APPENDIX 9

Aboriginal Cultural Heritage and
Archaeological Assessment

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Aus-10 Rhyolite Pty Ltd

ABORIGINAL CULTURAL HERITAGE AND ARCHAEOLOGICAL ASSESSMENT

Proposed Expansion of Tinda Creek Sand Quarry

May 2014

Aus-10 Rhyolite Pty Ltd

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Proposed Expansion of Tinda Creek Sand Quarry

May 2014

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Aus-10 Rhyolite Pty Ltd

Project Director:	**Peter Jamieson**
Report No.	**1731/R13/FINAL**
Date:	**May 2014**

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Acknowledgement

Aus-10 Rhyolite Pty Ltd and Umwelt would like to acknowledge the Traditional Custodians of the Tinda Creek area – the Darug peoples – and pay respect to their cultural heritage, beliefs and continuing relationship with the land.

Aus-10 Rhyolite Pty Ltd and Umwelt would also like to acknowledge the post-contact experiences of Aboriginal peoples who have attachment to the Tinda Creek area.

We pay our respect to the Elders – past, present and future – for they hold the memories, traditions, culture and hopes of Aboriginal peoples in the area.

Aus-10 Rhyolite Pty Ltd and Umwelt thank the registered Aboriginal parties for their participation in this project and for their valuable contribution to the assessment report.

Executive Summary

Introduction

Aus-10 Rhyolite Pty Ltd t/a Hy-Tec Concrete and Aggregates (Hy-Tec) operate Tinda Creek, a sand quarry located approximately 67 kilometres north of Windsor along Putty Road, approximately 23 kilometres north of Colo Heights, NSW (refer to **Figure 1.1**). Hy-Tec is seeking approval to increase production levels from Tinda Creek Quarry from approximately 125,000 tonnes per annum (tpa) up to 300,000 tpa by increasing the area subject to sand extraction to include proposed additional extraction domain areas.

The quarry is currently located within Lot 2 DP 628806. The proposed additional extraction domain areas are shown on **Figure 1.2** within Lot 1, Lot 2 and Lot 3 of DP 628806. Lot 1, Lot 2 and Lot 3 are 86 hectares, 86.67 hectares and 86 hectares respectively, and contain a total proposed disturbance area of 52.43 hectares. This area is bounded on the north, east and south by Yengo National Park and on the west by Putty Road, several agricultural land holdings and Wollemi National Park (**Figure 1.2**). The Tinda Creek Quarry is within the Metropolitan Local Aboriginal Land Council (MLALC) area and within the Country of the Darug Peoples (Tindale, 1974).

Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Hy-Tec to prepare an Environmental Impact Statement (EIS) for the Tinda Creek Project (the Project) area with this Aboriginal cultural heritage and archaeological assessment undertaken as part of the EIS. The aim of this assessment is to develop an understanding of the Aboriginal cultural heritage and archaeological values of the Tinda Creek Project area through consultation with Aboriginal parties, background research and archaeological survey.

As the proposed changes to the quarry will provide access to a resource of in excess of 5 million tonnes, the development application meets the criteria listed within Schedule 1 cl7(1)(b) of State Environmental Planning Policy (State and Regional Development) 2011 for assessment as 'state significant development' under Section 89C of the *Environmental Planning and Assessment Act 1979* (the EP&A Act). The Minister for Planning will be the determining authority for the development application.

It is noted that quarry expansion plans have developed and changed since an initial proposal and archaeological survey in 2011. Subsequently two Aboriginal consultation processes and fieldwork periods are reported in this document dating from 2011 and 2013 to account for the changes in quarry plans. In 2011, Domain Area 6 was surveyed, as was an area associated with a sedge swamp in the south-eastern corner of Lot 3 (DP 628806), referred to at that time as Domain Area 5. There were no sites or potential archaeological deposits (PADs) identified in the Domain 5 area and it has subsequently been excluded from this assessment as it no longer forms part of the area proposed for sand extraction. Domain Areas 1, 2 and 3 were surveyed in 2013, Domain Area 4 having been the subject of an earlier approval (DA 134/95) (refer to **Figure 1.2**).

Aboriginal Party Consultation and Involvement

Aboriginal party identification and consultation for this assessment has been undertaken in accordance with the Department of Environment, Climate Change and Water (DECCW[1], 2010a) *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRs). Through the notification process required by the ACHCRs the following Aboriginal parties were identified as having an interest in the Project area:

- Darug Aboriginal Cultural Heritage Assessments (DACHA);
- Darug Aboriginal Land Care (DALC);
- Darug Custodial Aboriginal Corporation (DCAC);
- Darug Land Observations (DLO);
- Darug Tribal Aboriginal Corporation (DTAC);
- Gunjeewong Cultural Heritage Aboriginal Corporation (GCHAC);
- Hawkesbury-Nepean CMA Catchment Officer (Aboriginal Communities) (HMCA);
- Metropolitan Local Aboriginal Land Council (MLALC); and
- Yarrawalk (Y).

All Registered Aboriginal Parties were consulted throughout the course of the Aboriginal heritage assessment process from the time of their registration. In summary, this involved: the opportunity to attend meetings; provide cultural input throughout the assessment process; involvement in archaeological surveys and review of key documents, including the draft survey strategy and draft assessment report. Copies of correspondence to and from registered Aboriginal parties is provided in **Appendix B**.

Environmental Context

The Project area is located on the edge of the Macdonald Ranges. The Project area is a private land holding, bordered by the Yengo National Park to the north, east and south and the Putty Road to the west, with the Wollemi National Park on the western side of Putty Road (refer to **Figure 1.2**). The two National Parks surrounding the Project area form part of the Greater Blue Mountains World Heritage area which was gazetted in 2000. The World Heritage area is comprised of eight protected areas (including the Yengo and Wollemi National Parks) and is noted for its representation of eucalypt habitats as well as localised swamps, wetlands and grassland (UNESCO, 2000).

The Project area is located in the Sydney Basin, which is generally composed of Narrabeen and Hawkesbury sandstones and shales (NPWS, 2010c). The Project area is underlain by Hawkesbury Sandstone and overlain by Quaternary Alluvium consisting of gravel, sand, silt and clay layers (refer to **Figure 4.1**).

The Project area is located within two soil landscapes, the Gymea soil landscape and the Oxford Falls Variant A soil landscape (**Figure 4.2**). The proposed extraction domain areas are almost entirely within the Oxford Falls soil landscape. The soil profile integrity, and thus integrity of possible archaeological deposits is low in both soil landscapes, as a result of historic land clearance, quarrying activities and agricultural practices. The sandy nature of

[1] Now the Office of Environment and Heritage

the soils also suggests that if artefactual material was discarded in the area that it would be likely to move down through the soil profile through bioturbation.

The Project area is part of the Mellong Swamp system and reflects the general topography of the Mellong Range, which is characterised by rounded broad crests and wide valley floors (DECC, 2008), with elevations ranging from 340 to 380 metres. In the swampy areas the slopes are generally gently inclined (McInnes, 1997). Spur crests define the north, east and western edges of the Project area while the central and eastern areas are comprised of low gradient slopes, creeklines and sedge swamp (refer to **Figure 4.3**).

Tinda Creek is a tributary of Wollemi Creek which joins the Colo River approximately 15.5 kilometres to the south-west of the Project area. From its start in the Project area, Tinda Creek flows intermittently to the north-west, and has been diverted around the eastern and northern boundaries of the existing quarry via a small earthen drainage channel. Tinda Creek joins with other intermittent second order streams at the northern boundary of the existing quarry. These drainage lines contain water during and immediately following rainfall, but do not hold water during periods of dry weather. Based on currently available data, the water table within the Tinda Park area is relatively deep, with the sedge land communities surviving in the area due to the high humic content within the sand.

A review of the flora and fauna species recorded in and immediately around the Project area identified the presence of species with known Aboriginal uses but suggested that the larger Mellong Swamp may have been the focus of Aboriginal resource gathering activities.

Ethnographic recordings indicate that Aboriginal pathways and trade routes existed throughout the broader Yengo and Wollemi National Park areas and that specific areas within Yengo National Park were regularly used for ceremonial purposes.

Aboriginal Cultural Context

No specific information was provided by the Registered Aboriginal Parties in relation to the Aboriginal cultural context of the quarry extension area. However, information in relation to Aboriginal cultural significance of the area was provided by relevant stakeholders as part of the consultation process (refer to section on **Aboriginal Cultural Significance** below).

Archaeological Context

A search of the Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) database conducted on 3 April 2013 revealed eight previously recorded archaeological sites located in an area of 10 kilometres by 10 kilometres surrounding the Project area (AMG coordinates E281000-291000/N6323000-6333000) (refer to **Table 1**). The site locations are shown in **Figure 1.1**.

Table 1 – Registered Sites within 5 kilometres of the Project Area

Site ID	Site Name	Datum	Easting	Northing	Site Type	Distance and Direction from the Project Area
45-2-0346	Yengo NP	AGD	287970	6331630	Axe Grinding Groove, Rock Engraving	3.75 km north-north-east
45-2-0390	Yengo NP	AGD	287620	6328010	Shelter with Art	850 m east
45-2-2404	C806	AGD	283800	6332790	Shelter with Art	4.7 km north-north-west
45-2-2430	Caloul Swamp Shelter	GDA	283357	6326785	Shelter with Artefact Scatter, Grinding Grooves, Archaeological Deposit	1.9 km south-west
45-2-2467	Fern Bank Shelter	GDA	281732	6326188	Shelter with Artefact Scatter and Axe Grinding Grooves	3.6 km
45-2-2468	Attic Shelter	GDA	281750	6326208	Shelter with Axe Grinding Grooves	3.7 km south-west
45-2-2493	Tari Valley Shelter	GDA	281560	6323328	Shelter with Art and Artefact scatter	5.75 km south-south-west
45-3-2257	Yengo NP	AGD	287850	6328100	Axe Grinding Grooves	1.1 km east

A site search of a broader area (20 kilometres by 30 kilometres) identified 107 sites. The majority of these sites were rockshelters with art, engraving sites and grinding groove sites. There were a very low number of artefact scatter sites recorded.

The only previous archaeological survey of the Tinda Park area was undertaken by Bonhomme and McDonald for Brayshaw and Associates in August 1984. This inspection related to a dam immediately north of the currently approved extraction operation. As part of the survey, all eroded/exposed areas were inspected and rock outcrops were examined for engravings, art and possible shelter habitation. During the survey a piece of rhyolite/silcrete with no obvious evidence of flaking and a quartz flake with a definite bulb of percussion were identified within a metre of each other approximately 1.5 kilometres east of the power-line easement[2]. The silcrete/rhyolite was uncommon enough in the region to warrant inspection, however, all of the breakages were deemed to be fresh. It was concluded that both 'isolated finds' had resulted from the use of an access track and were only of 'possible' Aboriginal origin. No other artefactual material was located within the area assessed. The two pieces of stone were outside the then proposed dam impact area.

In relation to the broader Yengo and Wollemi National Parks, previous archaeological investigations and the OEH AHIMS register indicate that:

- occupation sites are rare – this may be a reflection of past investigation biases rather than what is actually present;
- engraving sites are relatively common where suitable sandstone is exposed on ridgelines;

[2] A distance of 1.5 km east of the power easement is outside the Project area, approximately 300 m east of Putty Road.

- grinding groove sites are relatively common where suitable sandstone is located in association with creeklines or a water source such as a pothole within a sandstone platform;

- stone arrangements, while not common, do occur in the area;

- rockshelters with evidence of use are relatively common in areas with suitable geology/topography. These may contain a mix of art, artefacts, grinding grooves and/or PAD; and

- scarred trees have been recorded in the adjoining National Parks but are not common.

Predictive Modelling

Based on the environmental, ethnographic and archaeological (refer to **Sections 4.0** and **5.0**) context of the Project area the following predictive model was formulated:

- there is a very low likelihood that archaeological material/sites reflecting intensive use by Aboriginal people will be located in the Project area;

- if sites are located within the Project area they are likely to be small artefact scatters and isolated finds resulting from transient use of the area by Aboriginal people;

- small artefact scatter sites and isolated finds if present are most likely to be situated on the slightly elevated, low gradient, spur crests within 50 metres of Tinda Creek;

- if small artefact scatter sites and isolated finds are present they are most likely to be identified in areas with high levels of exposure in proximity to creek banks or in areas of prior disturbance;

- if artefacts are located they are likely to have been manufactured from quartz, fine grained siliceous materials, quartzite or basalt. Flakes, broken flakes and flaked pieces are the most likely artefact types;

- the nature of the sandy soil within the Project area and surrounds mean that sites containing stone artefacts are likely to have been affected by ongoing taphonomic processes which may have acted to destroy sites through erosion or to bury the artefacts through soil aggradation at the base of slopes or through bioturbation[3];

- within the area of the sedge swamp and unmodified slopes visibility is expected to be low. Vegetation cover is expected to be moderate to high based on reasonable rainfall experienced prior to survey;

- scarred trees may be present within wooded areas;

- grinding grooves and rock engraving sites are not likely to occur/to have been preserved in the Project area due to the unsuitable highly weathered nature of the sandstone and the limited area in which it outcrops;

- due to the low gradient topography rockshelters will not occur in the Project area;

- the spur crest and ridge crests surrounding the Project area were likely used as travel ways through the landscape. There are low-lying, low gradient spurs extending into the

[3] Bioturbation refers to activities of animals and insects that act to move artefacts through the soil profile through activities such as burrowing or trampling.

edges of the Project area from the surrounding ridges. It is possible that Aboriginal people passed through the Project area and used these spurs to access the ridges. Based on ethnographic information it is also possible that the Putty Road, passing to the west of the Project area was used by Aboriginal people as a travel way;

- the swampy portions of the Project area would have been attractive for aquatic resource gathering but would not have been a favourable location for Aboriginal people to camp in the past, as it would have been wet or damp, especially after periods of rainfall. The western portion of the Project area is likely to have contained more swamp land in the past, also making it unattractive for camping; and

- the Project area is more likely to have been used as a resource gathering area rather than for camping an activity that does not often result in large amounts of artefact discard and making occupation/use difficult to discern.

The Survey

The survey methodology approved by the registered Aboriginal parties included 100% survey of the proposed extraction domain areas. Two periods of survey were undertaken, the first in February 2011 and the later in May 2013. The survey resulted in the location of a small artefact scatter (Tinda Creek Artefact Scatter 1) consisting of a mudstone core and a quartzite flaked piece within a dam in Domain Area 3. The artefacts were in a secondary depositional context having washed in from upslope or upstream.

The majority of the proposed extraction domain areas (with the exception of Domain 2 and Domain 3) were found to be highly disturbed from past land clearance activities, historic quarrying and erosion. It was assessed that while it was possible that further stone artefact may be located within the proposed extraction domain areas in a subsurface context it was assessed that they were also likely to be of low complexity and low archaeological integrity.

Aboriginal Cultural Significance

As Aboriginal cultural significance relates to the values of a site, place or landscape to Aboriginal people, it must be determined by Aboriginal people. The Aboriginal parties participating in the project therefore have the right and obligation for assessing the significance of their cultural heritage.

After the survey in 2011, Gordon Workman (Darug Land Observations) indicated that he was interested in the hills surrounding the Project area and if the proposed impacts were to extend to those areas he would like to be involved. In 2013 Phil Khan (Yarrawalk) indicated that the entire landscape was of cultural significance to Aboriginal people and the soils closer to the creek would have greater potential for providing evidence of Aboriginal occupation of the landscape.

Leanne Watson (DCAC) made the following comments in relation to Aboriginal cultural significance of the Project area prior to the 2013 survey (refer to **Appendix B**).

> This area is highly significant to the Darug people due to the evidence of continued occupation, within close proximity to this project site there is a complex of highly significant sites. Sites are significant to us for the information that they hold and the connection to Darug people. Aboriginal people (Darug) had a complex lifestyle that was based on respect and belonging to the land, all aspects of life and survival did not impact on the land but helped to care for and conserve land and the sustenance that the land provided. As Darug people moved through the land there were no impacts left, although there was evidence of movement and lifestyle, the people moved through areas with knowledge of their areas and followed signs that were left in the landscape. Darug people knew which areas were not to be entered and respected the areas that were sacred.

> Yengo – Wollemi National parks are of extremely high significance due to the sites and dreaming that this area holds, our group has spent time in these areas documenting sites and stories and the significance is all over this area.

Archaeological Significance

Tinda Creek Artefact Scatter 1 was assessed as having low archaeological significance due to its lack of complexity, lack of integrity and overall low research potential. The landforms incorporated in the proposed extraction domain areas were also area assessed as having low potential for archaeological significance based on the results of the survey and the predictive model.

Impact Assessment

The current proposal involves the removal and stockpiling of topsoil progressively over proposed extraction domain areas and the establishment of dredge ponds or progressively extending the existing dredge pond into the proposed extraction domain areas and bulldozing and/or hydraulically excavating peripheral sand into the dredge pond for extraction in areas where dredging alone is not feasible.

The principal concern regarding the management of these development impacts is in respect to the management of Tinda Creek Artefact Scatter 1 which is located in a disturbed context in Domain Area 3. Impact to the exposed Aboriginal artefacts must be avoided or the appropriate approvals must be obtained.

Management Options

There are a number of basic management options possible:

1. Change the quarry extraction plans to avoid Tinda Creek Artefact Scatter 1 and provide for its protection during quarrying activities.

2. Undertake further archaeological investigation in the area of Tinda Creek Artefact Scatter 1 to better understand the archaeological character of any subsurface deposits.

3. Allow for the collection of the two artefacts from Tinda Creek Artefact Scatter 1 without the requirement for further archaeological investigation.

4. Allow for the destruction of the Tinda Creek Artefact Scatter 1 site without further archaeological investigation.

Option 1 would impact on the future feasibility of the sand quarry operation an outcome that is not assessed as warranted as the area has already undergone substantial historic impact.

As the artefact scatter is in a highly disturbed context and does not retain any archaeological integrity – Option 2 – further archaeological investigation is also not warranted. As the artefacts are of significance to the registered Aboriginal parties for this Project Option 4 is not assessed as appropriate, resulting in Option 3 being assessed as the most appropriate management outcome. It is noted that as this is a State Significant development it will be necessary for the artefact collection to be undertaken in compliance with a stand-alone Aboriginal Cultural Heritage Management Plan (ACHMP) or as part of a broader Environmental Management Plan (EMP).

Management Recommendations

The following recommendations apply to the proposed extraction domain areas (refer to **Figure 1.2**). Based on the outcomes of this assessment it is recommended that:

- archaeological subsurface investigation is not necessary within the proposed extraction domain areas, prior to the quarry expansion proceeding;

- Hy-Tec in consultation with the registered Aboriginal parties prepare an ACHMP/Section of an EMP for the proposed quarry extension area which will allow for management (collection) of the artefacts located in the Tinda Creek Artefact Scatter 1 site in Domain 3 and to provide for future management of Aboriginal cultural heritage issues should they arise across the broader Project area;

- the artefacts located within the Tinda Creek Artefact Scatter 1 site are collected using the methodology set out in **Section 9.5.1** and under the protocols and procedures of the approved ACHMP;

- in the unlikely event that previously unrecorded artefactual material is exposed during ground disturbance works within the quarry extension area, work must cease in the vicinity of the artefactual material and the registered Aboriginal parties contacted and the artefactual material managed in accordance with an ACHMP using the methodology set out in **Section 9.5.2**;

- in the highly unlikely event that human/possible human skeletal material is uncovered during quarry works associated with the proposed extraction domain areas or by natural erosion processes within any part of the Project area, all work likely to affect the human skeletal material shall cease immediately. Hy-Tec must notify the NSW Police Department (police coroner) in the first instance. The area becomes a crime scene and is under the control of the NSW Police Department until the Police have declared otherwise. If the Police determine the skeletal remains are not of a criminal nature then Hy-Tec must notify OEH (Enviroline 131555), a suitably qualified forensic archaeologist/anthropologist and the relevant Aboriginal parties to determine an appropriate course of action prior to the recommencement of work in the area;

- in the highly unlikely event that sandstone with evidence of Aboriginal engravings or grinding grooves is exposed during ground disturbance works within the proposed extraction domain areas, work should cease in the immediate area and the registered Aboriginal parties and the OEH should be contacted immediately to discuss an appropriate course of action prior to the recommencement of work in the area;

- to mitigate the impact to the Aboriginal cultural values of the area, remediation of the existing quarry and proposed impact areas should be undertaken following cessation of quarrying activities; and

- in order that Hy-Tec employees/contractors working on the Project have the skills to identify the above–mentioned site types an Aboriginal Cultural Heritage Training Package should be prepared in consultation with the registered Aboriginal parties to be provided as part of the quarry induction process.

In response to a review of the draft report by the registered Aboriginal parties (refer to **Appendix B** for full comments):

- Gordon Morton of Darug Aboriginal Cultural Heritage Assessments supported the management recommendations within the draft report.

- Gordon Workman of Darug Land Observations supported the management recommendations within the draft report (Gordon Workman pers. comm. September 2013).

No further comments were provided by the registered Aboriginal parties following the review of the draft report.

Care and Control of Artefacts

Consultation was undertaken with the registered Aboriginal parties as part of the preparation of this report in relation to Care and Control of the artefacts located within the Tinda Creek Artefact Scatter 1 site in Domain Area 3 and any other artefacts that may be recovered during quarry operations (if any) under the protocols of the ACHMP/EMP.

Only one response was provided in relation to care and control of any artefacts recovered from the Tinda Creek Artefact Scatter 1 site or during works in the quarry extension area. Gordon Morton of Darug Aboriginal Cultural Heritage Assessments requested that any artefacts recovered from the quarry extension area be reburied within country and outside the proposed impact areas. The artefacts to be collected using the methodology set out in **Section 9.5.1** and under the protocols and procedures of an approved ACHMP. This recommendation will be incorporated into the ACHMP.

Aboriginal Cultural Heritage Management Plan (ACHMP)

The following are suggestions only to be revised once consultation with Registered Aboriginal Parties has occurred as part of the draft report review process.

As the Tinda Creek project is defined as a State Significant project there is no requirement to apply to the OEH for an AHIP for impact to Aboriginal archaeological sites, instead management and impacts to known and unknown sites/artefacts are usually managed in compliance with an ACHMP approved by the Department of Planning and Environment (DP&E).

The ACHMP will be required to detail management strategies for the Tinda Creek Artefact Scatter 1 site and for any future Aboriginal objects encountered during quarry works (if any). The ACHMP will be prepared in consultation with the registered Aboriginal Parties and clearly identify the responsibilities of all parties involved – Hy-Tec, registered Aboriginal parties, archaeologists – and designate timeframes for required heritage management processes.

Section 9.5.1 outlines a methodology for the collection of the known surface artefacts from the Tinda Creek Artefact Scatter 1 site for incorporation into the ACHMP. **Section 9.5.2** outlines a methodology for any currently unknown artefacts that may be located during the proposed extraction of the domain areas (if any).

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APPENDICES

1.0 Introduction

Aus-10 Rhyolite Pty Ltd t/a Hy-Tec Concrete and Aggregates (Hy-Tec) operate Tinda Creek, a sand quarry located approximately 67 kilometres north of Windsor along Putty Road, approximately 23 kilometres north of Colo Heights, NSW (refer to **Figure 1.1**). Hy-Tec is seeking approval to increase production levels from Tinda Creek Quarry from approximately 125,000 tonnes per annum (tpa) up to 300,000 tpa by increasing the area subject to sand extraction to include proposed additional extraction domain areas.

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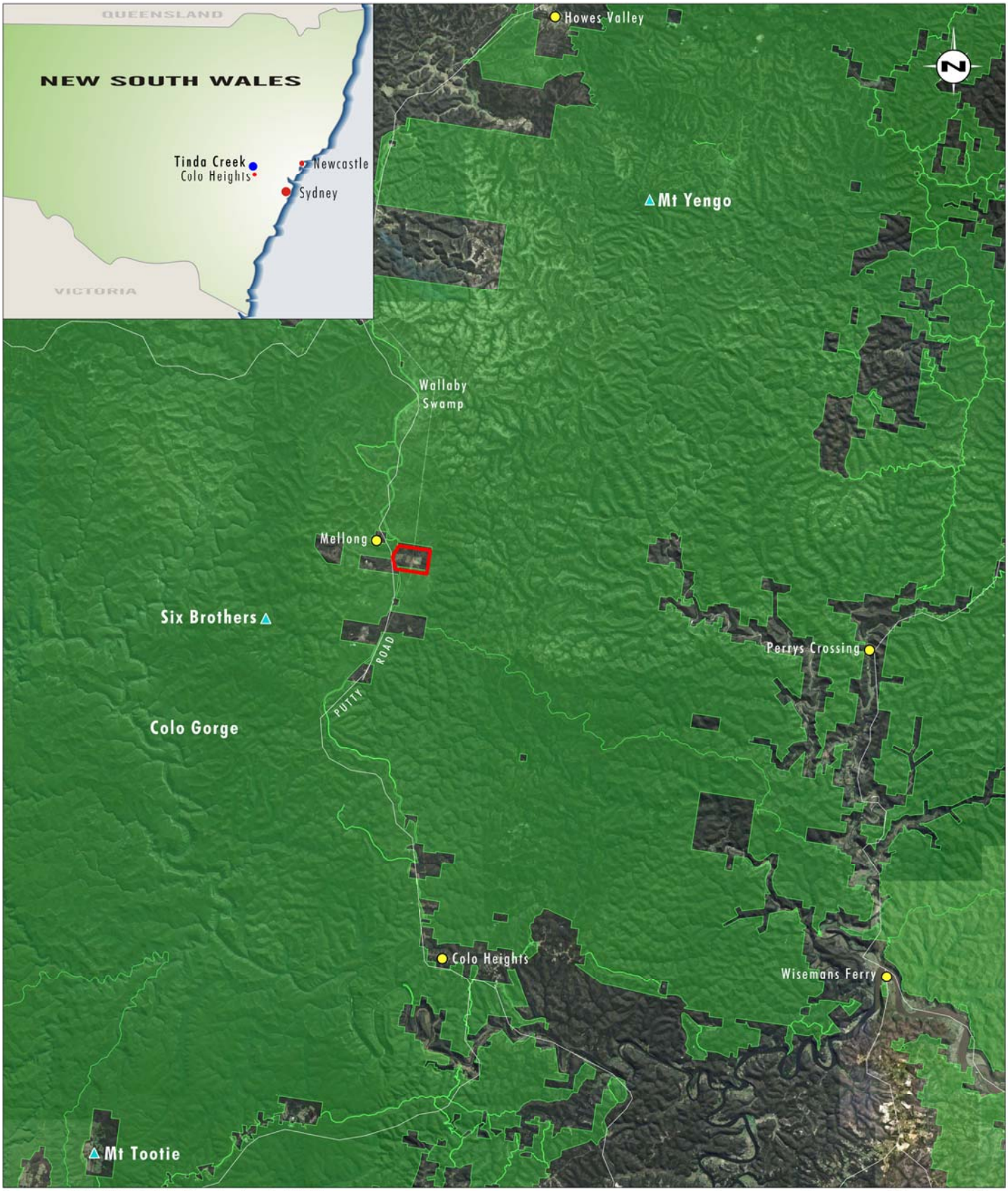
1.1 Contents of this Report

Section 2.0 provides a summary of the existing operations and infrastructure within the Project area, and outlines the key components of the proposed Project.

Section 3.0 identifies the Aboriginal parties with a registered interest in the Project, and outlines the Aboriginal party notification process and Aboriginal party consultation and involvement in all stages of the assessment.

Section 4.0 provides the context for the Aboriginal cultural heritage and archaeological assessment, reviewing literature related to the key environmental, ethnohistoric and land use history and discusses the implications of this research for the Project area.



Source: LPI NSW (2000), Google Earth (2010)

0 5 10 15km
1:300 000

Legend
- Project Area (DP 628806)
- National Park

FIGURE 1.1

Project Area in relation to
Landscape Features and Protected Areas

Source: LPI NSW (2000), Google Earth (2010)

0 0.5 1.0 2.0km
1:50 000

Legend

- Project Area (DP 628806)
- National Park
- Identified Resource Domains (Stitt 2012)

FIGURE 1.2

Project Area

Section 5.0 presents the Aboriginal cultural context for the area provided by the participating Aboriginal parties. It also provides the archaeological context for the Project area, reviewing the available Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) data and relevant previous archaeological research.

Section 6.0 presents the archaeological predictive model developed for the Project area drawing on the information presented in **Sections 4.0** and **5.0** identifying likely site type occurrence, site content, site distribution and site integrity.

Section 7.0 details the survey methodology, discusses registered Aboriginal party participation and outlines the results of the archaeological survey, including survey coverage and effective coverage. An evaluation of the predictive model based on the results of the archaeological survey is also presented to further refine the understanding of the archaeological context of the Project area.

Section 8.0 provides a summary of the Aboriginal cultural significance of the Project area as provided by the registered Aboriginal parties and discusses the archaeological significance of the Project area.

Section 9.0 reviews the works proposed for the Project and discusses likely impacts to identified Aboriginal cultural and archaeological values before discussing management options and then providing recommendations for management of the proposed extraction domain areas developed in light of the archaeological context of the locality, the findings of the survey, the results of consultation with the registered Aboriginal parties, the potential impacts of the proposed development on Aboriginal and archaeological values and current cultural heritage legislation. This section includes recommendations for the care and control of artefacts located during this assessment and any future potential Aboriginal objects encountered during works. It also includes a recommendation for the development of an Aboriginal Cultural Heritage Management Plan (ACHMP) that could be a stand-alone document or part of broader Environmental Management Plan (EMP).

Section 10.0 lists reports and publications cited in the text.

Andy Roberts (Senior Archaeologist) and Amanda Reynolds (Archaeologist) conducted the archaeological surveys. Amanda Reynolds and Andy Roberts co-ordinated the Aboriginal heritage assessment and co-authored this report. Jan Wilson (Manager, Cultural Heritage) provided strategic direction for the Project and the quality review of draft and final reports. Peter Jamieson (Director) and Justin Meleo (Senior Consultant) managed the preparation of the Umwelt EIS, including the Aboriginal cultural heritage and archaeological component.

1.2 Statutory Controls

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *National Parks and Wildlife Act 1974* (NPW Act – as amended 2010) are the primary statutory controls protecting Aboriginal heritage within New South Wales. The relevant provisions of the Acts are discussed below.

1.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act regulates development activity in New South Wales. Division 4.1 of the EP&A Act provides a framework for the assessment and approval of development determined as State Significant in NSW. The Minister for Planning and Infrastructure is the approval authority for all projects assessed as state significant development. Hy-Tec is seeking to have the current proposal considered under Section 89C of the EP&A Act as the proposal fits the criteria listed within Schedule 1 cl.7(1)(b) of the State Environmental Planning Policy (State and Regional Development) 2011.

State significant projects approved under Part 4.1 of the EP&A Act do not require the proponent to obtain an Aboriginal Heritage Impact Permit (AHIP) under the NPW Act (1974) to impact on Aboriginal cultural heritage sites/objects. However, Department of Planning and Infrastructure – DP&I (now known as the Department of Planning and Environment – DP&E) will distribute the assessment report to OEH for its review and input on the conditions for any Project Approval (or requirements for further information if it is perceived by the OEH that adequate information is not within the assessment report; or if it is not demonstrated within the assessment report that appropriate Aboriginal consultation has taken place). For the OEH to be able to complete this process it is necessary that the assessment report addresses not only the type of management/mitigation measures to be undertaken for each site to be impacted/protected within a project area, but also that an appropriate research design and methodology is provided for any salvage works proposed (if and where this is appropriate) and that documentation to show that this research design and methodology has been assessed and endorsed by the registered Aboriginal parties is included in the assessment. Impact to Aboriginal cultural heritage sites/objects is generally managed in accordance with protocols and procedures within an ACHMP prepared in consultation with the registered Aboriginal parties.

1.2.2 New South Wales National Parks and Wildlife Act 1974

The Office of Environment and Heritage (OEH) is primarily responsible for regulating the management of Aboriginal cultural heritage in New South Wales under the NPW Act (as amended October 2010). The NPW Act is accompanied by the National Parks and Wildlife Regulation 2009 (the Regulation), the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010a) and other industry-specific codes. The objectives of the NPW Act include:

> The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to: (i) places, objects and features of significance to Aboriginal people.

The NPW Act defines an Aboriginal object as:

> any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales.

Under Section 84 of the NPW Act, an Aboriginal Place must be declared by the Minister as a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture.

In accordance with Section 86(1) of the NPW Act, it is an offence to harm or desecrate a known Aboriginal object, whilst it is also an offence to harm an Aboriginal object under Section 86(2). Similarly, Section 86(4) states that a person must not harm or desecrate an Aboriginal place. Harm to an object or place is defined as any act or omission that:

a) destroys, defaces or damages an object or place, or
b) in relation to an object – moves the object from the land on which it had been situated, or
c) is specified by the regulations, or
d) causes or permits the object or place to be harmed in a manner referred to in paragraph (a), (b) or (c),

but does not include any act or omission that:

e) desecrates the object or place, or
f) is trivial or negligible, or
g) is excluded from this definition by the regulations.

Section 87(1) of the NPW Act specifies that it is a defence to prosecution under Section 86(1) and Section 86(2) if the harm or desecration of an Aboriginal object was authorised by an AHIP and the activities were carried out in accordance with that permit. As discussed above, the provisions of Part 4.1 of the EP&A Act can overrule the requirement for an AHIP under the NPW Act, with these provisions applying to activities approved under Part 4.1 only. However, the other provisions of the NPW Act are still applicable.

Section 87(2,4) of the NPW Act establishes that it is a defence to prosecution under Section 86(2) (the strict liability offence) if due diligence was exercised to reasonably determine that the activity or omission would not result in harm to an Aboriginal object or if the activity or omission constituting the offence is a low impact act or omission (in accordance with Section 80B of the Regulation). The Regulation identifies that compliance with an industry specific code (or if such a code does not exist the generic OEH code) is taken to constitute due diligence in determining whether a proposed activity will harm an Aboriginal object. In addition, Section 3A of the Regulation specifies that an act carried out in accordance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010b – hereafter the Code) 'is excluded from the definition of harm' as provided in the NPW Act. This may include (but is not limited to) test excavations carried out in accordance with the Code.

1.2.3 Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation

Consultation with the Aboriginal community is an integral part of identifying and assessing the significance of Aboriginal objects and/or places and determining and carrying out appropriate strategies to mitigate impacts upon Aboriginal heritage. It is a requirement of all State Significant developments that the potential impact of the Project on Aboriginal cultural heritage and archaeological values is assessed as part of the Aboriginal cultural heritage and archaeological assessment process. The DP&I refers proponents to the draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (Department of Environment and Conservation[4], 2005) for the requirements for assessing Aboriginal cultural and archaeological values for state significant developments (hereafter the draft Guidelines (2005)).

Under the draft Guidelines Aboriginal consultation is undertaken using the DECCW (2004) *Interim Community Consultation Requirements for Applicants*. For all other non state significant projects this consultation procedure has now been replaced by the DECCW (2010a) *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (hereafter the ACHCRs). For state significant projects where subsurface archaeological testing is

[4] DEC - became Department of Environment and Climate Change (DECC), then Department of Environment and Climate Change and Water (DECCW) - now the Office of Environment and Heritage – OEH.

required as part of the assessment process this can be undertaken under the Code but only if the ACHCRs have been followed up to subclause 80C(6) of the Regulation. In order to allow for that possibility the ACHCRs were followed for this assessment and the requirements of the Code were broadly implemented so that subsurface testing could be undertaken if and where required.

2.0 Tinda Creek EIS Project Description

Quarrying activities have been undertaken on Lot 2 for approximately the last 30 years with the quarry currently producing up to 125,000 tonnes of product per year. The material quarried is comprised of clayey sand that contains typically 18% to 40% silt and clay. The quarry operation involves the extraction of clayey sand from the quarry area using a cutter-suction dredge that floats on an approximately 3 hectares dredge pond. The clayey sand is dredged from a depth of up to approximately 5 metres below the surface of the dredge pond. Sand, silt and clay is piped from the dredge pond to the sand processing plant where the sand is separated from the silt and clay. Product sand is stockpiled and subsequently transported off-site. Silt, clay and water are returned to tailings dams where the sediment is allowed to settle out. Water that seeps from the processing area, sediment dams and tailings dams into the underlying unconfined aquifer contributes to groundwater recharge in the area surrounding the quarry. Excess silt and tailings are removed from the dredged sand and returned to the Stage 1 Dredge Pond as slurry. Clay is stockpiled and used in ongoing site rehabilitation works.

Recent geological assessment on Lots 1 to 3 (Stitt, 2010; 2012) and a constraints analysis undertaken as part of this EIS identified an additional sand resource of approximately 6.84 Mt adjoining the current quarry operations with a combined area of 50.17 hectares. These areas are proposed for quarry extraction expansion. The proposed extraction domain areas are located on Lots 1 to 3, which are bound the north, east and south by Yengo National Park and to the west by the Putty Road. Wollemi National Park is also located beyond Putty Road. The areas of Yengo National Park to the east and Wollemi National Park to the west also form part of the Greater Blue Mountains World Heritage Area.

Sand extraction in the proposed extraction domain areas will be a continuation of current operations as shown on **Figure 2.1**. The proposed extraction domains will further the existing sand extraction operations on the site as additional stages of development. The following resource domains are the subject of this assessment.

- Domain 1 – approximately 14.17 hectares area comprising an indicated product-sand resource of 1.89 Mt.

- Domains 2 and 6 – approximately 18.46 hectares area comprising an indicated product-sand resource of 2.61 Mt.

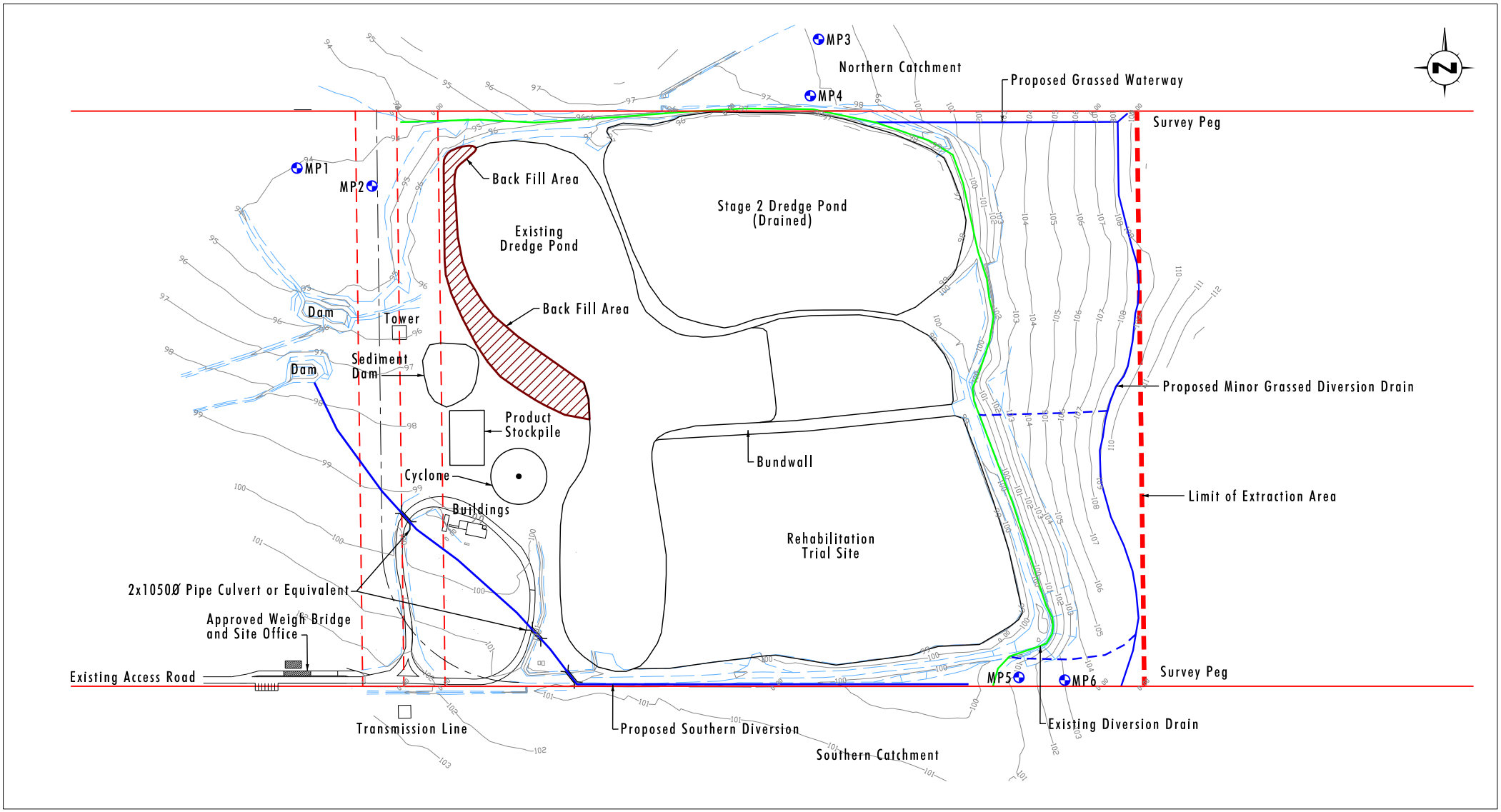
- Domains 3 and 4 – approximately 17.54 hectares area comprising an indicated product-sand resource of 2.34 Mt.

Depending on which of the two identified biodiversity offset area configurations is adopted, quarrying may be undertaken within Domain 7 rather than Domain 3. Quarrying within Domain 7 would disturb approximately 12.12 hectares with an indicated resource of approximately 2 Mt.

The total product-sand resource is therefore estimated at 6.84 Mt, based on the results of the geotechnical and constraints assessment, a maximum extraction depth of 15 metres below ground level and internal batters of 3H:1V.

Each extraction stage will involve the removal and stockpiling of topsoil followed by the extraction of available resource via cutter suction dredge. A summary of the extraction sequence is described as follows:

- Following completion of dredging in Domain 4 (the majority of which is within the existing approved extraction area), extraction will continue in a westerly direction into Domain 6.



Source: Freeburn Surveyors

0 50 100 200m
1:4000

Legend

- Groundwater Monitoring Bore Locations

FIGURE 2.1

Existing Quarry

- While the dredge is located within Domain 6, extraction operations will also be undertaken in Domain 2 as a dry extraction operation, from which sand will be 'pushed' into the Domain 6 dredge pond (e.g. via dozer, excavator and haulage truck) and then dredged to the processing plant.

- After extraction in Domain 6 is completed, operations would move into the Domain 1 area.

- After completion of Domain 1, the dredge will be dismantled and moved back upstream to the Domain 3 area.

If extraction is approved for Domain 7 rather than Domain 3, quarrying will commence in Domain 7 and then progress to Domains 6, 2 and 1 as outlined above. No extraction will occur in Domain 3 under these circumstances.

No additional surface infrastructure or roads will be constructed at the site outside the proposed extraction domains. Accordingly the archaeological survey was restricted to these domains (the Project area) as shown on **Figure 1.2**.

Seven resource domains have been identified on the site, five of which form the subject of the application. Four of these domains have been investigated as part of the Archaeological field assessment (the fifth (Domain Area 4) having been approved previously). All areas were surveyed as part of due diligence for exploration drilling.

It should be noted that quarry expansion plans have developed and changed since the initial proposal and survey in 2011. At that time further areas (Domain Area 5 and Domain Area 7) in the south-east of the Project area centred on a sedge swamp in Lot 3 were surveyed with registered Aboriginal parties. No Aboriginal artefacts/objects or PADs were located during this survey.

3.0 Aboriginal Party Consultation and Participation

The Aboriginal consultation regarding this Project has been undertaken in compliance with the DECCW (2010a) consultation requirements. Consultation with registered Aboriginal parties has been ongoing since the initial inspection undertaken on 7 December 2011 (see **Section 4.2** and **Appendix A**). A full consultation log and consultation records are attached in **Appendix B**.

Registered Aboriginal Parties were encouraged to provide comments on the Aboriginal cultural values and significance of the Project area and on a draft of this report for inclusion in this Aboriginal Cultural Heritage and Archaeological Assessment Report.

3.1 Party Identification

In accordance with the DECCW (2010a) ACHCRs at the outset of the Aboriginal heritage assessment process, Umwelt, on behalf of Hy-Tec, (on 26 October 2010), contacted the following organisations to identify the upcoming Aboriginal heritage assessment in the Tinda Park area, and to request notification of any Aboriginal parties who may have an interest in participating in the assessment process:

- Metropolitan Local Aboriginal Land Council (MLALC);
- Native Title Services Corp;
- Office of the Registrar of Traditional Owners;
- Department of Environment and Climate Change (DECCW now OEH);
- Hawkesbury City Council; and
- Hawkesbury-Nepean Catchment Management Authority (CMA).

The closing date for the above agencies to identify Aboriginal parties who may have an interest in the Project was 12 November 2010. All agency correspondence concerning the Project is included in **Appendix A**.

The National Native Title Tribunal replied with a Native Title Search that indicated there was a registered Native Title application in their search area, which covered the Hawkesbury City Council Local Government Area. The Native Title claim is over parcels of land in the Sydney and Western Sydney areas and does not reach as far north as the Project area (refer to **Appendix A**).

Responses were received from Hawkesbury-Nepean CMA, the Office of the Registrar, DECCW, and Hawkesbury City Council advising of the following groups who may have an interest in being involved in consultation for the Project:

- Darug Aboriginal Cultural Heritage Assessments (DACHA);
- Darug Aboriginal Land Care (DALC);
- Darug Custodial Aboriginal Corporation (DCAC);
- Darug Land Observations (DLO);

- Darug Tribal Aboriginal Corporation (DTAC);
- Deerubbin Local Aboriginal Land Council (DLALC);
- Gunjeewong Cultural Heritage Aboriginal Corporation (GCHAC);
- Hawkesbury-Nepean CMA Catchment Officer (Aboriginal Communities);
- MLALC; and
- Yarrawalk/Tocomwall.

Based on the agency responses, two Local Aboriginal Land Councils were identified as having an interest in the Project area. Hawkesbury City Council and the Office of the Registrar identified MLALC as the relevant Land Council for consultation, while DECCW identified DLALC as the relevant Land Council. The Land Council boundaries were investigated and it was found that the Project area falls within the MLALC boundary (refer to **Figure 3.1**), and therefore MLALC was the correct Land Council for consultation.

Local media advertising was also conducted to identify any additional interested Aboriginal Parties, with advertisements appearing in the Hawkesbury Gazette on 27 October 2010 and the National Indigenous Times on 28 October 2010, both with a closing date for registration of 5 November 2010. As these advertisements had an incorrect closing date for registration (as they did not allow the requisite 14 days for registration), additional advertisements were then placed in the Hawkesbury Courier on 28 October 2010 as well as the Koori Mail on 3 November 2010, both with a closing date for registration for the Project of 17 November 2010.

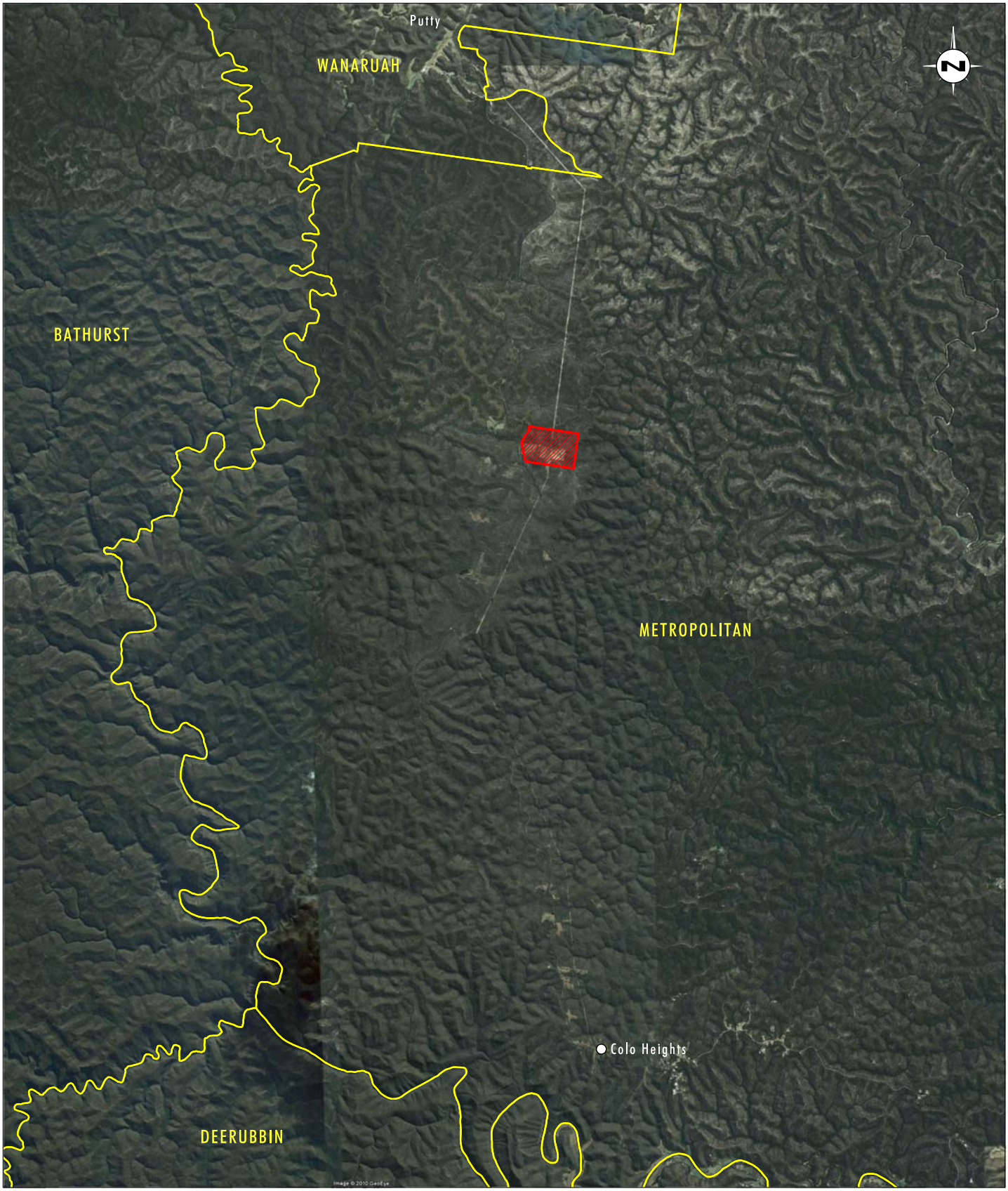
As a result of the above media advertising process, the following organisations registered an interest in consultation for the Project prior to 18 November 2010:

- MLALC;
- Yarrawalk; and
- Hawkesbury-Nepean CMA Catchment Officer (Aboriginal Communities).

On 1 December 2010, all Aboriginal parties identified during the notification process were sent a letter with a brief project introduction and information about the groups identified during the notification process. A proposed survey strategy and proposed project timeframe were included in the letter, asking groups to provide any comments or raise any concerns they may have with either. Those groups who had not previously registered an interest were also invited to register an interest in consultation for the Project by 17 December 2010.

As a result of the invitations to register for the Project, the following organisations registered an interest in consultation for the Project prior to 18 December 2010:

- Darug Aboriginal Cultural Heritage Assessments (15 December 2010);
- Darug Aboriginal Land Care (15 December 2010);
- Darug Custodial Aboriginal Corporation (7 December 2010);
- Darug Land Observations (7 December 2010); and
- Darug Tribal Aboriginal Corporation (13 December 2010).



Source: LPI NSW (2000)

0 2.5 5.0 10.0km
1:200 000

Legend
Project Area (DP 628806)
Local Aboriginal land Council Boundary

FIGURE 3.1

Local Aboriginal Land Council Boundaries
in the vicinity of the Project Area

A registration of interest in the Project by GCHAC was received on 12 January 2011, along with updated contact details differing from those provided by DECCW. As a result of the holiday period and the changed contact details, GCHAC was included as a registered Aboriginal party in the consultation process.

In accordance with DECCW's ACHCRs (2010), DECCW and MLALC were notified of the groups who registered and interest in the Project on 13 January 2011. This letter identified that both MLALC and DLALC were identified as Land Councils to be consulted and a figure (**Figure 3.1**) identifying the Project area and the surrounding Land Council boundaries was provided with justification for consulting with MLALC. No additional correspondence on the matter was received from DECCW. A second letter was sent out on 28 January 2011, identifying that DCAC and DTAC had also registered an interest in consultation for the Project, however were not included in the letter of 13 January 2011.

3.2 Aboriginal Party Consultation and Involvement

DECCW (now OEH) guidelines for Aboriginal heritage assessment and management acknowledge that it is primarily Aboriginal people who should determine the significance of their heritage and therefore OEH require applicants to demonstrate that Aboriginal people have been involved in the identification, assessment and management decisions relating to their heritage.

All registered Aboriginal parties were consulted throughout the course of the Aboriginal heritage assessment process from the time of their registration. In summary, this involved: attending meetings; providing cultural input throughout the assessment process; involvement in the archaeological surveys and review of key documents, including the draft survey strategy and draft assessment report. Copies of correspondence to registered Aboriginal parties are provided in **Appendix B**.

Appendix B of this report contains a copy of all registered Aboriginal party statements provided during the course of the Project, including comment on the draft survey strategy, cultural significance and management options and recommendations.

3.2.1 Review of Draft Survey Strategy

Initially a draft survey strategy, suggesting total (100%) survey of the former proposed extraction domain areas was provided to all registered Aboriginal parties and potential registrants identified by DECCW in the letter of 1 December 2010. The closing date for the return of comments was **14 January 2011**. This allowed 44 days for comment taking into account organisations' closure time over the Christmas period.

Written comment on the draft survey strategy was received from two of the nine registered Aboriginal parties by 15 January 2011. At an on-site meeting on 2 February 2011, prior to undertaking the survey, all registered Aboriginal parties were asked to confirm that they were satisfied with total survey of the proposed impact areas, or if they wished to raise any concerns with the survey strategy. Registered Aboriginal party comments on this draft survey strategy are summarised in **Section 7.0** and included in **Appendix B**.

A second period of consultation preceded the field survey for the modified quarry plan in May 2013. A draft survey strategy, suggesting additional survey of the four proposed extraction domain areas was provided to all Registered Aboriginal parties on 9 April 2013 allowing 36 days for the return of comments preceding the field survey on 16 May 2011. Six registered Aboriginal parties made contact leading up to the planned survey (refer to **Appendix B**) and provided insurances and/or agreed with the survey timing. Written

comment on the draft survey strategy was received from two of the nine registered Aboriginal parties. One comment (Yarrawalk) specified concern that the area was too large to be surveyed in one day.

3.2.2 Registered Aboriginal Party Meetings

Due to the relatively small scale of the Tinda Creek Quarry Expansion, and the disparate locations of the registered Aboriginal parties, it was thought best to hold project meetings on site on the day of the field survey, to reduce the amount of travel time to and from meetings and the field survey.

The initial project meeting was held at the Tinda Creek Quarry office on 2 February 2011. All Aboriginal parties (with a registered interest at that time) were invited to attend this meeting, which was first proposed in the letter sent out on 1 December 2010 and was followed up with phone and fax invitations in January 2011. At the meeting Hy-Tec provided an outline of the former proposed Project, with as much detailed design information on the Project as was available at this time. Umwelt provided background information about the known archaeological context of the Project area and surrounds, along with a brief archaeological predictive model. The participating registered Aboriginal parties were invited to provide any cultural information for discussion. The meeting also confirmed that all Aboriginal parties were happy with the proposed survey strategy and no change to the methodology or additional survey was requested.

Following the survey the participating registered Aboriginal parties were invited in a post-survey meeting to raise questions or concerns regarding the management of the Project area. Additional meetings were also offered to discuss the Project if required.

As mentioned above, due to reconsideration of the quarry plan a second period of fieldwork on 16 May 2013 was preceded by a further meeting in the Tinda Creek Quarry office where the parameters of the field survey were discussed. The meeting also confirmed that all Aboriginal parties were happy with the proposed survey strategy, and no change to the methodology or additional survey was requested. Following the survey the participating registered Aboriginal parties were invited to raise questions or concerns regarding the management of the Project area.

3.2.3 Fieldwork Participation

In recognition of the essential involvement of registered Aboriginal parties in the fieldwork program, Hy-Tec provided all registered Aboriginal parties with the opportunity to participate in the Tinda Creek survey. In total, eight of the nine Aboriginal parties with a registered interest in the Project expressed an interest in the survey and six eventually chose to participate in the survey program. Registered Aboriginal party participation in the fieldwork program is detailed in **Section 8.1**.

3.2.4 Review of Draft Aboriginal Archaeological Assessment Report

The draft Aboriginal cultural heritage and archaeological assessment report was provided to all registered Aboriginal parties on Monday 12 August 2013 with 28 days provided for review and provision of advice and comments from the registered Aboriginal parties. Emails and phone calls were undertaken to the registered Aboriginal parties on 6 September 2013 and again on the 20 September 2013 requesting comments on the draft of this report. A revised final date for provision of information was provided as the 23 September 2013. Information provided by the registered Aboriginal parties is included in **Sections 5.1** and **8.1** with the original documents provided in **Appendix B**.

4.0 Assessment Context

4.1 Landscape Context

Knowledge about the landscape characteristics and resources of a region is important to the investigation of past Aboriginal landscape use and the analysis of the potential distribution of archaeological sites. Information about sources of stone materials (used for tool manufacture), availability of drinking water, plant resources and prey animals can be used to identify environmental factors that influenced Aboriginal occupation and camp site selection. Information about the geomorphic evolution of a landscape can further identify the environmental factors influencing the chance of site preservation over time and the environmental conditions producing site exposure in the contemporary landscape.

The Project area is located on the edge of the Macdonald Ranges. The Project area is a private land holding, bordered by the Yengo National Park to the north, east and south and the Putty Road to the west, with the Wollemi National Park on the western side of Putty Road (refer to **Figure 1.2**). The two National Parks surrounding the Project area form part of the Greater Blue Mountains World Heritage area which was gazetted in 2000. The World Heritage area is comprised of eight protected areas (including the Yengo and Wollemi National Parks) and is noted for its representation of eucalypt habitats as well as localised swamps, wetlands and grassland (UNESCO, 2000).

4.1.1 Geology

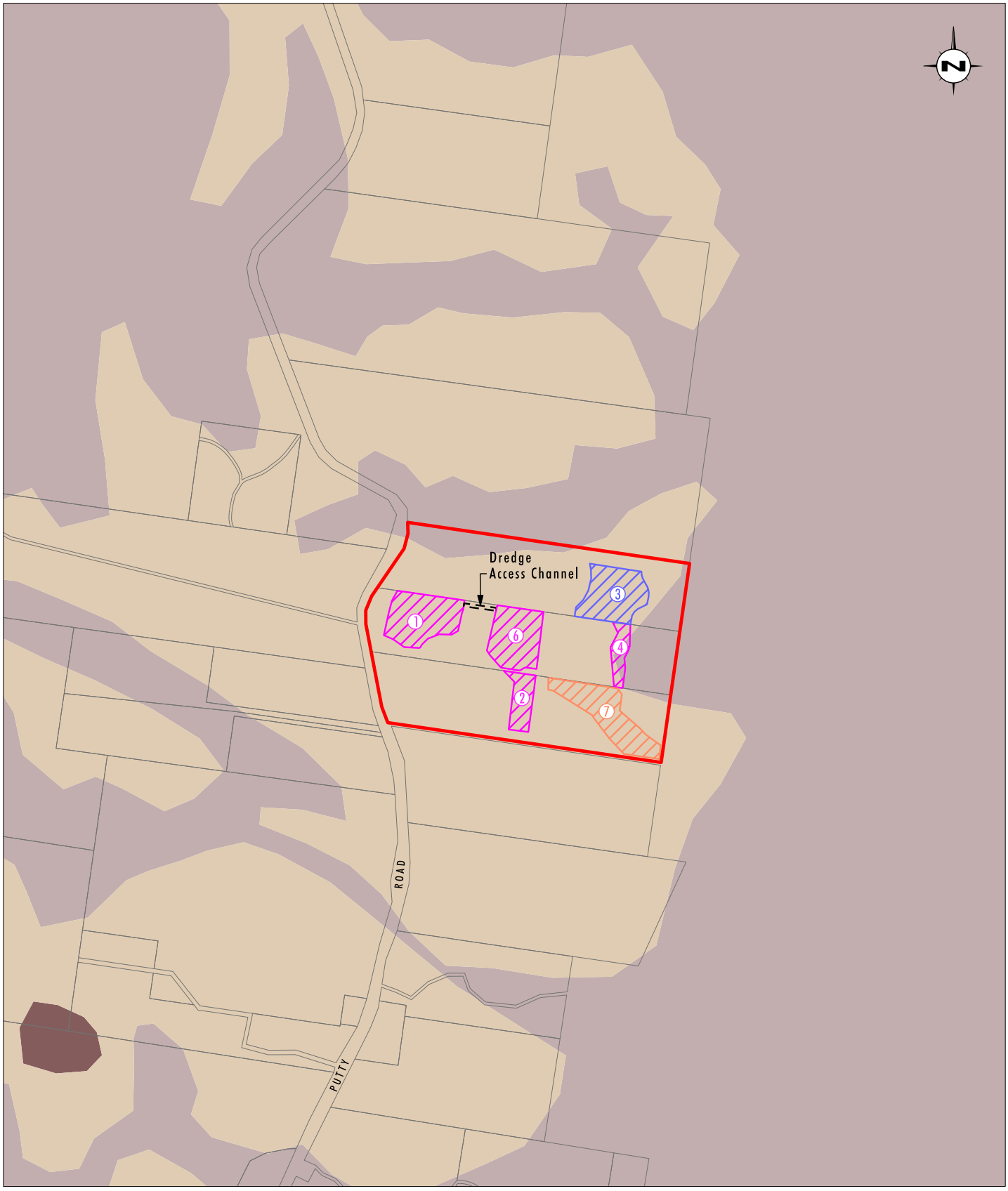
The Project area is located in the Sydney Basin, which is generally composed of Narrabeen and Hawkesbury sandstones and shales (NPWS, 2001c). The Project area is underlain by Hawkesbury Sandstone and overlain by Quaternary Alluvium consisting of gravel, sand, silt and clay layers (refer to **Figure 4.1**). In the region of Colo Heights, 6 kilometres south of the Project area there are outcrops of Hawkesbury Sandstone, while in the higher elevations such as Mount Yengo, Mount Tootie and Six Brothers, there are tertiary volcanic (mainly basalt and breccia) outcrops (McInnes, 1997).

In addition to the cultural importance ascribed to prominent landscape features in the wider Yengo National Park (for details refer to **Section 4.3.3**), stone tool resources in the terrace gravels and basalt outcrops as well as outcropping sandstone platforms used for grinding implements and sandstone overhangs used for shelter and rock art (paintings and engravings) have been identified throughout the Sydney Basin as being of importance to Aboriginal people (NPWS, 2003) and there is a significant representation of these features in the landscape surrounding the Project area (McInnes, 1997).

A geological investigation of the Project area was carried out by Coffey (1992). The investigation found that the geological sequence within this area consists of a colluvial layer of sands and silty sands to a depth of between 0.5 metre and 2 metres, underlain by residual clayey sands to a depth of between 10 metres and 27 metres. The clayey sands are derived from *in situ* weathering of the underlying Hawkesbury Sandstone and are underlain by extremely to highly weathered sandstone (CMJA, 2007).

Two key characteristics of the geology of the area are of relevance to this assessment, as both have an association with Aboriginal stone tool manufacture. These are:

- the occurrence of surface outcrops of sandstone; and
- the occurrence of fine grained siliceous raw materials.



Source: LPI NSW (2007)

0 0.5 1.0 2km
1:35 000

Legend

- Project Area
- Proposed Extraction Area
- Domain 3 Extraction Area
- Domain 7 Extraction Area
- QA - Alluvium: gravel, sand, silt, clay
- RH - Sandstone quartz with some shale
- TV - Flows of alkaline intergranular olivine basalt , ankaramite and tholeiitic basalt, with occasional sediment interbeds, dolerite, teschenite, trachyte and microsyenite

FIGURE 4.1

Geological Units

File Name (A4): R13_V1/1731_172.dgn

Where outcrops of sandstone are suitable, grinding grooves associated with creating cutting edges on tools such as stone axes, hatchets, adzes, chisels and fire hardened spear points are sometimes located. Most often this is in association with creek beds where water collects in rock pools or potholes, however, in the Yengo and Wollemi National Park areas grinding grooves have also been recorded on sandstone outcrops on ridge tops. These grinding grooves are located in association depressions and potholes where water accumulates after rain. Outcrops of sandstone on ridge tops have also been used by Aboriginal people for rock engravings. Where sandstone outcrops exist in areas of steep terrain, sandstone outcrops may also form rockshelters. These sheltered areas were sometimes targeted by Aboriginal people for habitation or ceremonial purposes, and sometimes retain evidence of this use where floor deposits remain.

Some of the sandstone overhangs are capped with basalt and some with conglomerates containing quartz and chert pebbles. These pebbles have been observed to have been broken out of the conglomerate matrix intentionally for use as raw materials for tool manufacture (Needham, 1981). The artefacts recorded in the Yengo and Wollemi National Parks have been recorded as predominantly being manufactured from quartz, quartzite and basalt supporting the use of these locally available materials. Sim (1966a in Needham, 1981) has also been cited saying basalt axe blanks were sourced from Mogo Creek, 25 kilometres east of the Project area (Mogo is the Darug word for axe) (Needham, 1981).

Grinding groove sites are relatively common in the Yengo and Wollemi National Parks, and are usually recorded in the upper tributaries of creek beds. Engraving sites make up most of the art sites in the Yengo National Park, especially in proximity to Mount Yengo (for example at Burragurra and Finchley). These engraving sites are situated on top of the ridges, often along traditional pathways (for details refer to **Section 4.3.2**).

Two ochre sources have been recorded in the vicinity of the Project area, indicating that the pigments used in the painted art are likely to have been sourced locally (for details on the previously recorded sites refer to **Section 4.2.1**).

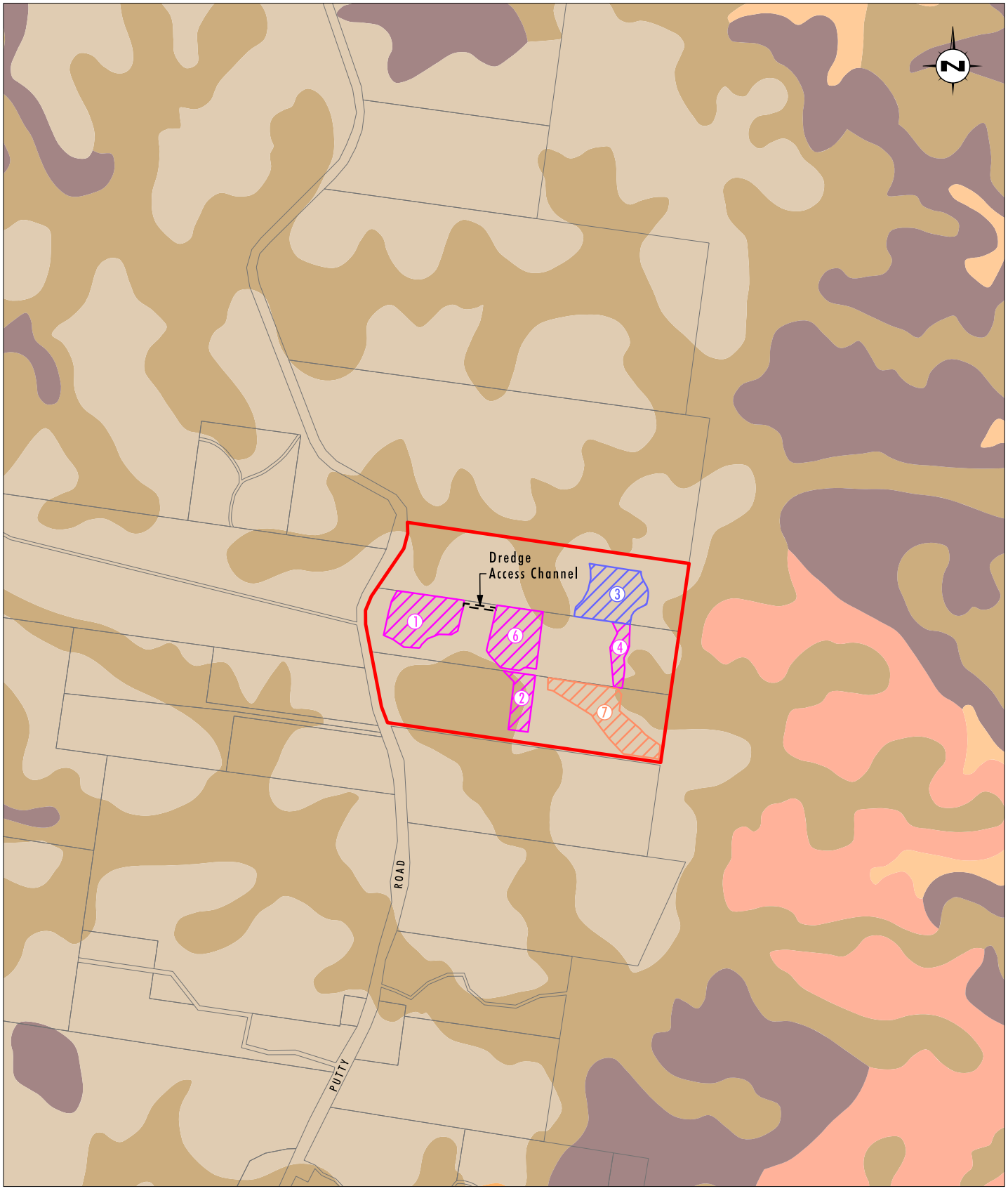
4.1.2 Soils

The Project area is located within two soil landscapes, the Gymea soil landscape and the Oxford Falls Variant A soil landscape (**Figure 4.2**). The impact area is almost entirely within the Oxford Falls soil landscape.

The soils in the Oxford Falls soil landscape are generally moderate to deep, between 70 and 150 centimetres in depth. The soils are predominantly well drained sands on slopes and terraces and poorly drained leached sands along drainage lines. In the swamps, the soils are generally deep (>150 centimetres) Gleyed Podzolic Soils that are poorly drained (McInnes, 1997). The soils are acidic (4.5 to 6.5 pH) and are generally subject to high levels of erosion when cleared of vegetation.

The soils of the Gymea soil landscape are shallow to moderately deep, between 30 and 100 centimetres, with soils along drainage lines deeper, up to 150 centimetres in depth. The soils are well drained along drainage lines. The soils are subject to high levels of erosion when cleared and the soils are acidic (4.0 to 6.5 pH).

Within the Project area the soil profile integrity, and thus integrity of possible archaeological deposits is likely to be low in both soil landscapes, as a result of historic land clearance, quarrying activities and agricultural practices. The sandy nature of the soils also suggests that if artefactual material was discarded in the area that it would be likely to move down through the soil profile through bioturbation.



Source: LPI NSW (2007)

0 0.5 1.0 2km
1:35 000

Legend

- Project Area
- Proposed Extraction Area
- Domain 3 Extraction Area
- Domain 7 Extraction Area

Soil Landscapes:

- Gymea
- Hawkesbury
- Hawkesbury Variant
- Oxford Falls Variant
- Watagan

FIGURE 4.2

Soil Landscapes

File Name (A4): R13_V1/1731_173.dgn

The preservation of archaeological materials is influenced by many factors, such as soil pH[5], the activity of soil dwelling micro-organisms and the movement of water across the site. The soil pH levels across the Project area vary between slightly acidic and strongly acidic. This suggests that survival of organics (bones, wooden implements) is unlikely across the Project area, as neutral to alkaline soils are required for the preservation of organic materials. Water flow, such as would occur along the drainage lines and in the swamp that dominates the Project area, further aid the survival of the micro organisms, which act to increase decomposition of organic material (Mays, 1998:17-21) (refer to **Figure 4.3**).

4.1.3 Topography

The Yengo National Park forms part of the Hornsby Plateau, a dissected sandstone plateau of the Sydney Basin characterised by narrow sandstone ridges and steep-sided valleys, with elevations ranging from 270 metres to 370 metres (NPWS, 2001b). Drainage lines commonly flow through steep sided valleys which can be up to 100 metres deep (DEP, 1984). Most of the deeply incised creek lines and rivers within the National Park have Narrabeen sandstone exposed in the lowest valley levels (McDonald, 2008).

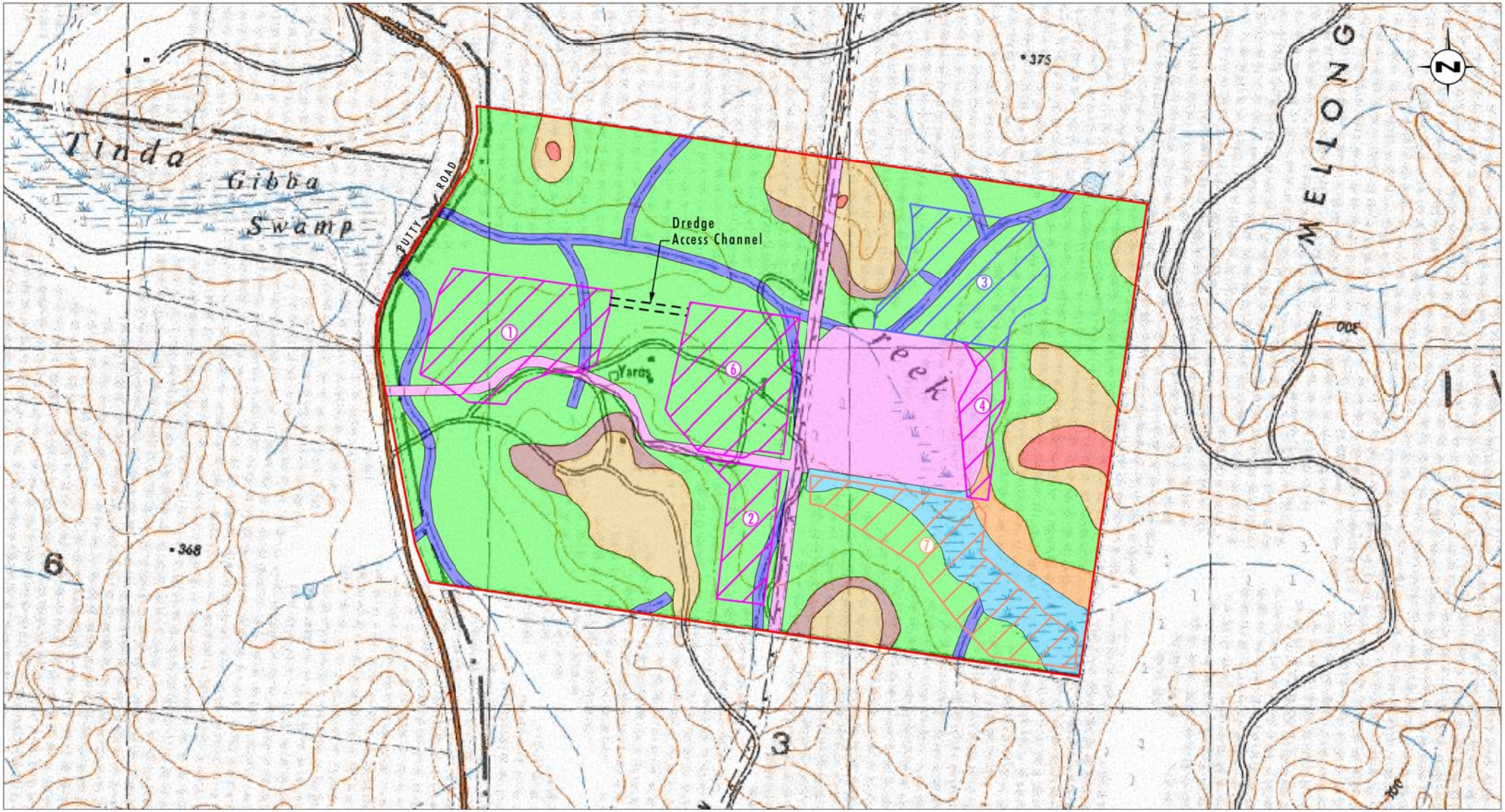
The narrow ridges and deep, steep sided valleys provide natural features that have been reported by DECCW (2010c) as suitable for use as buffers or boundaries between groups of Aboriginal Peoples: the Wiradjuri of the south-west slopes; the Dharug [Darug] and Darkinjung of the coast and mountains; the Wonnarua of the middle Hunter; and the Kamilaroi of the north-west slopes as far south as the Upper Goulburn River tributaries (DECCW, 2010c). Pathways along the ridges, through the National Parks connect these groups (refer to **Section 4.3.2**) and rock art studies have suggested that the rock art in the Yengo National Park differs from that elsewhere in the Sydney Basin and that certain elements at engraving sites suggest a boundary between groups of Aboriginal people may have existed along Mangrove Creek (Sim, 1966b).

The Project area is part of the Mellong Swamp system and reflects the general topography of the Mellong Range, which is characterised by rounded broad crests and wide valley floors (DECC, 2008), with elevations ranging from 340 to 380 metres. In the swampy areas the slopes are generally gently inclined (McInnes, 1997). Spur crests define the north, east and western edges of the Project area while the central and eastern areas are comprised of low gradient slopes, creeklines and sedge swamp (refer to **Figure 4.3**).

The spur crests continue up into the ridges that form the Mellong Range and would have provided access through the landscape and towards the documented Aboriginal pathways (refer to **Section 4.3.2**). The surrounding low gradient elevated spurs provide dry, level areas for camping in proximity to the resource rich swamps of the Mellong Swamp system, that increase in size and reliability (in terms of the supply of drinking water and in aquatic resources) to the north and outside of the Project area. The sedge swamp in the Project area does not have permanent standing water and would not have provided a reliable water source (for further discussion refer to **Section 4.1.4**).

A model of the Aboriginal use of the Hexham and Pambalong swamps (formed by run-off from the Sugarloaf Range near Newcastle) suggests that during the mid to late Holocene (6000 BP[6] to the present) swamps were able to sustain larger groups of people than the surrounding riparian corridors and hinterland (Umwelt, 2003). The archaeological evidence indicated that slightly elevated spur crests associated closely with the swamps were used far more intensively than the surrounding hinterland. The presence of large and complex stone artefact assemblages indicated that not only were larger groups of people able to congregate in these areas, but also that they were able to stay for longer periods of time before having to move on to locate new food resources.

[5] pH is a measure of the acidity or alkalinity of the soil. Soil pH influences the preservation of archaeological material particularly organics.
[6] BP – years before present.



Source: LPI NSW (2000)

0 250 500 750m
1:15 000

Legend

- Project Area
- Proposed Extraction Area
- Domain 3 Extraction Area
- Domain 7 Extraction Area
- Sedge Swamp
- Creek Line
- High Point on Spur
- Gentle/Simple Slope
- Modified Land
- Spur Crest
- Upper Slope
- Area of negligible gradient along swamp

File Name (A4): R13_V1/1731_152.dgn

FIGURE 4.3

Landform Elements within the Project Area

In the context of the Mellong Swamp system the larger and more reliable Mellong Swamp to the north of the Project area is the most likely location of intensive Aboriginal occupation in the general locale. This does not mean that the swamp associated with the Project area was not used by Aboriginal people, only that its use would have been restricted.

4.1.4 Hydrology

The upper catchment system of the Colo River, which includes Tinda Creek, is characterised by swamps in the corridor between the Yengo and Wollemi National Parks. This swamp system developed where an extension of the Kurrajong Fault impeded drainage to the east (Colong, 1999) and is dominated by Mellong Swamp, approximately 6 kilometres north of the Project area. The Project area is situated in the upper catchment of Tinda Creek and includes two second order tributaries and their associated first order tributaries, which flow across the Project area (refer to **Figure 4.3**). The south-eastern corner of the Project area is dominated by a sedge swamp at the confluence of two first order tributaries of Tinda Creek.

Tinda Creek is a tributary of Wollemi Creek which joins the Colo River approximately 15.5 kilometres to the south-west of the Project area. From the Project area, Tinda Creek flows intermittently to the north-west, and has been diverted around the eastern and northern boundaries of the existing quarry via a small earthen drainage channel. Tinda Creek joins with other intermittent second order streams at the northern boundary of the existing quarry. These drainage lines contain water during, and immediately following rainfall, but do not hold water during periods of dry weather. Based on currently available data, the water table within the Tinda Park area is relatively deep with the sedge land communities surviving in the area due to the high humic content within the sand.

The previous disturbance in the centre of the Project area and interruption of Tinda Creek by the existing quarry suggests that the sedge swamp in the south-east corner of the Project area is likely to have continued toward the western portion of the Project area. Tinda Creek also has swamp land on the western side of Putty Road, and it is likely that there was some continuation between the swamp land in the south-east corner of the Project area and the swamp land on the western side of Putty Road.

4.1.5 Flora and Fauna

As noted in **Section 4.1** the Yengo and Wollemi National Parks are part of the Greater Blue Mountains World Heritage area, which was gazetted in 2000 in recognition of its eucalypt habitats, heathlands, swamps, wetlands and grasslands. The World Heritage area has a significant representation of Australian flora, with a significant number of rare or threatened species (UNESCO, 2000) and is habitat to over 400 different faunal species (UNESCO, 2000) with 390 faunal species recorded in the Wollemi National park (NPWS, 2001a) and 223 recorded in the Yengo National Park (including 41 mammal species, 128 bird species, 17 amphibian species and 37 reptiles) (NPWS, 2001a).

Most of the vegetation in the Yengo and Wollemi National Parks can be characterised by four vegetation communities, with the most common being Hawkesbury Sandstone Woodland (McDonald, 2008). There is also Narrabeen-Hawkesbury Ironbark Forest, the Sheltered Hawkesbury Sandstone Forest and the Complex Hawkesbury Sandstone Sheltered Forest (McDonald, 2008). In addition to the eucalypt forests, pockets of rainforest and sheltered forest occur on richer, moister soils and paperbark swamps are recorded in poorly drained alluvial areas (Sanders et al. in Macdonald, 2008). The Mellong Swamp, 6 kilometres north of the Project area, supports a unique plant community which provides important habitat for reptiles and invertebrates in the bioregion (NPWS, 2003) with the small communities not well conserved in other nearby conservation areas (NPWS, 2002).

Recent ecological surveys of the Project area (Umwelt, 2013) identified six vegetation communities in the immediate vicinity of the Project area including Mellong Sandmass Dry Woodland, Mellong Sandmass Swamp Woodland, Red Gum Riparian Forest, Hawkesbury Hornsby Plateau Exposed Woodland, Stringybark – Ironbark Forest, Mellong Sandmass Sedgeland as well as previously disturbed areas dominated by a mixture of native and introduced species. The vegetation communities within the area would have provided habitat for a wide range of flora and fauna species, with increased diversity of both flora and fauna species likely to be found within the swamp systems in the area.

A review of the floral species recorded in and immediately around the Project area identified the presence of species with known Aboriginal uses as listed in **Table 4.1**. These lists have been derived from recent ecological surveys of the Project area and surrounds (2013). The flora survey identified 180 floral species, and due to limited land clearing in the National Park around the Project area, it is likely that this list is representative of species that would have been present in the past and within the Project area.

Table 4.1 – Floral Species Identified in the Project Area and Known Aboriginal Use

Scientific Name	Name	Known Aboriginal Use	Reference
Acacia sp.	Wattle	Economic plant – timber often used for fuel, leaves crushed and soaked with nets to waterproof them – wood used for boomerangs, clubs and digging sticks Food plant – gum that exudes from wounds on trunk eaten; pink witchetty grub live under tree	Australian National Botanic Gardens Education Services, 2000 Gott, 1995 Stewart and Percival, 1997:8 Umwelt (2003)
Allocasuarina sp.	She oak	Economic plant – hard wood used for making boomerangs, shields and clubs Food plant – young shoots were chewed to allay thirst and young cones were eaten.	Low 1989
Angophora sp.	Rough-barked Apple Broad-leaved Apple	Medicine plant – has astringent qualities, used for reducing blood flow and diarrhoea Burls on trunks removed an hollowed for use as containers and to boil water	Low, 1989 Umwelt (2003)
Astroloma humifusum	Native cranberry	Food plant – berries were eaten	Flood, 1980:96
Banksia sp.	Banksia	Food plant – nectar eaten Economic plant – cones used to carry fire	Low, 1989; Stewart & Percival, 1997
Billardiera scandens	Apple berry	Food plant – berries were eaten	Low, 1989: 22- 23
Burchardia umbellata	Milkmaids	Food plant – sweet, juicy potato like tubers were eaten	Gott, B (Australian National Botanic Gardens) Low, 1988 Zola and Gott, 1992: 43
Calaena major	Duck orchid	Food plant – the tubers are edible	Zola and Gott, 1992: 45 Low, 1989:

Table 4.1 – Floral Species Identified in the Project Area and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Callistemon linearis	Narrow-leaved bottlebrush	Food plant – flowers were sucked for nectar	Australian National Botanic Gardens Education Services, 2000
Callitris sp.	Cypress pine	Economic plant – the wood was used for oars and spears and the resin used for glues Medicine plant – the resins were used in medicine	MacDonald and Davidson, 1998
Cassytha sp.	Devil's twine	Food plant – sweet sticky fruits are edible	Low, 1989: 52
Centella asiatica	Pennywort	Medicine plant – salve or poultice applied to wounds and sores	Low, 1990: 56
Cyperus sp.	Sedge	Food plant – underground stem or tuber can be eaten in some species Economic plant – leaves used for weaving	Low, 1989:105; Zola & Gott, 1992:60
Dianella sp.	Blue flax lily	Economic plant – leaves split and used for weaving or to make string; leaves used to make a high-pitched whistle that attracts birds Food plant – fruits eaten raw and the roots pounded and cooked on hot rocks Medicine plant – roots boiled and drunk as tea for colds	Low, 1989: 8 Fraser & McJannett, 1993: 70 Zola & Gott, 1992:59 Gott, 1995 Stewart and Percival, 1997:24
Eucalyptus sp.	Eucalypts	Food plant – roots chewed for water in dry areas Medicine plant – leaves used to reduce fever Economic plant – bark and heartwood of some species used for wooden bowls, shields, canoes	Australian National Botanic Gardens Education Services, 2000; MacDonald and Davidson, 1998
Exocarpos cupressiformis	Native Cherry	Food – berries were eaten Economic plant – wood was used for spear throwers and bullroarers	Low Zola and Gott: 47
Grevillia spp.	Silky oak	Food – flowers sucked for nectar	Flood, 1980
Haemadorum sp.	Blood root	Medicine – anti venom Economic – orange-red dye can be made from the roots	Stockton, Eugene (ed): Blue Mountains Dreaming: The Aboriginal Heritage
Hardenbergia violacea	False sarsparilla	Medicine plant – the leaves of the plant are crushed and then sucked or mixed with water and taken as an elixir for stomach ache	Umwelt, 2003.
Hovea sp.	Hovea	Food plant – young pods were eaten	Flood, 1980:95
Juncus sp.	Rush	Food source- underground stem can be eaten Economic – leaves used for weaving	Low, 1989; Zola & Gott, 1992
Lambertia formosa	Mountain devil	Food plant – nectar sucked from flowers	Low, 1989: 170

Table 4.1 – Floral Species Identified in the Project Area and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Leptospermum sp.	Tea tree	Medicine Plant – leaves were crushed and inhaled for coughs and colds. Leaves were also soaked to make an infusion to treat sores and burns	Low, 1989; Low, 1990: 95
Leucopogon sp.	Beard heath	Food – berries were eaten raw	Fraser & McJannett, 1993:35
Lomandra filliformis	Wattle mat rush	Food plant – nectar was drunk and seeds were husked and ground into flour Economic plant – leaves were used in basket making	Low, 1989: 131, 174. MacDonald and Davidson, 1998. Low 1989 Zola & Gott, 1992:59
Lomandra spp.	Mat rush	Food plant – edible flowers and leaf bases; seeds were husked and ground into flour Economic plant - strong leaves were made into net bags by Aboriginal women	Low, 1989: 131, 174; Zola & Gott, 1992:59
Macrozamia spiralis	Cycad	Food plant – the seeds were treated to leach toxins then used to make flour Economic plant – strong barbed leaf shafts were used to make tools	Botanic Gardens Trust (undated)
Melichrus procumbens	Jam tarts	Food Plant – nectar can be drunk	Low, 1989: 174
Melaleuca sp.	Paperbark	Medicine Plant – leaves were crushed and inhaled for coughs and colds. Leaves were also soaked to make an infusion to treat sores and burns Economic plant – the bark was used for bedding and for bandages and for wrapping babies and corpses	Low, 1989; Low, 1990: 95 Umwelt, 2003
Panicum sp.	Grass	Food plant – seeds cooked and ground to use as flour	MacDonald and Davidson, 1998. Low 1989
Persoonia sp.	Geebung	Food plant – ripe fruit pulp eaten Medicine plant – fine scrapings of wood from young stems mixed with breast milk for eye treatment Economic plant – solution made from bark used to strengthen fishing lines	Stewart and Percival, 1997
Pimelia linifolia	Rice flower	Economic plant – fibres used to make string for nets, especially to catch Bogong moths	Zola & Gott, 1992: 33 Gott, 1995
Pteridium esculentum	Bracken fern	Food plant – underground fibrous stem roasted and beaten to remove starch	Zola & Gott, 1992 Threlkeld (in Gunson 1974:55)
Styphelia sp.	Five corners	Food plant – the fruits were eaten, and a rich honey water was drink	Low, 1989: 43, 176

Table 4.1 – Floral Species Identified in the Project Area and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
Themeda australis	Kangaroo grass	Food plant – seeds used for flour Economic plant – leaves and stem used for weaving	Greenway, 1910, Zola & Gott, 1992
Wahlenbergia sp.	Bluebell	Food plant – edible flowers	Fraser and McJannett, 1993: 65
Xanthorrhoea sp.	Grass tree	Food plant – base of leaves and pith inside eaten Economic plant – resin used for hafting stone tools, flowering stems used for spear shafts	Low, 1989; Zola & Gott, 1992

Table 4.1 identifies a wide range of food, medicine and economic plants used by Aboriginal people, with a number of multi-purpose plants recorded. Most plants identified are plants that flower or fruit in the spring or summer, or are useable to some extent year round. Only four of the flora species identified flower or fruit in the autumn or winter. It is likely that large quantities of sedges, rushes and ferns would have been present in the swamp in the past, providing Aboriginal people with a staple food source in the late spring to late summer months. The presence of large quantities of tubers in a central location would have meant that a ready supply of high energy food would have been available. The flora survey suggests that the Project area would have provided flora resources primarily in the spring and summer.

Table 4.1 also identifies tree species that are known to have been used by Aboriginal people for sourcing bark and heartwood for shields or bowls. Timber felling activities within the National Parks was mostly limited to fencing, huts and barns (NPWS, 2001c), indicating that culturally scarred and/or carved trees (if present) may have survived in the wider National Park. The Project area has been cleared in the past, reducing the likelihood of scarred trees remaining. The Parr State Conservation area south of the Project area was also heavily cleared during the time of the 1940-1950s sawmilling industry (NPWS, 2001c).

A review of the fauna species recorded in and immediately around the Project area identified the presence of species with known Aboriginal uses as listed in **Table 4.2**. These lists have been derived from recent ecological surveys of the Project area and surrounds (Umwelt, 2013). The fauna survey identified 116 fauna species, including 67 bird species, 32 mammal species, 11 species of amphibian and 6 species of reptile. **Table 4.2** presents native flora and fauna and due to limited land clearing in the National Park around the Project area, it is likely that this list is representative of species that would have been present in the past and within the Project area.

A number of the mammal species recorded within the Project area during the ecology survey (Umwelt, 2013) are known to have been hunted by Aboriginal people including the red-necked wallaby (*Macropus rufogriseus*), eastern grey kangaroo (*Macropus giganteus*), squirrel glider (*Petaurus norfolcensis*), common brushtail possum (*Trichosurus vulpecula*), koala (*Phascolarcotos cinereus*), wombat (*Vombatus ursinus*) and the grey-headed flying-fox (*Pteropus poliocephalus*).

One bird species which could have been exploited by Aboriginal people was observed during the ecological survey, the kookaburra (*Dacelo* spp.) (Umwelt, 2013), however the eggs of numerous small bird species are likely to have been collected for food. Monitors (*Varanus rosenbergi* and *Varanus varius*) were recorded during the survey, which were a prized food resource.

Table 4.2 – Aboriginal Faunal Resources

Scientific Name	Name
Acahthiza pusilla	Brown thornbill
Acanthiza reguloides	Buff-rumped thornbill
Acanthorynchus tenuirostris	Eastern spinebill
Acrobates pygmaeus	Feathertail glider
Amphibolurus muricatus	Jacky lizard
Anthus ausralis	Australian pipit
Antrhochaera chrysoptera	Little wattle bird
Artamus cyanopterus	Dusky woodswallow
Cacomantis flabelliformis	Fantail cuckoo
Cacomantis variolosus	Brush cuckoo
Carlia tetradactyla	Southern rainbow skink
Cercartetus nanus	Eastern pygmy possum
Chenonetta jubata	Australian wood duck
Chrysococcyx lucidus	Shiny bronze cuckoo
Colluricincla harmonica	Grey shrike thrush
Coracina novaehollandiae	Black faced cuckoo shrike
Corombates leucophaeus	White throated treecreeper
Corvus coronoides	Australian raven
Coturnix ypsilophora	Brown quail
Cracticus tibicen	Australian magpie
Ctenotus robustus	Striped skink
Dacelo novaeguineae	Laughing kookaburra
Eopsaltria australis	Eastern yellow robin
Eulamprus tenuis	Barred-sided skink
Falcunculus frontatus	Crested shrike-tit
Gerygone olivacea	White throated gerygone
Hylacola cauta	Shy heathwren
Lichenostomus chrysops	Yellow faced honeyeater
Lichenostomus leucotis	White eared honeyeater
Lichenostomus melanops	Yellow tufted honeyeater
Lichenostomus melanops cassidix	Helmeted honeyeater
Malurus cyaneus	Superb fairy wren
Manorina melanocephala	Noisy miner
Melithreptus brevirostris	Brown headed honeyeater
Melithreptus lunatus	White naped honeyeater
Microeca fascinans	Jacky winter
Myiagra rubecula	Leaden fly catcher
Ninox novaeseelandiae	Southern boobook
Ninox strenua	Powerful owl
Oriolus sagittatus	Olive back oriole
Pachycephala rufiventris	Rufous whistler
Pardalotus punctatus	Spotted pardalote
Petrochelidon nigricans	Tree martin
Petroica boodang	Scarlet robin

Table 4.2 – Aboriginal Faunal Resources (cont)

Scientific Name	Name
Phaps chalcoptera	Common bronzewing
Philemon buceroides	Helmeted friarbird
Philemon corniculatus	Noisy friarbird
Phylidonyris nigra	White cheeked honeyeater
Phylidonyris novaehollandiae	New Holland honeyeater
Platycercus eximius	Eastern rosella
Ptilonorhynchus violaceus	Satin bowerbird
Rhipidura fuliginosa	Grey fantail
Rhipidura leucophrys	Willie wagtail
Scythrops novaehollandiae	Channel billed cuckoo
Strepera graculina	Pied currawong
Todiramphus macleayii	Forest kingfisher
Tyto novaehollandiae	Masked owl
Vanellus miles	Masked lapwing
Acanthophis antarcticus	Death adder
Varanus rosenbergi	Heath monitor
Cercartetus nanus	Eastern pygmy possum
Macropus giganteus	Eastern grey kangaroo
Macropus rufogriseus	Red-necked wallaby
Petaurus norfolcensis	Squirrel glider
Phascolarcotos cinereus	Koala
Pseudomys novaehollandiae	New Holland mouse
Pteropus poliocephalus	Grey headed flying fox
Trichosurus vulpecula	Brush tail possum
Varanus rosenbergi	Rosenberg's goanna
Varanus varius	Lace monitor
Vombatus ursinus	Wombat

It has been reported (Sim, 1966b) that the swamp systems adjoining the MacDonald River catchment were once rich in wildfowl and game, however, by the mid-nineteenth century they had all but dried up with many species leaving. The current economic faunal species available within the Project area therefore may not represent the diversity available in pre-contact times or within the broader Yengo and Wollemi National Parks and it is noted that Aboriginal people utilising the Project area also had access to larger swamp environments within a day's walk.

4.2 Land Use History

The Yengo and Wollemi NP areas were not opened up to European settlers until the Putty Road was completed and opened for traffic in 1823. The first recorded instances of Europeans in the Wollemi and Yengo National Park areas were three expeditions, undertaken by William Parr, Benjamin Singleton and John Howe (1817 – 1820) (refer to **Section 4.3.1** for details) attempting to find an overland route from Sydney to the Hunter Valley (O'Rourke, 2009).

After an overland route to the Hunter Valley had been established, survey and settlement began, however this was focused on the more hospitable Hunter Valley area. The Putty Road was not heavily travelled after it was officially opened, as it was a dangerous road and soon became known for the bushrangers who attacked travellers. Travellers required a permit to use the road, with permits showing who was in the group, what animals and goods they were taking and how long they were expected to be on the road (PRTDM, 2010). The road continued to be used relatively infrequently. In 1942 the road was reconstructed as a defence route south as a result of the vulnerability of the Hawkesbury River ferry crossings and the threat of Australia being invaded from the north, and the road was fully sealed in 1964 (PRTDM, 2010).

The 1903 Ivory Parish Map shows no land grants existing around the Project area at that time (refer to **Figure 4.4**). The 1938 Ivory Parish Map (refer to **Figure 4.5** – which is the next available Parish Map), indicates the land to the east of Putty Road, including the Project area, as having been granted VCR & MI Meyer by that time. The original grant was likely made in the late 1920s or early 1930s. The earliest confirmed use of the land within the Project area is the use of the sedge swamp area for pumpkin cultivation (Ray Bygraves pers. comm.).

Disturbance factors within the Project area arising from historic use include ground disturbance caused by the existing quarry, the construction of earthen dams and levees for the diversion of water around the existing quarry, surface and subsurface disturbance caused by the installation of a 330 kV transmission line which runs north to south across the assessment area, cleared gravel vehicle tracks and general disturbance caused by vegetation clearance, agricultural practices and the movement of vehicles through the area.

All of these impacts have the potential to have disturbed and/or destroyed any Aboriginal sites that may have occurred within the parts of the Project area affected.

4.3 Ethnohistoric Accounts

Historic records, such as official records, personal observations recorded in diaries or publications and paintings, can provide rare information on Aboriginal lifestyles of a region at the time of European contact. Although a valuable source of information, the limitations of these documents must be recognised as colonial observers generally tended to record unusual rather than everyday events, religious and social life rather than economic activity, and men's behaviour rather than that of women and children. As such, ethnohistoric records are neither unbiased nor complete, and they cannot provide a complete understanding of Aboriginal lifestyles at the time of contact. The records are also clouded by the late 19th Century/early 20th Century Anglophile perceptions of the recorders who often did not understand the meaning/background of the events they witnessed and thus may have drawn conclusions/made assessments that were not accurate.

Official European exploration of the Yengo and Wollemi National Park areas began quite late and subsequent settlement and land use of the area has not been extensive when compared to other areas due to the rugged terrain. As a result of this there are limited early European accounts of Aboriginal life and use of the area with many of the accounts concerning the more easterly Hawkesbury region or northerly Hunter region.

4.3.1 The Putty Road

The Putty Road closely follows the Bulga Road, the route explored by John Howe in 1819/1820 (PRTDM, nd). This road, opened in 1823, was the first inland route from Sydney into the Hunter Valley, and was a popular cattle-rustling route.

Source: Land and Property Management Authority

0 0.25 0.5 1.0km

1:20 000

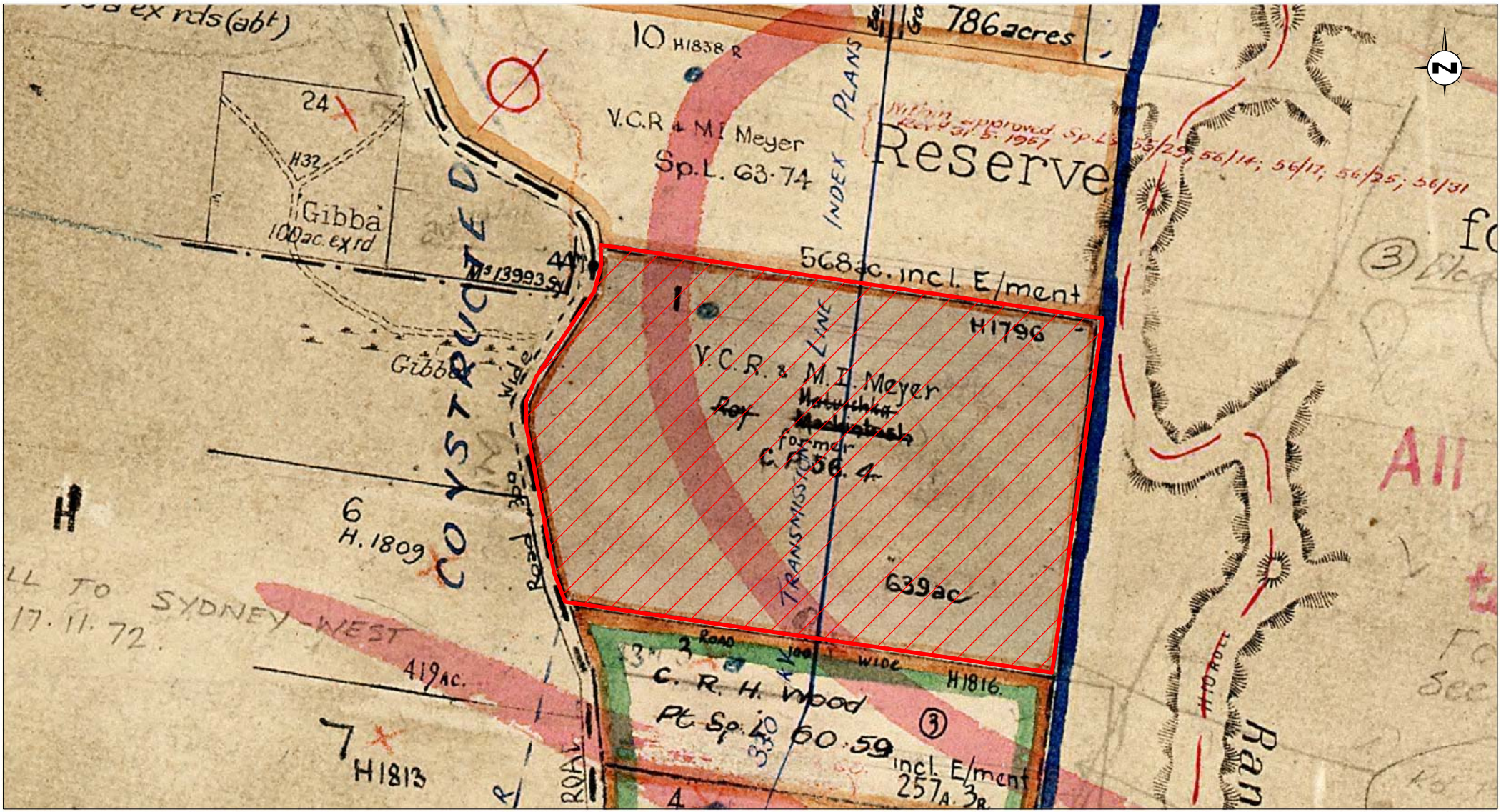
Legend

Project Area

FIGURE 4.4

1903 Ivory Parish Map

File Name (A4): R13_V1/1731_188.dgn



Source: Land and Property Management Authority

0 0.25 0.5 1.0km

1:20 000

Legend

Project Area

FIGURE 4.5

1938 Ivory Parish Map

File Name (A4): R13_V1/1731_189.dgn

As noted in **Section 4.2** there were three overland expeditions made to find an overland route from Sydney to the Hunter Valley. The first of these expeditions, by William Parr in 1817 has not recorded any assistance from Aboriginal guides. Parr does note in his journal that north of the Hawkesbury that 'Aborigines' had 'set fire to all the ridges round about' (NSW Archives 2/3623), and that there was fire and smoke everywhere and little feed for his horses (Brayshaw, 1986; O'Rourke, 2009). Threlkeld (in Gunson, 1974) noted that in the Sugarloaf Range in the Newcastle area, that the Awabakal people would burn large parts of the country prior to a kangaroo hunt. The extensive burning that Parr observed may have been the result of a similar practice.

The second attempt was undertaken in 1818 by Benjamin Singleton, whose party of four was accompanied by an unnamed Aboriginal person. He travelled beyond what is today Putty (20 kilometres north of the Project area) but turned back before reaching the Hunter, which the Aboriginal people in the area told him was a two day walk (O'Rourke, 2009).

The first officially sanctioned overland journey from Sydney to the Hunter Valley was led by Windsor chief constable, John Howe. The party of six explorers left from Windsor in 1819 and was accompanied by two Aboriginal guides, referred to as Myles and Mullaboy in Howe's journal. The route traversed the Wollemi National Park, and at Putty, Howe sent Myles to find the local Aboriginal people to provide assistance when the party was blocked by the 'rocks, lagoons, and creeks that were impassable' of the upper Macdonald River catchment (O'Rourke, 2009). The local Aboriginal people must not have been far off, as Howe made it to Jerry's Plains in the Hunter Valley two days later (O'Rourke, 2009). Just before he crossed from the MacDonald River Valley into the Hunter, Howe's group met a camp of about 60 Aboriginal people, 'many who had never seen a white man, and more [who] had never seen a horse (Brayshaw, 1986).' Upon reaching the Hunter River, Howe's party spent five days travelling downstream to Wallis Plains before turning and heading back to Windsor (Convict Trail, nd). Howe was unhappy with the route of his first expedition and was sent on another expedition in early 1820, with a larger group that again included Myles and Mullaboy (Gray, 1966). The group travelled along the Putty Road until they reached Wollombi Brook where, on advice from Myles and Mullaboy, they made their way east to reach the Hunter River at Whittingham (Gray, 1966).

4.3.2 Aboriginal Trade Routes and Pathways

While today the landscape is divided into two separate National Parks, Aboriginal people in the past would have divided the area up differently. For example, the engraving site at Finchley (35 kilometres to the north-east of the current Project area) is thought to be an Aboriginal tribal boundary marker (NPWS, 2001b).

A traditional travel route between the Darkinjung people of the Hawkesbury and the Wonnarua of the central Hunter Valley is thought to follow the Boree track from Mogo Creek to Milbrodale (Moore, 1981) (refer to **Figure 4.6**) and is likely to be one of the routes which Mr A B Bailey of St Albans recalls in his family accounts of Aboriginal people travelling north to the Wollombi District, each time following certain routes (Sim, 1966b).

Local Aboriginal people were reported to have guided the early settlers into the Wollombi and Howes Valley along this track (Sim, 1966b) and the ruts made by wagons can still be seen on rock sections of the track (Moore, 1981). Moore (1981) reports that the track follows the high ridges which have rock engravings all the way along it and it passes through Burragurra and Finchley, both important ceremonial places, with a branch heading to Mount Yengo and onto Milbrodale and another branch heading east to the Wollombi Valley.

Further east, another inland Aboriginal travel route has been reported linking Singleton with Brisbane Water followed along Wollombi Brook and the MacDonald River to Mangrove Mountain (McCarthy, 1939 in Brayshaw, 1986). An early resident of Tuggerah Lakes

Source: Geoscience Australia (2006), Google Earth (2011)

0 5 10 20km
1:500 000

Legend

- Project Area
- Approximate Location of Pathway between Singleton and Brisbane Water (from Sim 1966 - Smith 1981)
- Approximate Location of Boree Track between Wisemans Ferry and Mt Yengo (from Sim 1966 - Smith 1981)

FIGURE 4.6

Traditional Aboriginal Pathways

observed that, 'blacks from the interior would come to the sea coast once a year for about a fortnight to eat fish and kelp. The coastal blacks would go inland at this period' (Sim, 1966b). This observation indicates that there was contact between different tribal/clan groups, and that there seems to have been have been a reciprocal system where at specific times of the year they could visit the territory of the other tribe/clan.

If items were traded/exchanged along these routes is unknown from the historic records, however, stone from the Hunter Valley undoubtedly came into the Macdonald River valley, as artefacts of indurated mudstone (now known to be rhyolitic tuff) and quartzite assessed as being sourced from Hunter Valley were excavated from a rockshelter in the MacDonald River valley (Moore, 1981).

4.3.3 Ceremony

The Yengo National Park surrounds the Project area to the north, east and south. Mount Yengo, approximately 25 kilometres north-east of the Project area, was declared an Aboriginal Place under the NPW Act 1977 on 17 April 2009. The declared Aboriginal Place covers 1700 hectares within the Yengo National Park. Mount Yengo is a significant place in local Aboriginal lore, as it is the place where Baiame departed to the skies after finishing his tasks during the Dreamtime (DECCW, 2010c), leaving the top of the mountain flat.

> Under the National Parks and Wildlife Act the declaration of an Aboriginal Place gives legal protection to places of special significance to Aboriginal culture and recognises and promotes the importance of the place to the Aboriginal community. Mount Yengo Aboriginal Place has special significance to Wonnarua, Awabakal], Worimi and Darkinjung traditional owners and their descendents as well as to contemporary Aboriginal communities within the greater metropolitan, Central Coast and Hunter areas. It is significant as a spiritual and religious natural feature and forms the central point of connection for all of the major rock art sites from northern Sydney to the north of Newcastle and the upper Hunter Valley (DECC, 2009).

In addition to Mount Yengo, there are a number of significant Aboriginal sites within the Yengo National park, including Burragurra (Devil's Rock – protected as a men's site) and two engraving sites at Finchley. As late as 1910 a Mrs Rachel Milson recalled family stories relating to Aboriginal people of the Wollombi District going to the Devil Mountain 'to be made men' (Sim, 1966b). Her reference to the Devil Mountain is likely to be referring to Devil's Rock now known as Burragurra.

By the end of the nineteenth century a group of 60 Darkinjung men, women and children were living on a government reserve south of Windsor. It was reported that only two initiated men remained in this group, Joe Gooburra and Charley Clark, who were both old and infirm by this time (Matthews, 1897). Matthews (1897) reports that messengers were sent out to all of the neighbouring tribes and a good camping ground with plenty of fresh water and food for all the people was sought by the local tribe. Two earthen circles were created near the camp, one larger public ring and one smaller private ring (sacred circle) connected by a narrow pathway which was placed further from the camp for the initiation rituals. The distance between the circles varied based on the topography of the landscape. The various groups would set up camp once they were in sight of the public initiation ground, ensuring that these camp sites were facing the land from which they came. Ceremonial activities occurring in the larger circle and prior to the initiation could include men and women. Once all the groups that were expected had arrived, the date for the main initiation ceremony was set, and on that day the men and initiates set out for the sacred circle. Matthews adds that while the men were away at the initiation ceremony, the women, along with select old men from each tribe moved camp to another location a few miles away chosen by the head men before the ceremony. This new camp was similarly set out, with each group facing the land from where they came. After the initiation ceremony, all the groups came together and any tribal wrong that may have occurred since the last tribal meeting was settled (Matthews, 1897).

There are a number of early ethnohistoric accounts of initiation ceremonial activities, and these accounts very likely do not contain all of the information about what occurred. Most of the recorded accounts were also recorded quite late (Matthews, 1897; Fawcett, 1898), with the last reported Bora in the Wollombi Valley occurring in 1852 at Bulga (Needham, 1981). It is possible that the written accounts of Aboriginal ceremony combine and blur ceremony from different regions, due to a lack of understanding of specific occurrences. It is also possible that once Aboriginal populations began to decline, ceremonies were modified to cope with the decreasing numbers of participants, and these modified ceremonies are what was recorded.

Matthews does not say where the ceremony he recorded occurred, this information may not have been passed onto him. In relation to the Mount Yengo National Park campsites associated with the male initiation ceremony are most likely to have been located within proximity to Burragurra on low gradient spur crests relatively close to water and floral and faunal resources (as noted by Matthews, 1897). In this area it is also possible that stone circle arrangements, rather than earthen circle arrangements were constructed for the ceremony. Remnants of ceremonial grounds supporting this description have been recorded in the Watagan and Quorrobolong valleys, though over time they have become more and more difficult to identify in the landscape (Needham, 1981) and it may be that visible evidence of those associated with Burragurra have also disappeared.

4.4 Implications

Grinding groove and engraved art sites are common in the landscape surrounding the Project area. Being located in country dominated by sandstone geology, grinding grooves and engravings could be expected in areas where the sandstone is not conglomeritic or has not weathered/decomposed. The previous geological studies in the Project area indicated that the sandstone bedrock was decomposing *in situ*, limiting the potential for grinding grooves or engravings to have survived (if they ever existed in this area).

It has been noted that rockshelters with evidence of occupation have formed in the steeper ridge country and that further rockshelters could be located in similar areas that have not been surveyed to date. However, rockshelters are not likely within the Project area due to the unsuitable topography.

The geological information suggests that if local raw materials are being used that they are likely to be manufactured from quartz, quartzite and basalt.

The topography of the wider Yengo/Wollemi National Park area, previous models for Aboriginal landscape use within areas of similar topography and the ethnography, suggest that the spurs and ridges would have provided access to, and an easier means of moving around the narrow sandstone ridges and the easiest way to travel from the swamp country in the valleys to the surrounding steep ridge country. The spurs and ridges would have provided important travel paths. This is particularly relevant given the location of Burragurra and Finchley and the importance of Mount Yengo and the surrounds in relation to Aboriginal belief systems and ceremonial activities involving Aboriginal peoples from a variety of regions (DECCW, 2010c) (refer to **Section 4.1.3**). Therefore, it can be expected that spurs and ridges would have been used transiently as travel ways and thus may not retain evidence of intensive occupation.

The topography of the Project area differs greatly from the surrounding narrow ridges and steeped sided valleys, being low-lying, low gradient swampland and low gradient lower spur slopes. The Project area is connected to the ridge country via the low gradient spurs that skirt the edges of the Project area. Studies in other regions have shown that the elevated spurs surrounding swamps are likely to have evidence of Aboriginal occupation. Swamps

themselves were not suitable for occupation and any artefactual material located within swamps is likely to be in a secondary depositional context (e.g. washed in).

The Project area encompasses first order tributaries of Tinda Creek, including an area of sedge swamp. It is likely that this sedge swamp extended further into the Project area prior to past quarrying activity and realignment of the creek channel. The drainage lines within the Project area contain water during and immediately following rainfall, but do not hold this for any length of time. Therefore the Project area is not an ideal source of fresh water or aquatic resources. In comparison, the Mellong Swamp system to the north is likely to have been a far more reliable source of fresh water and aquatic resources. It currently supports a far wider variety of floral and faunal species than the Project area and is likely to have supported additional species in the past, making it a far more attractive area for Aboriginal people to camp. Thus it is probable that while there is a relatively large number of plant and animal species present in the Project area, the larger Mellong Swamp 6 kilometres north is likely to have been the primary focus of Aboriginal occupation in this general area.

5.0 Cultural Context

This section of the report will provide cultural information provided by the registered Aboriginal parties and the archaeological context of the Project area.

5.1 Aboriginal Cultural Context

No specific information was provided by the registered Aboriginal parties in relation to the Aboriginal cultural context of the quarry extension area. However, refer to **Section 8.1** for information in relation to Aboriginal cultural significance of the area.

5.2 Archaeological Context

5.2.1 Site Types

In accordance with OEH requirements the site types that occur within the Yengo and Wollemi National Parks and surrounding region are defined below.

Isolated Find/Artefact

The site type described as an 'isolated find' or 'isolated artefact' consists of a single stone artefact. The vast majority of stone artefacts were tools used in day to day activities or the debris left behind from the manufacture of those tools. Isolated finds may represent lost or discarded artefacts, but may also be the surface expression of a larger scatter of artefacts in a sub-surface context.

Artefact Scatter or Open Camp site

An artefact scatter or open camp site refers to areas (in the open landscape, not in a rockshelter or cave), that contain two or more stone artefacts, generally located within 100 metres of each other. Artefact scatters may result from the activities of a single person or a group of people. They may reflect a single occupation episode, or multiple episodes of occupation of a single place.

Rock Art Site

The term 'rock art site' generally refers to Aboriginal ochre paintings or ochre or charcoal drawings located on a rock face. The majority of rock art sites are found in positions that are sheltered from the elements. This observation, however, is probably biased to some extent, as rock art would not preserve well in open positions.

Engraving Site

The term 'engraving site' refers to places where Aboriginal people have incised (using techniques such as pecking or abrasion) some form of motif into rock. The engravings may be on a rock outcrop, rock slab, boulder, cliff-face, rock overhang, or in a cave or rockshelter. Engraving sites are not necessarily located in sheltered positions, but are most often located on softer rock types (like sandstone).

Rockshelter Sites

The term 'rockshelter site' refers to rockshelters/rock overhangs that contain evidence of Aboriginal occupation such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces).

Grinding Grooves

Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, stone hatchet heads, stone chisels or fire hardened wooden spear points. Grinding grooves are commonly located on sandstone ledges that outcrop in creek and river beds, as the availability of water enhances the speed with which grinding proceeds. Less commonly, grinding grooves are located on rock surfaces away from water and on stone types other than sandstone.

Scarred and Carved Trees

Aboriginal people often removed the bark/heartwood from the trunks of trees to make toe holds (to aid in climbing to extract honey or possums from tree hollows or from holes cut into the trunk), bowls, shields, spear throwers, boomerangs, shields, canoes and/or roofing material for shelters. The bark/heartwood removal leaves scars on the tree trunk which indicates the Aboriginal use of an area. Other trees were carved with designs. These carved trees were used to mark ceremonial grounds and burials (Etheridge, 1918:84; McBryde, 1974:126). Scarred trees have also been identified as markers for travel routes or as indicators of areas that may be off limits to some members of a group (e.g. men, women, uninitiated persons).

Stone Arrangements

Stone arrangements may take the form of single or multiple cairns, upright standing stones, lines, rings, pathways or arcs of stones or even stones arranged into figurative designs such as snakes or turtles. The location of many of the recorded stone arrangements suggests that they were related to ceremonial grounds and in particular initiation grounds (McBryde, 1974:31-42), while others appear to mark tribal boundaries (Leney, 1907:72-77).

Ochre Quarries

Ochre quarries are places where Aboriginal people sourced ochre (hydrated iron oxides and iron hydroxides – Whitten and Brooks, 1972:269) which they used for body decoration, implement decoration and rock art.

Waterholes/Wells

These are generally natural rock waterholes that contain water used for drinking or for special ritual purposes. Sometimes these holes are made larger by grinding out the sides and base and sometimes they are protected by placing large stones over the hole to keep out animals and to prevent the water from evaporating.

Precontact Burial Sites

The term 'precontact burial site' refers to Aboriginal skeletal material dating to a time before white settlement. The skeletal material may be buried, interred in a cave/rockshelter/under a ledge, in a tree hollow, in a hollowed out white ant nest, buried beneath a rock cairn, or exposed on a platform in a tree.

Postcontact Burial Sites

This term refers to burials/interments that have taken place since European settlement and that are not located in a recognised cemetery and are not documented. If they are documented then they are considered Aboriginal historic sites and not Aboriginal archaeological sites.

5.2.2 Previously Registered Sites

There are more than 650 Aboriginal sites recorded within the Wollemi and Yengo National Parks (NPWS, 2001c). This large number of sites has been recorded despite the limited number and extent of surveys conducted in these areas (DECCW, 2010c). It would appear that given this paucity of research in the wider area that significantly more sites will exist than are currently recorded and registered with the AHIMS. The number and diversity of Aboriginal site types in the surrounding Yengo National Park reflects the Aboriginal cultural heritage and archaeological value/significance of the area.

It is noted that most of the recorded sites surrounding the Project area are clustered beside roads and tracks and thus many areas remain unsurveyed and recorded site numbers are likely to be much lower than the actual number of sites. The majority of recorded sites are engraving sites, rockshelters with art and grinding grooves. It is assessed that the paucity of artefact scatter sites can be mainly attributed to the fact that most work undertaken in the region relates to academic research into various types of rock art with a concentration on locating sandstone platforms and rockshelters. Consequently, detection and recording of artefact scatters was generally not the focus of these investigations and this site type is highly likely to be severely underestimated.

5.2.3 Previously Registered Sites in the Vicinity of the Project Area

A search of the OEH AHIMS database conducted on 3 April 2013 revealed eight previously recorded archaeological sites located in an area of 10 kilometres by 10 kilometres surrounding the Project area (AMG coordinates E281000-291000/ N6323000-6333000) (refer to **Table 5.1**). The site locations are shown in **Figure 5.1**.

Table 5.1 – Registered Sites within 5 kilometres of the Project Area

Site ID	Site Name	Datum	Easting	Northing	Site Type	Distance and direction from the Project Area
45-2-0346	Yengo NP	AGD	287970	6331630	Axe Grinding Groove, Rock Engraving	3.75 km north-north-east
45-2-0390	Yengo NP	AGD	287620	6328010	Shelter with Art	850 m east
45-2-2404	C806	AGD	283800	6332790	Shelter with Art	4.7 km north-north-west
45-2-2430	Caloul Swamp Shelter	GDA	283357	6326785	Shelter with Artefact Scatter, Grinding Grooves, Archaeological Deposit	1.9 km south-west
45-2-2467	Fern Bank Shelter	GDA	281732	6326188	Shelter with Artefact Scatter and Axe Grinding Grooves	3.6 km

Table 5.1 – Registered Sites within 5 kilometres of the Project Area (cont)

Site ID	Site Name	Datum	Easting	Northing	Site Type	Distance and direction from the Project Area
45-2-2468	Attic Shelter	GDA	281750	6326208	Shelter with Axe Grinding Grooves	3.7 km south-west
45-2-2493	Tari Valley Shelter	GDA	281560	6323328	Shelter with Art and Artefact scatter	5.75 km south-south-west
45-3-2257	Yengo NP	AGD	287850	6328100	Axe Grinding Grooves	1.1 km east

A wider ranging AHIMS search (refer to **Appendix C**) was undertaken on 3 April 2013 revealing 107 sites in an area 20 kilometres by 30 kilometres surrounding the investigation area (MGA coordinates E270000-290000/N6320000-6350000). The site locations are shown in **Figure 5.2**. A summary of the registered sites is listed in **Table 5.2.** Within the table the sites have been separated into open sites and closed sites as noted on the AHIMS register[7].

Table 5.2 – AHIMS Aboriginal Archaeological Sites within the Broader Region

AHIMS Open Site Type	Site Features	Number of Sites (% of site class)	Percentage of all sites
Art (Pigment or engraved)	Rock art site containing an unknown number of motifs. Technique unknown (may be pigment or engraved art).	18 (41.9%)	(17.1%)
Axe grinding groove	Site containing an unknown number of grooves resulting from the production and resharpening of edge ground stone axes, hatchets, adzes and/or spears.	7 (16.3%)	(6.7%)
Axe grinding groove, art	Site containing an unknown number of grooves resulting from the production and resharpening of edge ground stone axes, hatchets, adzes and/or spears in association with a rock art site containing an unknown number of motifs. Technique unknown (may be pigment or engraved art).	7 (16.3%)	(6.7%)
Artefact	Number and types of artefacts (stone, bone, shell, wood, glass ceramic) unknown. Note these sites are usually isolated stone artefacts – Isolated Finds or Artefact Scatters.	4 (9.3%)	(3.8%)
Stone Arrangement	Arrangement of stones as single or multiple cairns, upright standing stones, lines, rings, pathways of stones or even stones arranged into figurative designs such as snakes or turtles.	3 (7%)	(2.9%)
Grinding groove, rock engraving, water hole	Site containing an unknown number of grooves resulting from the production and resharpening of edge ground stone axes, hatchets, adzes and/or spears in association with a rock engraving site containing an unknown number of motifs and a waterhole.	1 (2.3%)	(0.9%)

[7] The separation of open/closed sites was undertaken from the classification on the AHIMS register, as well as considering the name given to the site by the recorder. If a site was named with 'rockshelter/shelter' it was taken to be a closed site, despite any classification provided in the AHIMS table. If there was no information to suggest otherwise, the information provided by AHIMS was used.

Table 5.2 – AHIMS Aboriginal Archaeological Sites within the Broader Region (cont)

AHIMS Open Site Type	Site Features	Number of Sites (% of site class)	Percentage of all sites
Art, artefact	Rock art site containing an unknown number of motifs, in association with artefacts (number and type unknown). Technique unknown (may be pigment or engraved art).	1 (2.3%)	(0.9%)
Modified tree	Scarred or carved tree.	1 (2.3%)	(0.9%)
Ochre quarry	Source of ochre (hydrated iron oxides and iron hydroxides).	1 (2.3%)	(0.9%)
Total Number of Open Sites		**43**	**(41%)**
Shelter with art	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs. Technique unknown (may be pigment or engraved art).	30 (48.4%)	(28.5%)
Shelter with art, deposit	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs. Technique unknown (may be pigment or engraved art). Floor deposit of shelter contains evidence such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces).	12 (19.4%)	(11.4%)
Shelter with deposit	Rockshelters/rock overhangs that contains deposit with evidence such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces).	6 (9.7%)	(5.7%)
Shelter with deposit, grinding groove	Rockshelters/rock overhangs that contains deposit with evidence such as stone artefacts and/or bones and/or plant remains (from meals eaten at the site) and/or hearths (fireplaces). An unknown number of grooves resulting from the production and resharpening of edge ground stone axes, hatchets, adzes and/or spears is also associated with the shelter.	5 (8%)	(4.8%)
Restricted	Access and information restricted Please note that OEH AHIMS was contacted in order to ascertain the nature of the restriction of the sites, and obtain any information possible. The site names and the contact details for the site recorders were provided.	3 (4.8%)	(2.9%)
Shelter with grinding groove	Shelter with grinding grooves	2 (3.2%)	(1.9%)
Shelter with art and Aboriginal Ceremony and Dreaming	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs. Technique unknown (may be pigment or engraved art). The shelter is associated with Aboriginal ceremony and Dreaming.	1 (1.6%)	(0.9%)
Shelter with art, Aboriginal resource and gathering, and Aboriginal Ceremony and Dreaming	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs and resources used by Aboriginal people. Technique unknown (may be pigment or engraved art). The shelter is associated with Aboriginal ceremony and Dreaming.	1 (1.6%)	(0.9%)

Table 5.2 – AHIMS Aboriginal Archaeological Sites within the Broader Region (cont)

AHIMS Open Site Type	Site Features	Number of Sites (% of site class)	Percentage of all sites
Shelter with art, grinding groove	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs. Technique unknown (may be pigment or engraved art). An unknown number of grooves resulting from the production and resharpening of edge ground stone axes, hatchets, adzes and/or spears is also associated with the shelter.	1 (1.6%)	(0.9%)
Shelter with art, ochre quarry	Rockshelters/rock overhangs that contains rock art containing an unknown number of motifs and a source of ochre (hydrated iron oxides and iron hydroxides). Technique for art unknown (may be pigment or engraved art).	1 (1.6%)	(0.9%)
Total Number of Closed Sites		**62 (59%)**	

As shown in **Table 5.2** of the 105 previously registered sites, there are a high number (62 or 59%) of closed sites (rockshelters) registered in the broader search area. This is partly to do with the nature of the geology which is suited to rockshelter formation, as well as a lack of systematic survey in the National Parks that was not specifically targeted at the location of rockshelters. The rockshelters contain one or more features that identify them as having been visited by Aboriginal people in the past (art, artefacts, grinding grooves). Most (46 or 74.2%) of the recorded rockshelters have some form of art, either rock engravings or pigment art.

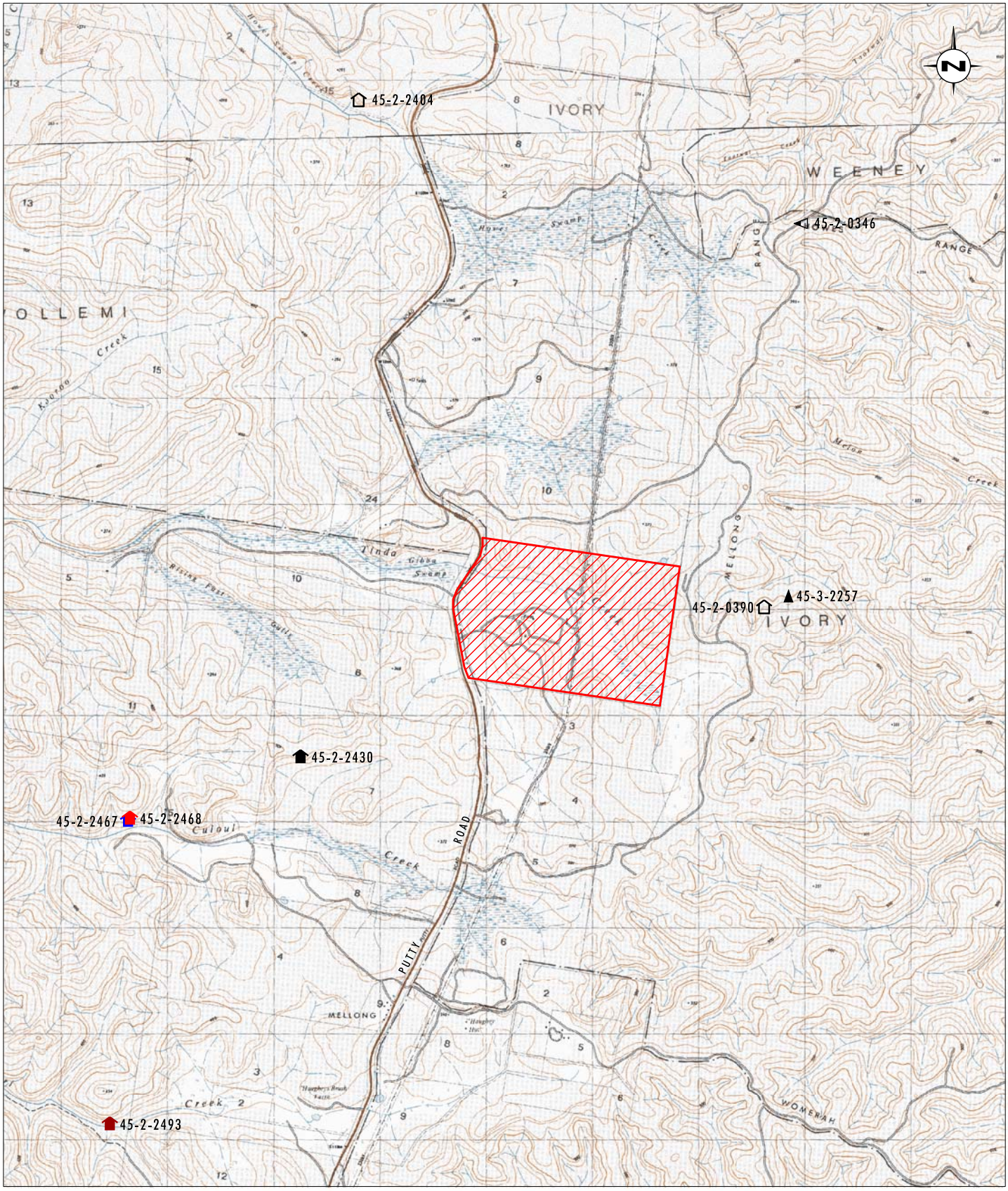
The most intensive research undertaken in the National Parks was focused on locating rockshelter sites with art and/or deposit near Mangrove Creek (50 kilometres south-east of the Project area (Attenbrow 1980, 1981, 1982a, 1982b, 1982c, 1987, 1997, 2006 and Bonhomme, 1984a, 1985) or 70 kilometres south-east of the Project area near Hawkesbury River (Vinnicombe, 1980; 1984).

While Attenbrow considered the stone artefacts excavated from the rockshelters, and collected from the surface at sites recorded near the rockshelters (for details refer to **Section 5.2.4.4**), the artefacts themselves were not the main focus of research, and survey was not conducted specifically to locate artefact sites (open sites).

The previously registered open sites are predominantly (46%) art sites (all most likely engravings) and grinding grooves (16.3%), with low numbers of artefact sites (9.3%), stone arrangements (7%), one modified tree (2.3%) and one ochre quarry (2.3%).

A number of art sites have additional site features, including seven with grinding grooves (16.3%), one with grinding grooves and a water hole (2.3%) and one with artefacts (2.3%).

A study by Sim (1966a) in the Macdonald River catchment (25 kilometres east of the Project area) identified 22 groups of the open rock engravings on the OEH AHIMS register. Sim was undertaking the study to look at and compare the rock engravings of the Macdonald River district with those found elsewhere in the Sydney Basin, in which he found some differences in subject matter and technique. No detailed study was undertaken or presented, more of a highlighted observation.



Source: LPI NSW (2000), AHIMS (2010)

0 1 2 2.5km
1:50 000

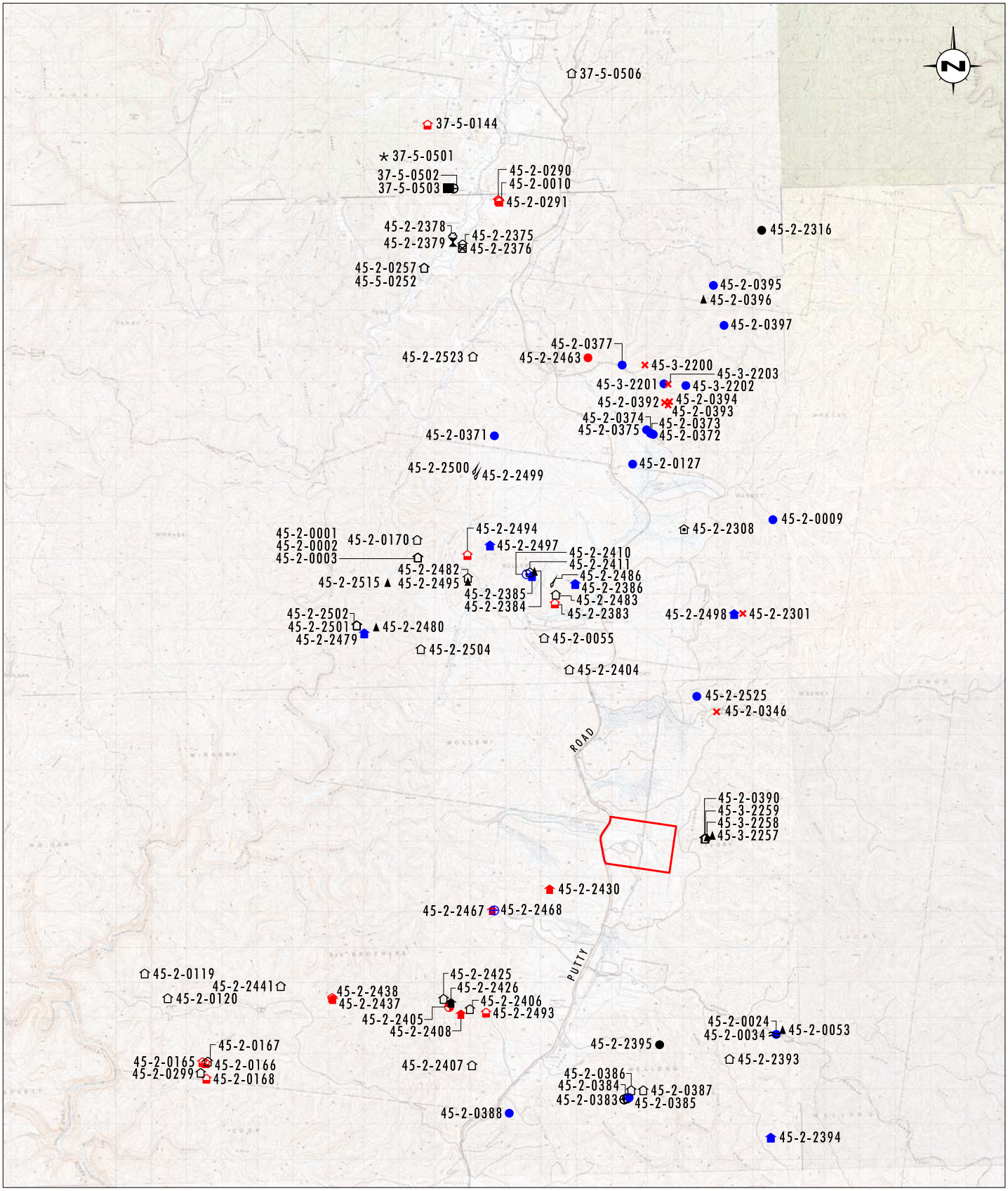
Legend

- Project Area
- Grinding Groove
- Axe Grinding Groove, Rock Engraving
- Shelter with Art and Artefact Scatter
- Shelter with Artefact Scatter and Grinding Grooves
- Shelter with Grinding Grooves
- Shelter with Deposit, Artefact Scatter and Grinding Grooves
- Shelter with Art

FIGURE 5.1

AHIMS Sites in the vicinity of the Project Area

File Name (A4): R13_V1/1731_179.dgn



Source: LPI NSW (2000), AHIMS (2010)

0 2.0 4.0 8km
1:150 000

Legend

- Project Area
- Artefact Scatter
- Engraving Site
- Isolated Find
- Ochre Source
- Scarred Tree
- Water Hole (well)
- Axe Grinding Groove
- Shelter with Art
- Stone Arrangement
- Grinding Groove and Rock Engraving
- Grinding Groove and Artefact with PAD
- Art (including Pigment or Engraved)
- Grinding Groove, Art (pigment or engraved) and Artefact
- Shelter with Art and Deposit
- Shelter with Deposit
- Shelter with Potential Archaeological Deposit
- Shelter with Art and Axe Grinding Groove
- Shelter with Deposit and Axe Grinding Groove
- Shelter with Art/ Aboriginal Ceremony and Dreaming
- Shelter with Art/ Aboriginal Resource and Gathering/ Aborignal Ceremony and Dreaming
- Shelter with Art/ Ochre Quarry
- Shelter with Grinding Groove

FIGURE 5.2

AHIMS Sites in the Wider Region

The artefact sites recorded in the Yengo and Wollemi National Park landscape are all situated in the upper tributaries of creeks. The artefacts recorded were made of quartz, silcrete and chert and include silcrete and chert flakes, a quartz core and a possible quartz manuport.

5.2.4 Previous Archaeological Research

As only a limited amount of research has been undertaken in the vicinity of the Project area, this section of the report will look at a wider range of studies (shown on **Figure 5.3**) including the previous study undertaken in the Project area, some of the larger studies within the Yengo National Park and a wider reaching study in the Sugarloaf Range that will assist in informing the current assessment.

5.2.4.1 Sim 1966b

As noted in **Section 5.2.3**, Sim located and recorded 22 groups of rock engravings in the MacDonald River Valley. Within these 22 groups of engravings there were 44 clusters of engravings, with emu tracks represented in a large number of sites. In the discussion of the engravings and the region, Sim notes that the southern section of the MacDonald River region is rugged and infertile, with the ridge tops almost devoid of water, apart from after heavy rains. Sim notes that the engravings are situated along the main ridges, with the majority being on the two ridges that provide routes between the more fertile valley areas in the region.

It was also highlighted that the engravings are limited to the area south of Putty and Wollombi, despite (painted) rockshelter art continuing north and west from the region. Sim avoided interpreting the engravings, apart from noting that many of the engraving sites were probably sacred sites.

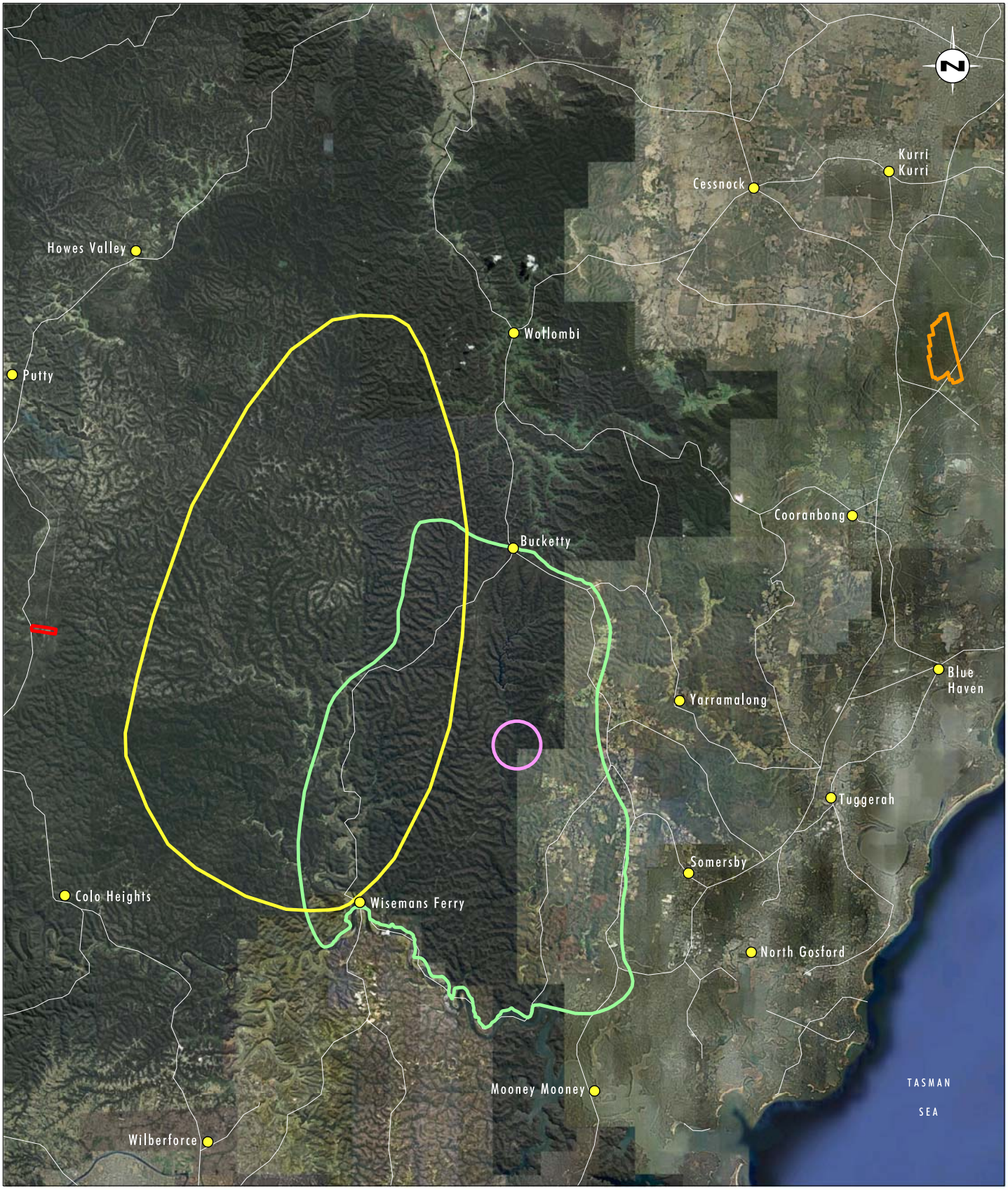
Observations about the environment at the time were made, including a note that the MacDonald River had at one stage been a deep, permanent reliable source well stocked with fish, but by 1966 it was silted and shallow. It was also noted that within then living memory a number of reliable water holes at the heads of gullies had been destroyed by silting and scouring.

5.2.4.2 Smith 1983

As part of her Honours research, Smith investigated rock art in the Mangrove Creek and Macdonald River valleys to see if a tribal boundary between the Kuringai and Darkingjung could be seen – being the Macdonald River itself, or a distinguishable boundary buffer zone that would have been used by both groups.

Smith looked at the spatial distribution of variations in form and techniques in the rock art of 108 shelters and 71 open engraving sites with macropods and anthropomorphic figures. In her study she did not look at the artefacts located at any of the shelters, therefore these cannot be used to inform the current Project.

In addressing what figures to compare, Smith observed all of the motifs and found that open engraving sites east of Mangrove Creek tend to have a predominance of lizards and implements and a low emphasis on tracks, while those on the west of Mangrove Creek appear to emphasise tracks rather than figures. On both sides of Mangrove Creek, fish and tracks are more likely to be found in valleys than ridge tops. This observation suggests that differences in sites were tied in with function, different functions carried out on ridge tops and in valleys, and between specific ridge tops. Areas which, from the ethnography, were traditionally trade and/or access routes were shown to have had a high level of variation in style and composition. Interestingly stylistic differences were observed at the engraving sites, however were not seen at the rockshelter sites.



Source: Google Earth (2006)

0 5 10 20km
1:450 000

Legend

- Sim 1966b
- Smith 1983
- Bonhomme 1984
- Attenbrow 2006
- OCAL Continued Underground Mining Area 2010

FIGURE 5.3

Previous Archaeological Research

The macropod engravings on the ridge tops in the Peats Ridge area and near the Boree Track tended to be more varied, in size, technique and style. The engraved macropods appeared to increase in size as you travel west. The change in macropods from east to west also appeared to have a zone around the Boree Track and MacDonald River area where the form of the macropods began to change. Smith concluded that macropods in engraving sites and whole panels at engraving sites had variations that correlated to a probable ethnic boundary at Mangrove Creek. Variations of form and size, rather than technique produced the correlation to a tribal boundary, however social constructs were seen as only one of the factors affecting these variations. Purpose, technique, topography also appeared to explain variations in the motifs, while some variations were unexplained.

5.2.4.3 Bonhomme and McDonald – Brayshaw and Associates 1984b

The only previous archaeological survey of the Tinda Park area was undertaken by Bonhomme and McDonald for Brayshaw and Associates in August 1984. This inspection related to a dam that was located immediately north of the extraction operations at the time (and is now part of the current extraction area). As part of the survey, all eroded/exposed areas were inspected and rock outcrops were examined for engravings, art and possible shelter habitation.

During survey a piece of rhyolite/silcrete with no obvious evidence of flaking and a quartz flake with a definite bulb of percussion were identified within a metre of each other approximately 1.5 kilometres east of the power-line easement[8]. The silcrete/rhyolite was uncommon enough in the region to warrant inspection, however all of the breakages were deemed to be fresh. It was concluded that both 'isolated finds' had resulted from the use of an access track and were only of 'possible' Aboriginal origin. No other artefactual material was located within the area assessed. The two pieces of stone were outside the proposed dam impact area.

The report concluded that the isolated 'finds' in the upslope area probably resulted from farm use of the access track and were not of Aboriginal origin and that while the swamps may have been a focus for food producing activities, occupation sites are more likely to occur in drier upslope areas.

5.2.4.4 Attenbrow 2006

In 2006 Attenbrow undertook a number of years of research of the Upper Mangrove Creek catchment to look at cultural and demographic change that may (or may not) have occurred in the catchment over time. A variety of site types were recorded in the Upper Mangrove Creek catchment – archaeological deposits, pigment and engraved images, grinding grooves and scarred trees. From excavations undertaken by Attenbrow it was found that stratified rockshelter deposits containing Aboriginal artefactual material dated back to 11,000 years before present (BP) with varying lengths of habitation at various sites.

With detailed chronological material, Attenbrow was able to observe changes in artefact types and numbers over the past 4000 years. Open sites were divided into base or habitation camps, where groups of people would establish a more long term, or recurring campsite and activity or location camps, which were created more opportunistically for an activity based purpose. In the fourth millennium BP an increase in the number of base camps was observed along with the first appearance of ground edge implements.

[8] A distance of 1.5 km east of the power easement is outside the Project area, approximately 300 m east of Putty Road.

In the third millennium BP a significant increase in the number of base camps was observed, however this increase was observed alongside an increase in the number of activity camps, suggesting increased use of the catchment. In the first millennium BP, a decrease in the local artefact accumulation was observed.

The artefact types recorded included retouched flakes, cores, ground implements, hammerstones/manuports, fractured pieces and waste. The waste category in the analysis included flakes, broken flakes and flaked pieces. The raw materials recorded include quartz, fine grained siliceous (FGS), chert, silcrete, quartzite and igneous. The quartz, FGS, chert (excluding tuff) and quartzite were described as having eroded out of the sandstone conglomerate layers. The chert category included jasper, chalcedony, indurated mudstone and volcanic tuff, exposed in the Grose Valley which drains into the Hawkesbury River.

The 'waste' category was by far the most common artefact class from the sites sampled, comprising over 90% of the artefacts recovered. Approximately half (51%) of the artefacts from the Upper Mangrove Creek sites were manufactured from quartz, while FGS (33%) was also prominent. Other raw materials that could be sourced locally were chert (8%) quartzite (4%) and igneous (3%). Silcrete (2% was probably imported to the area. Some of the chert was probably imported to the area as well, but was combined into the locally available category for Attenbrow's study.

5.2.4.5 Umwelt 2010

Umwelt undertook survey and assessment of an area within the Sugarloaf State Conservation Area. The topography of the Sugarloaf Range is similar to the Yengo and Wollemi National Parks, with steep narrow ridges and deep valleys. The ridge and spur crests in the Sugarloaf Range were the Aboriginal pathways through and across the mountains, similar to the main ridgelines through the Yengo and Wollemi National Parks.

The geology of the Sugarloaf Range is similar to that of the Yengo and Wollemi National Parks (refer to **Section 3.2**), consisting of Narrabeen Group sandstones and conglomerates (Matthei, 1995). Grinding groove sites were the dominant site type in the areas of steep terrain, with artefact sites most often located on spur crests that have access tracks with higher levels of visibility and soils prone to erosion. The ridgelines and gentle spurs in the Sugarloaf Range are known to have been the traditional Aboriginal pathways through the range, with most artefact sites being small scatters, likely to be indicative of transient use rather than prolonged camping.

The Sugarloaf Range differs from the Yengo and Wollemi National Park area, in that there are very few rockshelters with evidence of occupation in the Sugarloaf, as most shelters or overhangs are small with sloping floors and no deposit. There is also only one recorded art site, an engraving site associated with grinding grooves in a creek. Prior to systematic survey being undertaken in the Sugarloaf Range, a similar overall open site distribution to the Yengo and Wollemi National Parks could be seen, with previously recorded sites predominantly large numbers of grinding grooves in the upper reaches of the creeklines, where sandstone platforms in the creeks were suitable for grinding, with low numbers of other site types, including artefact scatters, isolated finds and scarred trees. The grinding grooves that were recorded were largely recorded by one person, whose activities targeted locating and recording grinding groove sites.

During the Umwelt (2010) survey 62 additional sites were recorded including 20 grinding groove sites, one site that had grinding grooves associated with a rockshelter and isolated artefact, one rockshelter with artefacts and deposit, 36 artefact scatter and isolated finds, three scarred trees and two stone arrangements.

After the systematic survey, that assessed all landforms, including ridges, spur crests, slopes and valleys, the number of recorded artefact sites within the Sugarloaf Range itself increased greatly. The artefacts in the Sugarloaf Range were all recorded on four wheel drive access tracks and motorbike trails on low gradient ridge and spur crests. A pattern of recurring artefact location on crests/benches between the upper tributary water courses rather than beside the water courses was noted. This was suggested to have three potential reasons: the steep gradient of the landforms associated with the watercourses making them unsuitable for camping, the gentle gradient of the spur crests were more suitable for camping and there was poor visibility next to the watercourses.

The artefacts were manufactured from Nobbys tuff and silcrete, with lower numbers of quartz, petrified wood, quartzite and indurated mudstone. Nobbys tuff, quartz and quartzite were locally available, while silcrete was also available nearby. The indurated mudstone was thought to have either been obtained through trade, or that prior to the silting up of the lower reaches of the Hunter River that mudstone cobbles may have been available in the cobble beds in the river (as they are currently further upriver).

5.2.5 Implications

Apart from the study by Bonhomme and McDonald (1984b) in the Project area, there has been minimal mention or discussion of artefact sites that have been located in the Wollemi and Yengo National Parks. Little attention has been paid to considering the potential for artefactual material to be present in the landscape. Attenbrow (1992) notes the artefacts that were excavated during her studies, however, she has combined artefact classes and raw materials in such a way that it is difficult to compare with other work.

Bonhomme and McDonald (1984) identified silcrete and quartz in their assessment, however concluded that both isolated pieces they located may not have been of Aboriginal origin. Attenbrow's work identified that quartz was the most common raw material used in the Mangrove Creek basin. This is likely to be the case across the Yengo National Park, as quartz is available in the local conglomerates.

As discussed in **Section 4.0**, the Project area does not have the suitable topography for rockshelters, having gradual elevation changes not steep ridges with sandstone overhangs. Sandstone outcrops and boulders have been identified outside of the proposed Project impact area (refer to **Figure 4.2**). In Domain Area 3 these were observed in the far east of the property boundary outside of the proposed impact area and were observed to be weathered with rough uneven surfaces and unsuitable for grinding unlike the platforms and benches that were more commonly used for engraving and grinding in the wider area.

While artefact class and raw materials located in the Sugarloaf Range are not comparable to what is identified in the Yengo National Park, the topography provides a potential model for artefact distribution. Artefact sites are most likely to consist of isolated artefacts or small artefact scatters located on low gradient ridge and spur crests.

In summary, in relation to the broader Yengo and Wollemi National Parks, previous archaeological investigations and the OEH AHIMS register indicate that:

- occupation sites are rare. This is highly likely to be a reflection of past investigation biases rather than what is actually present;

- engraving sites are relatively common where suitable sandstone is exposed on ridgelines;

- grinding groove sites are relatively common where suitable sandstone is located in association with creeklines or a water source such as a pothole within a sandstone platform;

- stone arrangements, while not common, do occur in the area;

- rockshelters with evidence of use are relatively common. These may contain a mix of art, artefacts, grinding grooves and/or PAD; and

- scarred trees have been recorded in the National Parks but are not common.

As noted in **Section 5.2.2**, there are over 650 registered Aboriginal sites in the Yengo National Park, and there are 105 registered sites within 20 kilometres of the Project area. Most (59%) of the registered sites in the search area are closed sites/rockshelters, with evidence of use/occupation. Most of the open sites registered in the search area (74%) are art sites and/or grinding grooves. Only four of the sites are artefact sites, which, without any additional systematic survey, supports the suggestions made that the wider area was not used for camping/occupation. This conclusion, however, is highly likely to have been biased by the focus of all earlier research on the location of art sites and rockshelters. Prior research in areas of similarly geology and topography have noted that spur and ridge crests were often used for travel routes by Aboriginal people and that small artefact scatter sites reflecting transient use by were found were these landforms occurred.

6.0 Predictive Model

The following predictive model has been formulated based on the information presented in **Sections 4.0** and **5.0** in an endeavour to indicate likely site types, site distribution and integrity for the Project area. It is assessed that:

- there is a very low likelihood that archaeological material/sites reflecting intensive use by Aboriginal people will be located in the Project area;
- if sites are located within the Project area they are likely to be small artefact scatters and isolated finds resulting from transient use of the area by Aboriginal people;
- small artefact scatter sites and isolated finds if present are most likely to be situated on the slightly elevated, low gradient, spur crests within 50 metres of Tinda Creek;
- if small artefact scatter sites and isolated finds are present they are most likely to be identified in areas with high levels of exposure in proximity to creek banks or in areas of prior disturbance;
- if artefacts are located they are likely to have been manufactured from quartz, fine grained siliceous materials, quartzite or basalt. Flakes, broken flakes and flaked pieces are the most likely artefact types;
- the nature of the sandy soil within the Project area and surrounds mean that sites containing stone artefacts are likely to have been affected by ongoing taphonomic processes which may have acted to destroy sites through erosion or to bury the artefacts through soil aggradation at the base of slopes or through bioturbation[9];
- within the area of the sedge swamp and unmodified slopes visibility is expected to be low. Vegetation cover is expected to be moderate to high based on reasonable rainfall experienced prior to survey;
- scarred trees may be present within wooded areas;
- grinding grooves and rock engraving sites are not likely to occur/to have been preserved in the Project area due to the unsuitable highly weathered nature of the sandstone and the limited area in which it outcrops;
- due to the low gradient topography rockshelters will not occur in the Project area;
- the spur crest and ridge crests surrounding the Project area were likely used as travel ways through the landscape. There are low-lying, low gradient spurs extending into the edges of the Project area from the surrounding ridges. It is possible that Aboriginal people passed through the Project area and used these spurs to access the ridges. Based on ethnographic information it is also possible that the Putty Road, passing to the west of the Project area was used by Aboriginal people as a travel way;
- the swampy portions of the Project area would have been attractive for aquatic resource gathering but would not have been a favourable location for Aboriginal people to camp in the past, as it would have been wet or damp, especially after periods of rainfall. The western portion of the Project area is likely to have contained more swamp land in the past, also making it unattractive for camping; and
- the Project area is more likely to have been used as a resource gathering area rather than for camping an activity that does not often result in large amounts of artefact discard and making occupation/use difficult to discern.

[9] Bioturbation refers to activities of animals and insects that act to move artefacts through the soil profile through activities such as burrowing or trampling.

7.0 Survey Methodology and Results

There have been two surveys undertaken for the Tinda Creek Project. A survey of Domain Areas 5, 6 and 7 was undertaken in 2011. A survey of Domain Areas 1, 2 and 3 was undertaken in 2013 when plans for the quarry were modified.

7.1 Survey Methodology and Registered Aboriginal Party Participation

The initial draft survey strategy for Domain Area 6 was prepared taking into consideration the DECCW *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b), as well as the limited size of the proposed impact area. As the impact area was deemed to be small, it was decided in consultation with the registered Aboriginal parties that total survey of the impact area was feasible and would be undertaken. Only the areas proposed for impact within the Project area were surveyed at that time as no other works were proposed.

The initial draft survey strategy was provided to the registered Aboriginal parties, as well as Aboriginal parties who were being invited to register an interest in the Project on 1 December 2010. Comment on the draft survey strategy was requested by 14 January 2011. During the comment period, two responses were received. One response (DTAC) agreed with the survey strategy, and one (DLO) did not agree with the survey strategy. DLO indicated that they did not agree with the survey strategy until a first walkover of the site was undertaken. On the day of the site inspection, 2 February 2011, Gordon Workman (DLO) indicated that DLO was happy with the total survey undertaken and that no additional survey was required.

Before the survey was undertaken on 2 February 2011, the proposed survey strategy was discussed on-site with the groups participating in the survey who were then asked to confirm that they agreed with the survey. All of the groups on site confirmed that they agreed with the proposed survey strategy.

The survey methodology approved by the registered Aboriginal parties in 2011 included:

- 100% pedestrian survey of the proposed Domain areas;
- based on the prediction that the creek banks, slopes within 50 metres of the creek line, the banks of the sedge swamp and the spur crests and high points will have the highest archaeological potential the survey would have an additional focus on surveying both sides of the creek and sedge swamp, where the ground becomes higher and drier; and
- additional areas surrounding the proposed impact areas would be surveyed if requested by the registered Aboriginal parties present on the day.

A second round of consultation regarding the proposed second survey for Domains 1, 2 and 3 was undertaken in May and June 2013. No changes to the total survey strategy were considered and 100% survey was once again proposed. The draft survey strategy was provided to the registered Aboriginal parties on 10 April 2013. Responses from registered Aboriginal Parties supporting the revised Domain 1, 2 and 3 survey strategy was received between 15 April 2013 and 15 May 2013. Yarrawalk replied on 15 May 2013 stating that they thought the time period (one day) given to survey the proposed extension domain areas was insufficient (refer to **Appendix B** for consultation log). Before the survey was undertaken on 16 February 2011, the proposed survey strategy was again discussed on-site with the

registered Aboriginal party representatives participating in the survey. There were no objections to the proposed survey strategy at this time and it was found that there was adequate time for total coverage of the proposed impact areas.

7.1.1 Field Survey Teams 2011

The survey of the proposed Domain Area 6 was undertaken on 2 February 2011 (refer to **Plates 1** to **5**) by a field team of two Umwelt archaeologists, and seven Aboriginal party representatives (with organisations/individuals involved listed in **Table 7.1**). The field team was accompanied by Darryl Thiedeke and Ray Bygraves from Hy-Tec.

Table 7.1 – Field Survey Team

Organisation	Representative/s
Darug Aboriginal Cultural Heritage Assessments	Gordon Morton and Tim Wells
Darug Custodial Aboriginal Corporation	Rhiannon Wright and Justine Coplin
Darug Land Observations	Gordon Workman
Darug Tribal Aboriginal Corporation	John Reilly
Yarrawalk	Ron Workman
Umwelt	Amanda Reynolds, Andy Roberts

7.1.2 Field Survey Teams 2013

The survey of the proposed impact areas 1, 2 and 3 (refer to **Plates 6** to **26**) was undertaken on 16 May 2013 by a field team of seven Aboriginal party representatives (with organisations/individuals involved listed in **Table 7.2**) and an Umwelt archaeologist. The field team was accompanied by Ray Bygraves from Hy-Tec.

Table 7.2 – Field Survey Team

Organisation	Representative/s
Darug Aboriginal Cultural Heritage Assessments	Gordon Morton
Darug Custodial Aboriginal Corporation	Tom Wright
Darug Tribal Aboriginal Corporation	John Reilly and Paul Goddard
Gunjeewong Cultural Heritage Aboriginal Corporation	Cherie Carroll Turrise and Bruce Turrise
Yarrawalk	Philip Khan
Umwelt Australia	Andy Roberts

7.2 Survey Coverage and Effective Visibility

A total of seven survey transects were conducted in the proposed extraction domain areas, two in 2011 and five in 2013, as illustrated on **Figure 7.1**. **Table 7.3** provides the survey coverage and effective coverage for each of the transects undertaken.

PLATE 1
View to west from start of Transect 1 at MGA 285992 6328061

PLATE 2
View of soil exposure in Transect 1 along drainage line

PLATE 3
View to west from MGA 285677 6328278 of Domain Area 6 at end of Transect 1

PLATE 4
View to north east from MGA 285593 6328018 of Domain area 6 in Transect 2

PLATE 5
View of exposure in Domain Area 6 in Transect 2 from MGA 285835 6328056

PLATE 6
Transect 3 view to north east showing regrowth vegetation above excavated drainage line at 286463 6328666

PLATE 7
Transect 3 view to north from MGA 286578 6328621 showing lower slopes, bracken undergrowth and open forest and grasslands. Note dense ground cover

PLATE 8
View of ground cover on Transect 3

PLATE 9
Lepidozamia sp. in Transect 3

PLATE 10
View to east from MGA 286674 6328554 showing vegetation diversity in Transect 3

PLATE 11
View to south west from MGA 286544 6328352 Transect 3

PLATE 12
Transect 5 view to south from MGA 285851 6327759

PLATE 13
View of ground surface in Transect 5

PLATE 14
Transect 5 view to west from MGA 285828 6327744 showing disturbance of soils

PLATE 15
Transect 5 view to west from MGA 285847 6327721 showing disturbance of soils

PLATE 16
View of exposure in Domain Area 6 in Transect 5 from MGA 285835 6328056

PLATE 17
Transect 5 view to east from MGA 285828 6327744 showing track from easement

PLATE 18
Transect 6 view to south from MGA 285456 6328332 showing cleared paddock on lowerslope.

PLATE 19
Transect 6 view of ground surface exposure at MGA 285224 63282662

PLATE 20
Transect 6 view to east from MGA 285081 6328359

PLATE 21
Transect 6. view to north west and creek at MGA 285045 6328261

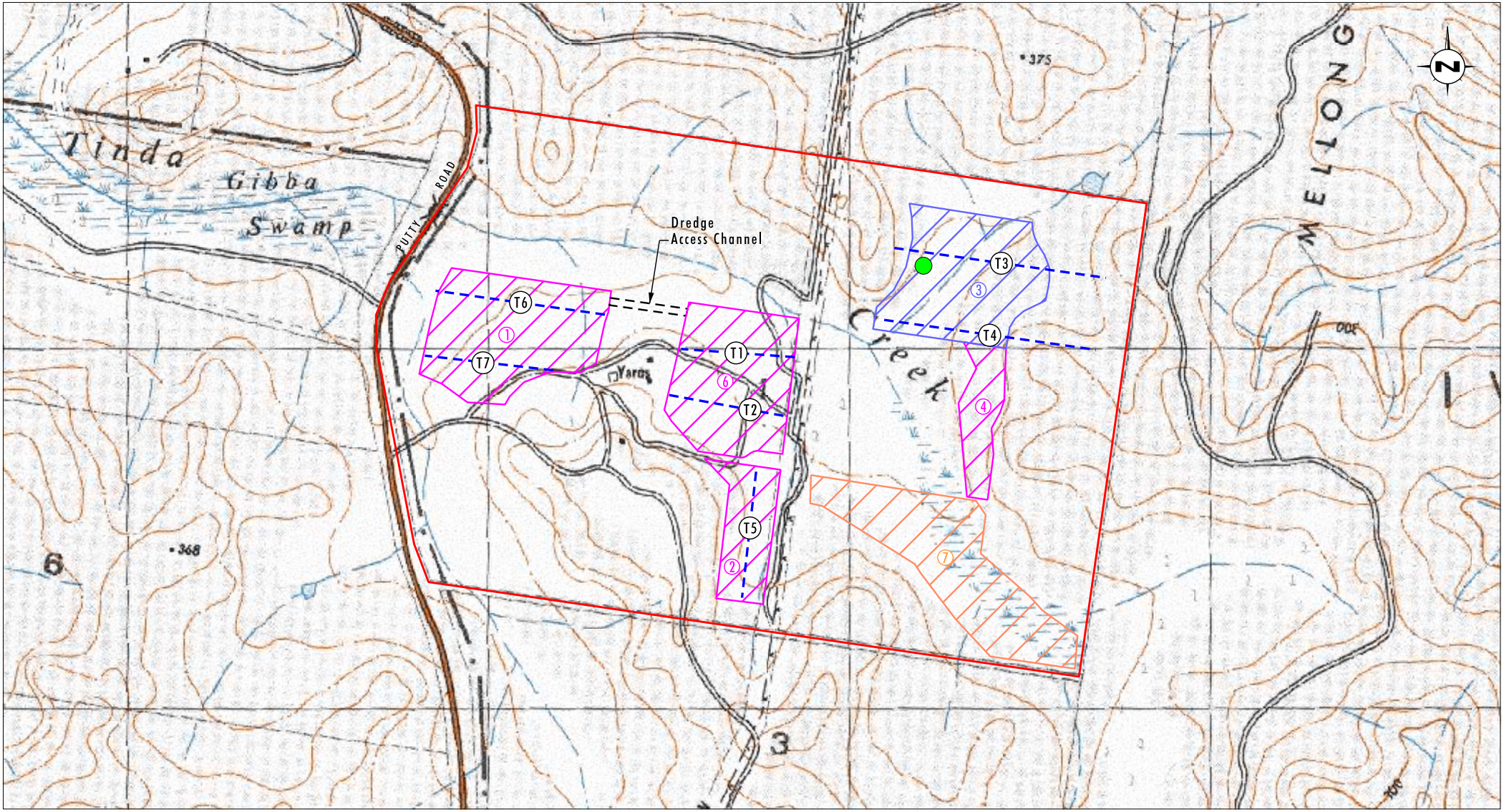
PLATE 22
Transect 7 view to east from MGA 284905 6328047

PLATE 23
Transect 7 view to north from MGA 286767 6328331 showing cleared lower slopes and remnant bloodwood vegetation

PLATE 24
Transect 7 view to north west from MGA 285120 6328061 showing access track and grasslands on lower slope

PLATE 25
Transect 7 ground surface from MGA 285120 6328061

PLATE 26
Transect 7 view to south east from MGA 285120 6328061 showing cleared paddock on gentle lower to midslope



Source: LPI NSW (2000)

Legend

- Project Area
- Proposed Extraction Area
- Domain 3 Extraction Area
- Domain 4 Extraction Area
- Survey Transect
- Artefact Scatter

File Name (A4): R13_V1/1731_178.dgn

FIGURE 7.1

Survey Transects and Site location

Table 7.3 – Survey Results and Effective Coverage

Domain Area	Transect #	Area (m^2)	Landform	General Visibility		Exposures	Effective Coverage	
				%	Area (m^2)	Area (m^2)	%	Area (m^2)
6	T1	35778.3	Simple slope, drainage line	1	357.8	143	1	500.78
6	T2	35988.5	Simple lower slope, drainage line	1	359.9	150	1.4	509.89
3	T3	82050	Simple slope, drainage line	3	2461.5	180	3.2	2641.5
3	T4	82050	Simple slope, drainage line	2	1641	270	2.3	1911
2	T5	58000	Slope of negligible gradient	4	2320	75	4.1	2395
1	T6	81300	Simple slope, drainage line	5	4065	90	5.1	4155
1	T7	81300	Simple lower slope to midslope	5	4065	200	5.2	4265
Total		**45,6466.8**			**15,270.2**	**1108**	**3.2**	**16,378.17**

As shown in **Table 7.3,** pedestrian survey of the proposed impact area totalling 45,6466.8 m^2 was undertaken. Effective coverage ranged between 1% and 5.2%. Following analysis of ground surface visibility, effective coverage within completed survey transects has been calculated at 16,378.17 m^2, or 3.2% of the total area.

Effective coverage ranged between 1.0 and 5.2% which is considered low and reflects the dense grass cover across the proposed impact areas. Effective coverage was highest in association with the simple slopes in Domain Area 1, where there were small areas of increased visibility on the lower slope. The effective coverage was lowest on the mid slopes in Domain Areas 6 and 3, due to increased grass cover.

Poor ground surface visibility throughout the Project area indicates that artefact scatters and isolated finds may go undetected during survey. The lower slope landforms in Areas 1, 3 and 6 contained colluvial sediments at the base of slope, but there were no indications that the these areas contained landforms that were suitable for PAD.

7.3 Results

One very small artefact scatter was located in a disturbed context in Domain Area 3 (refer to **Figure 7.1**). The artefact scatter (refer to **Plates 27** to **29**) comprised a mudstone core and quartz flaked piece located at MGA 286312E 6328413N. The artefacts were located within 7 metres of each other on the inside edge of a dam and had presumably spent some time under water before the dam wall was breached. They were currently located on disturbed sands subject to sheet wash erosion (refer to **Plate 30**). Each artefact was found on a pedestal of sand indicating active erosion was still occurring. The artefacts were clearly in a

PLATE 27
Artefact scatter located in disturbed context on edge of dam at MGA 286312 6328413

PLATE 28
Mudstone core tool at MGA 286312 6328413

PLATE 29
Quartz flaked piece located at MGA 286312 6328413

PLATE 30
View of excavated drainage line at 286463 6328666 showing soil profile (loose sands).

secondary depositional context presumably having washed into the dam from the adjacent slope or from upstream. The site was called Tinda Creek Artefact Scatter 1 and a site card has been completed and forwarded to the OEH for inclusion on the AHIMS register in compliance with Section 89A of the NPW Act (1974).

No sandstone outcrops were observed in the proposed extraction domain areas.

The decomposed bedrock in the proposed extraction domain areas was compact and a uniform bleached white. In the previously modified areas the sand was a darker orange colour and also formed of decomposed sandstone bedrock. High levels of disturbance due to infrastructure, landscape clearing and the existing quarrying operations had affected the soil profile integrity of the Project area as a whole. Observation of soil profiles in existing drainage ditches in Domain Area 3 identified high levels of bioturbation within the loose sandy soils.

The nature of the Project area, especially the sedge swamp in the south-east corner and creek line to the north-west indicated that it was likely to have had some Aboriginal food resource potential in the past and that it would have attracted transient hunters and gatherers. The ephemeral nature of these activities, however, is unlikely to have resulted in archaeologically visible artefactual material. The larger Mellong Swamp north of the Project area, however, would have been a more bountiful resource area and more suitable for occupation events which may be more visible archaeologically.

While the low spurs on the periphery of Project area may possibly have been used to access the more elevated ridges to the east it was also assessed as unlikely that this use would have resulted in the discard of sufficient artefactual material to make it archaeologically visible.

Overall, the survey indicated that while further Aboriginal artefacts could possibly occur in a subsurface context within the Project area, they will typically be at relatively low densities and of low complexity. Furthermore prior impacts to the Project area are high to very high suggesting that artefacts within areas subject to disturbance will be in a secondary depositional context and lack any spatial association and therefore will be of low archaeological value in terms of understanding the Aboriginal behaviour that resulted in their discard. This, however, does not reduce their Aboriginal cultural value.

7.4 Assessment of Predictive Model

The predictive model developed in **Section 6.0** identified the likely site types to occur within the Project area, and their likely distribution, content and integrity. The surveys undertaken in 2011 and 2013 supported the predictions posed in **Section 6.0** (refer to **Table 7.4**).

Table 7.4 – Assessment of Predictive Model

Predictive Model	Survey Results	Assessment of Predictive Model
There is a very low likelihood that archaeological material/sites reflecting intensive use by Aboriginal people will be located in the Project area.	Only two artefacts were located in the Project area.	The predictive model was supported.
If sites are located within the Project area they are likely to be small artefact scatters and isolated finds resulting from transient use of the area by Aboriginal people.	Only two artefacts were located in the Project area suggesting that transient use of the area is likely.	The predictive model was supported.

Table 7.4 – Assessment of Predictive Model (cont)

Predictive Model	Survey Results	Assessment of Predictive Model
Small artefact scatter sites and isolated find sites are most likely to be situated on the slightly elevated low gradient spur crests within 50 m of Tinda Creek.	Not possible to determine exact original location of artefact discard but likely to have been from foot slope of spur within 50 m of Tinda Creek.	The predictive model was supported.
If sites are present they are most likely to be identified in areas with high levels of exposure in proximity to creek banks or in areas of prior disturbance.	The two artefacts were located within a dam and in an area of high disturbance.	The predictive model was supported.
If artefacts are located they are likely to have been manufactured from quartz, fine grained siliceous materials, quartzite or basalt. Flakes, broken flakes and flaked pieces are the most likely artefact types.	One mudstone core and one quartz flake were located.	The predictive model was supported.
The nature of the sandy soil within the Project area and surrounds mean that sites containing stone artefacts are likely to have been effected by ongoing taphonomic processes which may have acted to destroy sites through erosion or to bury the artefacts through soil aggradation at the base of the slope or bioturbation.	Two artefacts were located that had washed into a dam from the slope above or from upstream.	The predictive model was supported.
Within the area of sedge swamp and unmodified slopes visibility is expected to be low. Vegetation cover is expected to be moderate to high based on reasonable rainfall experienced prior to survey.	The visibility within the Project area was very low, with high levels of grass, heath and sedge cover.	The predictive model was supported.
If any mature trees remain, scarred trees may be present.	No culturally scarred/carved trees were identified during the survey despite mature trees being present in Domain Area 3.	The predictive model was therefore not supported.
Grinding grooves and rock engraving sites are not likely to occur/to have been preserved in the Project area due to the highly unsuitable, weathered nature of the sandstone and limited area in which it outcrops.	No sandstone outcrops were located in the Project impact area. Therefore grinding grooves and/or engravings were not possible.	Part of the predictive model was supported in regard to there being no grinding grooves and/or engravings within the Project area.
Due to the low gradient topography rockshelters will not occur in the Project area.	No overhangs or features suitable for rockshelters were observed in the Project area.	The predictive model was supported.

Table 7.4 – Assessment of Predictive Model (cont)

Predictive Model	Survey Results	Assessment of Predictive Model
The spur crests and ridge crests around the Project area were likely used as travel ways through the landscape. There are low-lying, low gradient spurs extending into the edges of the Project area from the surrounding ridges. It is possible that Aboriginal people passed through the Project area and used these spurs to access the ridges. It is also possible that the Putty Road, passing to the west of the Project area was used by Aboriginal people as a travel way.	Only a tiny portion of the lower slopes of the low lying, low gradient spurs were within the proposed extraction domain areas. Visibility in these areas was poor.	This part of the predictive model could not be evaluated.
The swampy portions of the Project area would have been attractive for aquatic resource gathering but would not have been a favourable location for Aboriginal people to camp in the past, as it would have been wet or damp, especially after periods of rainfall. The western portion of the Project area is likely to have contained more swamp land in the past, also making it unattractive for camping.	Domain Area 3 had been highly disturbed and modified with drainage channels and a dam and its past morphology could not be identified. Areas 1, 2 and 6 offered drier land surfaces on the lower slopes of a spur. Foot slopes adjacent to Tinda Creek in the north of the Project area have similarly been modified for drainage.	Due to the highly disturbed nature of the Project area, this part of the predictive model could not be properly evaluated.
The Project area is likely to have been used as a resource gathering area.	A large number of economic floral and faunal resources were observed in the Project area.	The predictive model is supported.

8.0 Significance Assessment

The Burra Charter defines cultural significance in terms of aesthetic, scientific, historic and social values. Aboriginal cultural heritage is typically assessed according to its social and scientific significance; however other values may also be of importance. The assessment of cultural significance is critical in establishing mitigation and management strategies for cultural heritage (refer to Pearson and Sullivan, 1995:21).

The assessment of significance provides a guideline for determining appropriate mitigation and management strategies. The relationship between levels of significance and management strategies can be summarised as follows:

- High significance – the site should be conserved and protected from the impacts of development, where possible.
- Moderate significance – the site should be protected if possible, however, if impacts to the site are unavoidable, appropriate mitigation strategies should be implemented prior to impact.
- Low significance – the site should be protected if possible, however, if impacts to the site are unavoidable, the presence of the site should not impede the proposed development.

8.1 Aboriginal Cultural Significance

As Aboriginal cultural significance relates to the values of a site, place or landscape to Aboriginal people, it must be determined by Aboriginal people. The Aboriginal parties participating in the project therefore have the right and obligation for assessing the significance of their cultural heritage. In assessing this significance a range of factors may be considered and this can extend beyond the physical presence of a site and its contents. Archaeological material, cultural knowledge, natural resources and landscape may all be considered.

Leanne Watson (DCAC) made the following comments in relation to Aboriginal cultural significance of the Project area prior to the 2013 survey (refer to **Appendix B**).

> This area is highly significant to the Darug people due to the evidence of continued occupation, within close proximity to this project site there is a complex of highly significant sites. Sites are significant to us for the information that they hold and the connection to Darug people. Aboriginal people (Darug) had a complex lifestyle that was based on respect and belonging to the land, all aspects of life and survival did not impact on the land but helped to care for and conserve land and the sustenance that the land provided. As Darug people moved through the land there were no impacts left, although there was evidence of movement and lifestyle, the people moved through areas with knowledge of their areas and followed signs that were left in the landscape. Darug people knew which areas were not to be entered and respected the areas that were sacred. Yengo - Wollemi National parks are of extremely high significance due to the sites and dreaming that this area holds, our group has spent time in these areas documenting sites and stories and the significance is all over this area.

Gordon Workman (DLO) indicated in 2011 during the field survey that he was interested in the hills surrounding the Project area and if the proposed impacts were to extend to those areas he would like to be involved. Phil Kahn (Yarrawalk) indicated that all Aboriginal sites were significant and this region was known for its significant cultural sites.

8.2 Archaeological Significance

Archaeological or scientific significance is assessed according to principles outlined originally in Australia in the Burra Charter (1979), which was adapted from the UNESCO sponsored ICOMOS (International Council for Monuments and Sites) Venice Charter. The Burra Charter defines cultural significance as the 'aesthetic, historic, scientific or social value for past, present or future generations' of a place. This section assesses the site found within the Project area.

The archaeological significance of Aboriginal archaeological site is assessed according to its potential to contribute to the scientific understanding of past Aboriginal culture. This is generally termed archaeological research potential. Archaeological research potential is assessed by six criteria:

- **Rarity**: Whether the site (location, type, integrity, contents, and archaeological potential) is common or rare within the local and regional context.
- **Representativeness**: Whether the site (location, type, integrity, contents, and archaeological potential) is common or uncommon within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.
- **Integrity**: Whether the site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from subsurface investigation.
- **Connectedness**: Whether the site is connected to sites in the local area or the region through chronology, site type, the use of an unusual raw material, knapping technique/reduction strategy, and/or information provided by Aboriginal oral history.
- **Complexity**: Whether the site exhibits or is predicted to contain either a complex assemblage of stone artefacts in terms of artefact types and/or raw materials, or features such as hearths or heat treatment pits, activity areas.
- **Potential for archaeological deposit**: Whether the site has the potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that suggests its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

In practice, site integrity and complexity are the keys to archaeological significance. Sites with high structural and contextual integrity and/or complexity are generally rare in an open context in areas subject to prior disturbance. Where they do occur, they have the potential to provide significantly more information about the past than for example large numbers of artefact scatter sites in a disturbed context or that lack complexity.

8.2.1 Rarity

The archaeological significance of a site is assessed as higher if it is perceived as unique or rare within the local area and/or within the region; conversely, the archaeological significance of a site is assessed as lower if it is perceived as common within the local area and/or within the region. Rarity may relate to the type of site, the age of the site, the location of the site in the landscape, the preservation of the site (undisturbed sites are rare), or the nature of the site contents (it may contain artefact types or reduction strategies that are unknown or not well represented in other sites; it may contain raw material types or mixes of raw material types that are not usually found in sites or are unusually informative of Aboriginal resource use in that area, it may contain hearths or other features that are rarely preserved in sites or a distinct style of painted art or engravings not known elsewhere).

The artefact scatter (Tinda Creek Artefact Scatter 1) recorded during archaeological survey within the Project area is assessed as having overall low to moderate archaeological significance for rarity in a local and regional context based on the following:

- artefact scatters are not common known site types in the local area.

8.2.2 Representativeness

One of the aims of cultural heritage management is to ensure that a representative sample of sites is preserved for future generations. The objective is to preserve a sample of every type of site in the range of landscapes in which they occur to provide for future research that may have different agendas than those of the contemporary Aboriginal and archaeological community.

Tinda Creek Artefact Scatter 1 is assessed as having low archaeological significance for representativeness in the local and regional context, based on the following:

- it contains commonly occurring artefact types and raw material types; and
- as the artefacts are in a secondary depositional context their current location is not representative of any landscape and thus has no research potential.

8.2.3 Archaeological Integrity

The archaeological integrity or intactness of a site is important when assessing its significance and conservation value. A site that has been subject to minimal disturbance following the deposition of cultural materials contains considerably more information about environmental change and/or cultural sequences than a similar site that has been disturbed by natural processes or human actions.

Tinda Creek Artefact Scatter 1 is assessed as having low archaeological significance for integrity based on:

- the high degree of disturbance of the soil profile; and
- as the artefacts are in a secondary depositional context.

While it is possible to predict that the remnant A horizon soils within the Project area could contain very low numbers and densities of subsurface archaeological material, the history of disturbance as well as the sandy nature of the soil indicate that stratigraphic or spatial integrity is extremely unlikely in any portion of the Project area.

8.2.4 Connectedness

Connectedness refers to the relationship between sites within an area. Connectedness can be considered in a number of ways, at a number of scales. In its broadest sense, 'connectedness' refers to patterns linking sites within an area. Connectedness is often difficult to ascertain as the chronological sequence of use of surface sites is unknown at this stage of their assessment. Thus connectedness must be related to other features of sites and/or their assemblages. Sites may appear connected due to their location within the landscape (for example a series of sites associated with a terrain unit or landform element) or because of the nature of their assemblages (for example the use of similar raw materials and reduction sequences aimed at producing similar implement types) or the nature of features within the sites (for example art motifs or techniques, heat treatment pits, hearths, knapping floors).

In some cases, it may be that a series of sites within an area relates to a number of different activities which are in fact all components of a single land use system (for example a stone quarry, a camp site at which reduction of that stone takes place or a sandstone outcrop on which that stone is ground). Furthermore connections may be drawn between art sites with similar components of an artistic style. As mentioned above, the difficulty with assessing such an aspect of connectedness arises in demonstrating that all of the sites relate to the same period of time. While it is broadly possible to assign some artefacts to limited time periods (backed blades, Bondi points, eloueras, edge ground axes), these time periods still span thousands of years and the artefacts in question generally only represent a minor component of most assemblages and thus their presence cannot be used to make statements about the majority of the artefacts within any assemblage. Thus, the use of 'artefact types' to date surface assemblages remains too broad (e.g. 4000 to 7000 years for backed artefacts) to be useful in discussing the operation of a pattern of land use at any given time and to make judgements related to connectedness.

Tinda Creek Artefact Scatter 1 is assessed as having low archaeological significance for connectedness at both local and regional levels, as no recorded archaeological evidence provides any associations with other sites on the basis of the nature of the stone artefact assemblage recorded and as it is in a secondary depositional context.

8.2.5 Complexity

The complexity of a site is an indication of its ability to contribute information on the local Aboriginal culture. The complexity of an artefact scatter may be indicated by the number and/or density of stone artefacts it contains, or by the range of raw materials, knapping methods, reduction strategies and/or features that occur within it. Features that may occur within a site include knapping floors, heat treatment pits, hearths or other items that do not fall within the description of a generalised scatter of flaked stone artefacts.

Tinda Creek Artefact Scatter 1 is assessed as having low archaeological significance for complexity based on:

- the limited range of artefact numbers, types and raw materials present, which provide minimal information on raw material sourcing, knapping methods and reduction techniques;
- the absence of any exposed features such as hearths, knapping floors or heat treatment pits; and
- the context of the site – the artefacts have washed into the area and thus have no relationship to their find location and geomorphic processes and land use history identify that the current location of the artefacts is unlikely to have subsurface intact soil profiles and therefore no potential for subsurface features.

8.2.6 Potential for Archaeological Deposit

For a site to be able to contribute to an understanding of cultural sequences, it must contain distinguishable features or aspects that can be shown to have been created at different times within the context of that site or between sites. For such relationships to be possible the artefacts or features within the sites need to be located within a stratified context. It is also possible that a site may contain artefacts in a subsurface context that may not remain in a stratified context, but that may by their investigation add to the knowledge of Aboriginal use of the landscape/resource base in a more general sense. Sites of this kind are generally of high complexity.

Tinda Creek Artefact Scatter 1 is assessed as having low archaeological significance for potential archaeological deposit based on:

- the artefacts are not in their area of original discard;
- there is no site complexity; and
- the disturbed nature of the site area and soils, impacted by geomorphic processes and construction and use of the dam, water erosion and historic tree clearance.

8.2.7 Ranking of Criteria for Evaluating Archaeological Significance

A standardised approach to the evaluation of overall archaeological significance has been developed for this project, involving the use of numerical values for each significance criterion so that an overall significance assessment could be quantified. **Table 8.1** outlines the basis for numerical values attributed to each criteria set, which are as follows:

- low significance was afforded a score of 1;
- moderate significance was afforded a score of 2; and
- high significance was afforded a score of 3.

Overall significance was scored as follows:

- low significance 12 to 15;
- low to moderate significance 16 to 19;
- moderate significance 20 to 23;
- moderate to high significance 24 to 27; and
- high significance 27+.

Table 8.1 – Criteria Used in Evaluating Archaeological Significance

	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Rarity	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are common within the local and regional context.	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are common within the regional context but not the local context.	The location of the site within the landscape, its type, integrity, contents and/or potential for sub-surface artefacts, are rare within the local and regional context.
Representativeness	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is common within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local context but common in a regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site, when viewed in relation to its type, contents, integrity and location in the landscape, is uncommon within a local and regional context and sites of similar nature (or in better condition) are not already set aside for conservation within the locality or region.
Integrity	Stratigraphic integrity of the site has clearly been destroyed due to major disturbance/loss of topsoil. The level of disturbance is likely to have removed all spatial and chronological information.	The site appears to have been subject to moderate levels of disturbance, however, there is a moderate possibility that useful spatial information can still be obtained from sub-surface investigation of the site, even if it is unlikely that any useful chronological evidence survives.	The site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from sub-surface investigation of the site, even if it is still unlikely that any useful chronological evidence survives. (In cases where both spatial and chronological evidence is likely to survive the site will gain additional significance from high scores for rarity and representativeness).

Table 8.1 – Criteria Used in Evaluating Archaeological Significance (cont)

	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Connectedness	There is no evidence to suggest that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and/or • information provided by Aboriginal oral history.	There is some evidence to suggest that the site is connected to other sites in the local area or the region through one of the following: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; or • information provided by Aboriginal oral history.	There is good evidence to support the theory that the site is connected to other sites in the local area or the region through two or more of the following: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and/or • information provided by Aboriginal oral history.
Complexity	The site does not exhibit and is not predicted to contain either of the following in a sub-surface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials (including use of local and imported raw materials) and/or knapping techniques/ reduction strategies; and/or • features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain one of the following in a sub-surface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and/or • features such as hearths or heat treatment pits, activity areas.	The site exhibits or can be predicted to contain both of the following in a sub-surface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and • features such as hearths or heat treatment pits, activity areas.

Table 8.1 – Criteria Used in Evaluating Archaeological Significance (cont)

	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
PAD	The site does not have or has only a low potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that suggests its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a moderate potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site has a high potential to contain sub-surface archaeological material that has stratigraphic integrity or is of a nature that its sub-surface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

Table 8.2 lists the numerical values attributed to Tinda Creek Artefact Scatter 1 for each archaeological assessment criterion. The overall archaeological significance of the artefact scatter is considered to be low.

Table 8.2 – Archaeological Significance Assessment

Site Name	Rarity		Representativeness		Archaeological Integrity		Connectedness	
	Local	Regional	Local	Regional	Local	Regional	Local	Regional
Tinda Creek Artefact Scatter 1	2	1	1	1	1	1	1	1
	Complexity		**Potential for Archaeological Deposit**		**Overall Archaeological Significance**			
	Local	Regional	Local	Regional	Score		Significance	
	1	1	1	1	13		low	

8.3 Significance of the Landscape

The Project area is surrounded by the Yengo and Wollemi National Parks, which are traditionally extremely significant to Aboriginal people and all Australians as a component of the Greater Blue Mountains World Heritage Area inscribed on the World Heritage List in 2000. Significant art, occupation and ceremonial sites are scattered throughout the region.

The high levels of historic disturbance of the Project area due to infrastructure, landscape clearing and the existing quarry have affected the archaeological integrity of the Project area. It is estimated that approximately 10% of soils in the overall Project area have been modified with dams and drainage ditches and are assessed as having no archaeological significance as they have no potential to contain sites which could address research questions or provide greater insight into Aboriginal society or how Aboriginal people utilised the landscape and its resources.

The remainder of the Project area has been subject to lower levels of disturbance, associated with tree clearance, bioturbation and erosion and is assessed as having low potential for archaeological significance based on the results of the survey (refer to **Section 8.0**) and the predictive model (refer to **Section 6.0**).

9.0 Impact Assessment and Management Options and Recommendations

This section of the report discusses the impact of the development of the proposed extraction domain areas on Aboriginal cultural and archaeological values. It also provides a discussion of management options and management recommendations.

9.1 Impact Assessment

The current proposal involves the removal and stockpiling of topsoil progressively over proposed extraction domain areas and the establishment of dredge ponds or progressively extending the existing dredge pond into the proposed extraction domain areas and bulldozing and/or hydraulically excavating peripheral sand into the dredge pond for extraction in areas where dredging alone is not feasible.

The principal concern regarding the management of these development impacts is in respect to the management of Tinda Creek Artefact Scatter 1 which is located in a disturbed context in Domain Area 3. Impact to the exposed Aboriginal artefacts must be avoided or the appropriate approvals must be obtained.

9.2 Management Options

There are a number of basic management options possible:

1. Change the quarry extraction plans to avoid Tinda Creek Artefact Scatter 1 and provide for its protection during quarrying activities.

2. Undertake further archaeological investigation in the area of Tinda Creek Artefact Scatter 1 to better understand the archaeological character of any subsurface deposits.

3. Allow for the collection of the two artefacts from Tinda Creek Artefact Scatter 1 without the requirement for further archaeological investigation.

4. Allow for the destruction of the Tinda Creek Artefact Scatter 1 site without further archaeological investigation.

Option 1 would impact on the future feasibility of the sand quarry operation an outcome that is not assessed as warranted as the area has already undergone substantial historic impact. It is noted however that Tinda Creek Artefact Scatter 1 will not be disturbed if Domain 7 is quarried rather than Domain 3.

As the artefact scatter is in a highly disturbed context and does not retain any archaeological integrity – Option 2 – further archaeological investigation is also not warranted. As the artefacts are of significance to the registered Aboriginal parties for this Project Option 4 is not assessed as appropriate, resulting in Option 3 being assessed as the most appropriate management outcome.

It is noted that as this is a state significant development it will be necessary for the artefact collection to be undertaken in compliance with a stand-alone ACHMP or as part of a broader EMP.

9.3 Management Recommendations

The following recommendations apply to the proposed extraction domain areas (refer to **Figure 1.2**). Based on the outcomes of this assessment it is recommended that:

- archaeological subsurface investigation is not necessary within the proposed extraction domain areas, prior to the quarry expansion proceeding;

- Hy-Tec in consultation with the registered Aboriginal parties prepare an ACHMP/section of an EMP for the proposed quarry extension area which will allow for management (collection) of the artefacts located in the Tinda Creek Artefact Scatter 1 site in Domain 3 and to provide for future management of Aboriginal cultural heritage issues should they arise across the broader Project area. It is noted that if Domain 3 is not quarried, the Artefact Scatter will not be disturbed by quarrying;

- If Domain 3 is to be quarried, the artefacts located within the Tinda Creek Artefact Scatter 1 site are collected using the methodology set out in **Section 9.5.1** and under the protocols and procedures of the approved ACHMP;

- in the unlikely event that previously unrecorded artefactual material is exposed during ground disturbance works within the quarry extension area, work must cease in the vicinity of the artefactual material and the registered Aboriginal parties contacted and the artefactual material managed in accordance with the ACHMP using the methodology set out in **Section 9.5.2**;

- in the highly unlikely event that human/possible human skeletal material is uncovered during quarry works associated with the proposed extraction domain areas or by natural erosion processes within any part of the Project area, all work likely to affect the human skeletal material shall cease immediately. Hy-Tec must notify the NSW Police Department (police coroner) in the first instance. The area then becomes a crime scene and is under the control of the NSW Police Department until the Police have declared otherwise. If the Police determine the skeletal remains are not of a criminal nature then Hy-Tec must notify OEH (Enviroline 131555), a suitably qualified forensic archaeologist/anthropologist and the relevant Aboriginal parties to determine an appropriate course of action prior to the recommencement of work in the area;

- in the highly unlikely event that sandstone with evidence of Aboriginal engravings or grinding grooves is exposed during ground disturbance works within the proposed extraction domain areas, work should cease in the immediate area and the registered Aboriginal parties and the OEH should be contacted immediately to discuss an appropriate course of action prior to the recommencement of work in the area;

- to mitigate the impact to the Aboriginal cultural values of the area, remediation of the existing quarry and proposed impact areas should be undertaken following cessation of quarrying activities; and

- in order that Hy-Tec employees/contractors working on the Project have the skills to identify the abovementioned site types an Aboriginal Cultural Heritage Training Package should be prepared in consultation with the registered Aboriginal parties to be provided as part of the quarry induction process.

In response to a review of the draft report by the registered Aboriginal parties (refer to **Appendix B** for full comments):

- Gordon Morton of Darug Aboriginal Cultural Heritage Assessments supported the management recommendations within the draft report.

- Gordon Workman of Darug Land Observations supported the management recommendations within the draft report (Gordon Workman pers. comm. September 2013).

No further comments were provided by the registered Aboriginal parties following the review of the draft report (refer to Consultation Log provided in **Appendix B**).

9.4 Care and Control of Artefacts

Consultation was undertaken with the registered Aboriginal parties as part of the preparation of this report in relation to Care and Control of the artefacts located within the Tinda Creek Artefact Scatter 1 site in Domain Area 3 and any other artefacts that may be recovered during quarry operations (if any) under the protocols of the ACHMP/EMP.

Only one response was provided in relation to Care and Control of any artefacts recovered from the Tinda Creek Artefact Scatter 1 site or during works in the quarry extension area. Gordon Morton of Darug Aboriginal Cultural Heritage Assessments requested that any artefacts recovered from the quarry extension area be reburied within country and outside the proposed impact areas. The artefacts to be collected using the methodology set out in **Section 9.5.1** and under the protocols and procedures of an approved ACHMP. This recommendation will be incorporated into the ACHMP.

9.5 Aboriginal Cultural Heritage Management Plan (ACHMP)

As the Tinda Creek project is defined as a state significant project there is no requirement to apply to OEH for an AHIP for impact to Aboriginal archaeological sites, instead management and impacts to known and unknown sites/artefacts are usually managed in compliance with an ACHMP approved by the DP&E.

The ACHMP will be required to detail management strategies for the Tinda Creek Artefact Scatter 1 site and for any future Aboriginal objects encountered during quarry works (if any). The ACHMP will be prepared in consultation with the registered Aboriginal Parties and clearly identify the responsibilities of all parties involved – Hy-Tec, registered Aboriginal parties, archaeologists – and designate timeframes for required heritage management processes.

Section 9.5.1 outlines a methodology for the collection of the known surface artefacts from the Tinda Creek Artefact Scatter 1 site for incorporation into the ACHMP. **Section 9.5.2** outlines a methodology for any currently unknown artefacts that may be located during the proposed extraction of the domain areas (if any).

9.5.1 Surface Artefact Collection Known Artefacts

This methodology relates to the collection of known artefacts from the Tinda Creek Artefact Scatter 1 site.

The recommended methodology for surface artefact collection is as follows:

- inspection of the designated collection area by a field team consisting of an archaeologist and registered Aboriginal party representative(s);

- flagging of all identified surface artefacts with high visibility flags;

- recording of surface artefact locations using a handheld GPS. A site plan will also be made to document distribution of artefacts within the collection area;
- a photographic record will be prepared of the site location, with artefact locations identified by high visibility flags;
- all collected artefacts will be bagged and tagged to OEH standards; and
- the artefacts will be managed in accordance with the agreed Care and Control management procedure.

9.5.2 Artefact Collection – Previously Unknown Finds

This methodology relates to the collection of any previously unknown artefacts from the quarry extension area that may be located during ground disturbing works. It is reiterated that this is assessed as unlikely.

- Work should cease in the immediate area and the registered Aboriginal parties and a suitably qualified archaeologist should be contacted immediately to inspect the find/finds and to ascertain its/their Aboriginal cultural and archaeological significance.
- If assessed of low Aboriginal cultural and archaeological significance it will be collected under the protocols and procedures of the approved ACHMP using the following methodology:
  - inspection of the designated collection area by a field team consisting of a suitably qualified archaeologist and registered Aboriginal party representative(s);
  - flagging of all identified surface artefacts with high visibility flags;
  - recording of surface artefact locations using a handheld GPS. A site plan will also be made to document distribution of artefacts within the collection area;
  - a photographic record will be prepared of the site location, with artefact locations identified by high visibility flags;
  - all collected artefacts will be bagged and tagged to OEH standards; and
  - the artefacts will be managed in accordance with the agreed Care and Control management procedure.
- If the artefacts are assessed as having moderate to high Aboriginal cultural or archaeological significance the OEH will be informed and a suitable methodology for their collection/salvage will be prepared in consultation with the OEH, the registered Aboriginal parties and a suitably qualified archaeologist.

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