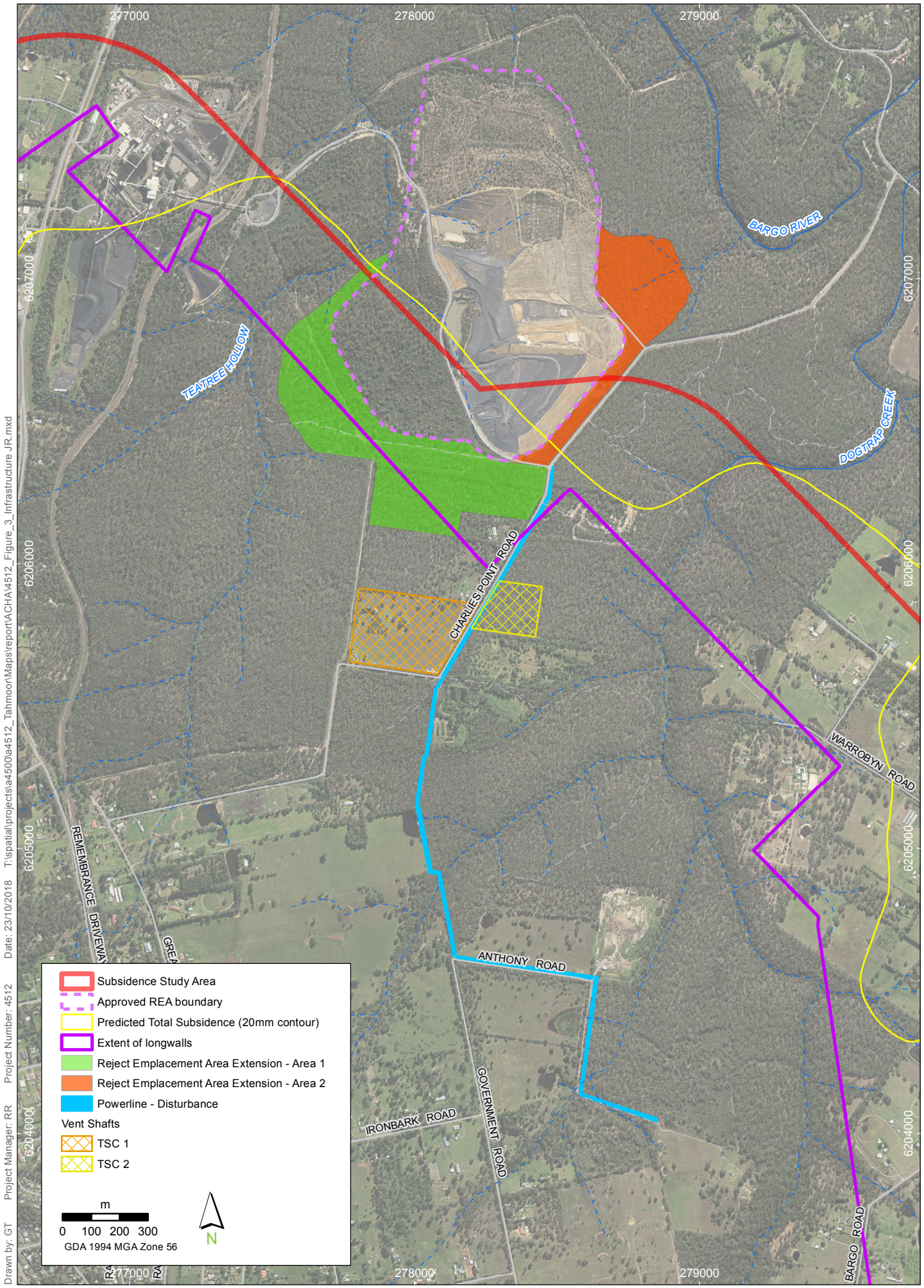
Project Layout - Underground Investigation Tahmoor South

Tahmoor South Aboriginal Cultural Heritage Assessment

FIGURE 2

Imagery: (c) LPI and Glencore 2013; Source: Tahmoor Coal and Niche

niche Environment and Heritage

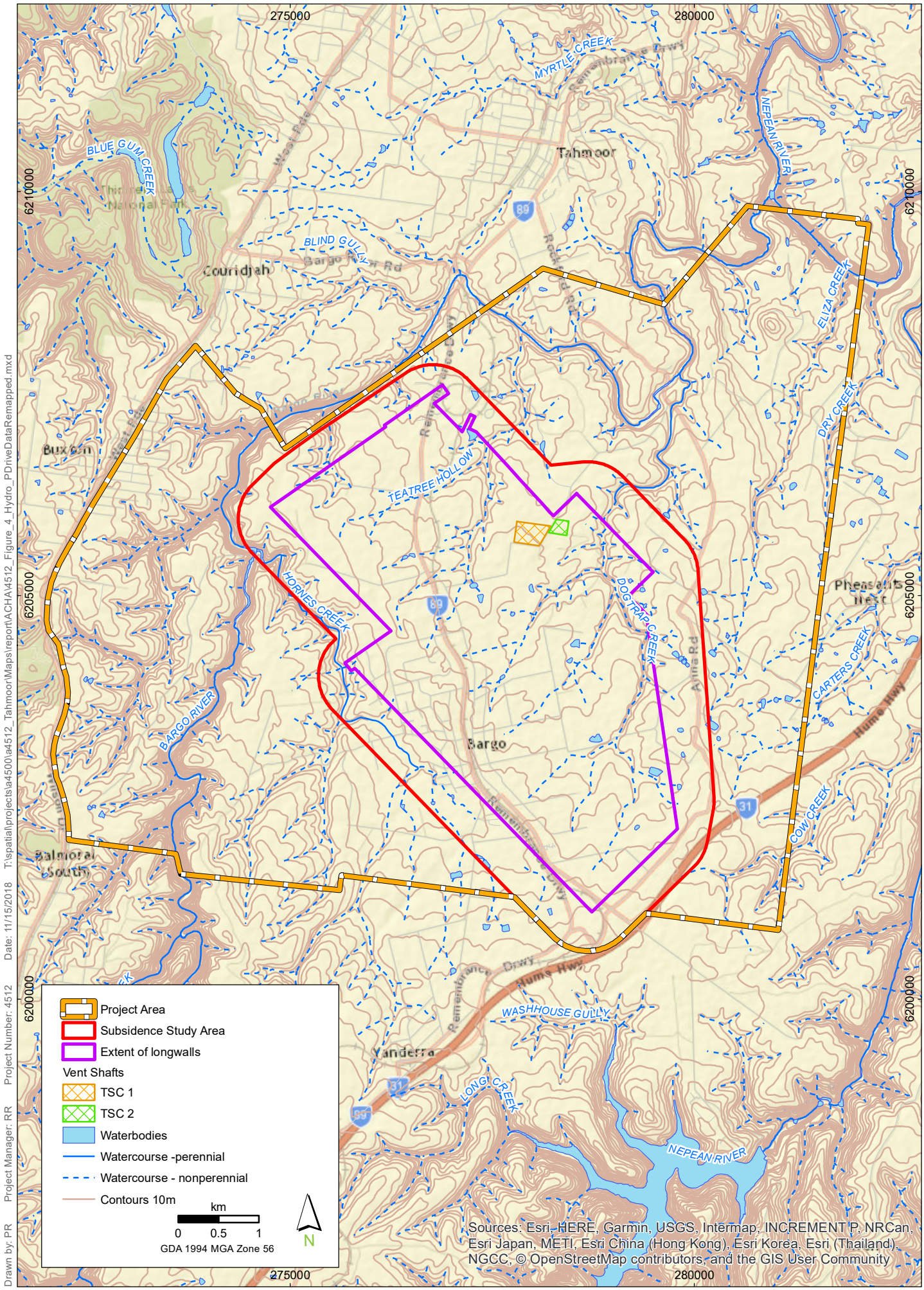


Project Layout - Surface Infrastructure

Tahmoor South Aboriginal Cultural Heritage Assessment

FIGURE 3

Imagery: (c) Glencore 2013



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Topography and Hydrology within the Subject Area

Tahmoor South Aboriginal Cultural Heritage Assessment

FIGURE 4

Imagery: (c) LPI and Glencore 2013

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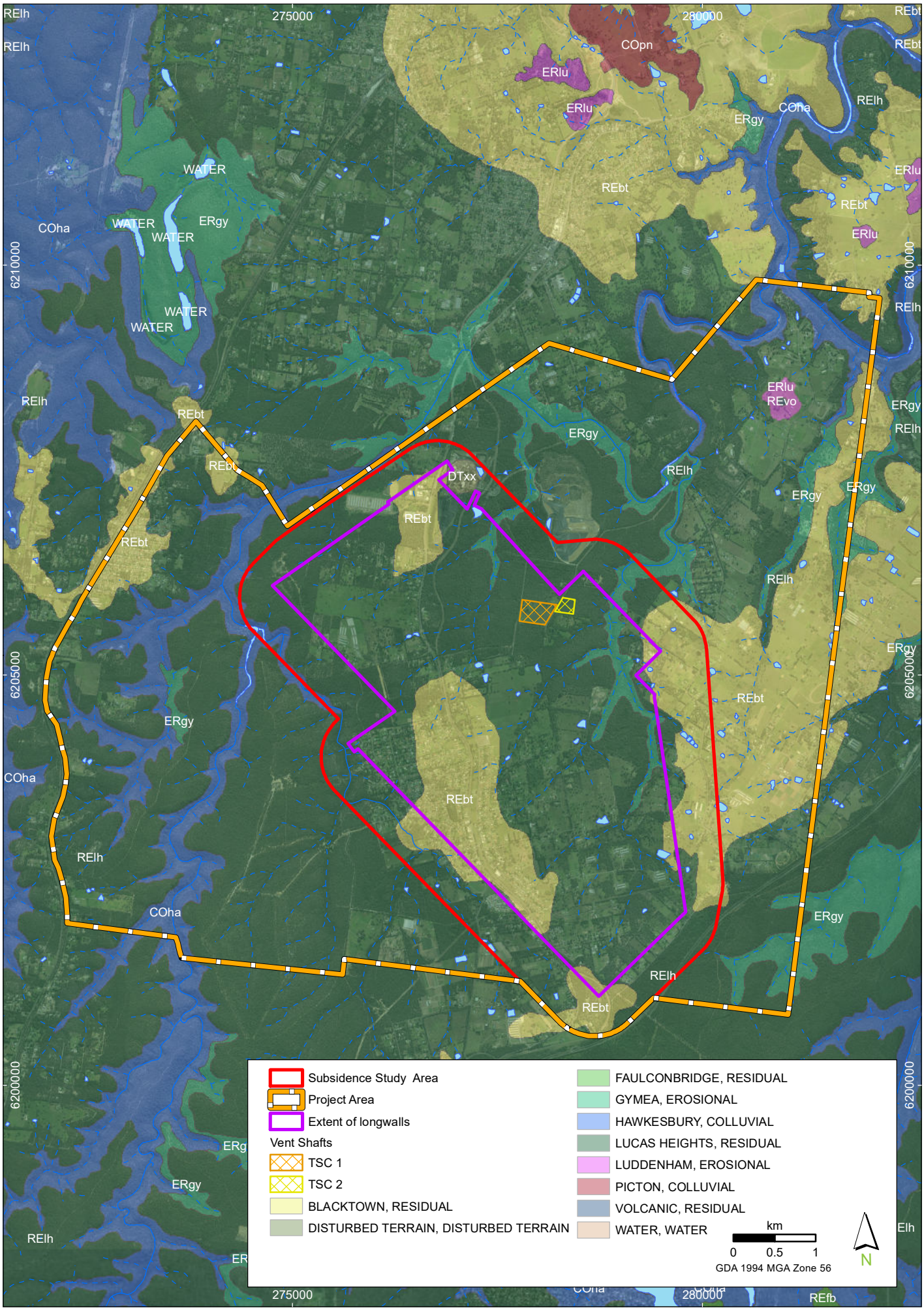

Soil Landscapes Within the Subject Area

Tahmoor South Aboriginal Cultural Heritage Assessment

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FIGURE 5

Imagery: (c) LPI and Glencore 2013
Source: LPI 2016, DECCW 2009 and Niche

Appendix 7: AHIMS Results

Removed due to cultural sensitivites

Appendix 8 MSEC Subsidence Assessment Extract

Removed due to cultural sensitivites

Niche Environment and Heritage

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