



**AUSTRALIAN
ZIRCONIA LTD**

(A wholly owned subsidiary of Alkane Resources Ltd)

Dubbo Zirconia Project

Aboriginal Heritage Assessment

Prepared by

**OzArk Environmental & Heritage
Management Pty Ltd**

August 2013

**Specialist Consultant Studies Compendium
Volume 3, Part 8**

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(A wholly owned subsidiary of Alkane Resources Ltd)

Aboriginal Heritage Assessment

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THE ENVIRONS OF THE DUBBO ZIRCONIA PROJECT, AT THE "KARINGLE" PROPERTY.

PART 8: ABORIGINAL HERITAGE ASSESSMENT

Dubbo Zirconia Project

August 2013

**Report Prepared by
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FOREWORD

It is noted that following the completion of field survey for the Dubbo Zirconia Project (DZP), the DZP Site boundary was modified to account for a larger mining lease application area. OzArk can confirm that the additional area of the modified DZP Site boundary (357ha) does not include any disturbance and that field survey includes all areas where disturbance is proposed.

The alignment of the Macquarie River Water Pipeline was also modified slightly following the completion of field survey to accommodate a possible future centre pivot for irrigation on the "Mia Mia" property. OzArk can confirm that the realignment would not require any disturbance to remnant native vegetation.

Appendix 6 provides figures comparing the modified DZP Site boundary and Macquarie River Water Pipeline alignment against the boundary and alignment provide at the time of field survey.

As the modification to the DZP Site boundary and Macquarie River Water Pipeline followed the completion of field survey, **Figures 6, 8, 10, 11, 39, 52 and 53** retain the DZP Site boundary as nominated at the time of field survey. OzArk confirm, however, that the assessment and conclusions of this report incorporate the DZP Site Boundary and Macquarie River Water Pipeline as presented on **Figures 2 and 3**.

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EXECUTIVE SUMMARY

The Dubbo Zirconia Project (DZP; the Proposal) comprises the development, mining and processing of zirconium, niobium and rare earth element resources located near Toongi, approximately 25km south of the town of Dubbo (**Figure 1**).

The Proposal would comprise a small scale, open cut mine supplying approximately 1Mt of ore containing rare metals (zirconium and niobium) and rare earth elements (REE's) to a processing plant annually. The Proposal also incorporates the following four component areas which are collectively referred to as 'The Application Area'.

- The DZP Site.
- Toongi-Dubbo Rail Line and Natural Gas Pipeline Corridor.
- Macquarie River Water Pipeline.
- Public road network (Toongi Road and Obley Road).

The term 'DZP Site assessed area' reflects a very recent change to the DZP Site and Macquarie River Water Pipeline. The DZP Site assessed area includes an area of 2,507 hectares and reflects the DZP Site boundary prior to an enlargement by the Applicant to account for a larger mining lease application area. The DZP Site has been enlarged by an additional 357 hectares (refer to **Figures 1** and **2**), however, it is noted that the DZP Site assessed area includes all areas of proposed disturbance. The alignment of the Macquarie River Water Pipeline has also been modified slightly following the completion of field survey, however, it is noted that the realigned section occurs entirely on previously cleared paddocks (see **Figure 3**). **Appendix 6 (Figures 54 and 55)** show the relationship between the DZP Site assessed area and the DZP Site.

Australian Zirconia Ltd (Alkane; the Applicant) has commissioned R.W. Corkery & Co Pty Ltd (RWC) to assemble a team of specialists to provide an assessment that will assist in the design of the Proposal and to undertake an assessment of the environmental impacts of the Proposal. OzArk Environmental & Heritage Management Pty Ltd (OzArk) has been commissioned by RWC to provide an assessment of the Proposal's impacts to Aboriginal heritage.

Surveys were conducted by OzArk accompanied by representatives from Dubbo Local Aboriginal Land Council, Wirrimbah Direct Descendants and Binjang Wellington Wiradjuri Heritage Survey on multiple occasions between May 2012 and February 2013.

A total of 52 Aboriginal sites have been recorded in the Study Area. 33 of these sites have been recorded as part of this study and 19 were recorded by a previous investigation of the proposed site of the DZP (**Figure 10; Table 8**). The newly recorded sites include a Potential Archaeological Deposit (PAD 12) that has been designated in an area where no artefacts were recorded.

Fourteen (14) sites are likely to be totally or partially impacted by the Proposal and 11 sites are adjacent to the impact footprint and may be indirectly impacted. Two sites with associated PADs are within the impact footprint and were investigated through test excavation (OzArk 2013). No intact or substantial archaeological deposits were found at these sites and no other PADs are to be impacted by the Proposal. One site, outside the proposed impact footprint, would require monitoring to ensure that it is not harmed by the Proposal. Twenty six (26) sites would be avoided by the Proposal. Impacts associated with the Proposal must be considered as permanent. The recommendation for management of these sites falls under three management groups (**Section 6.3; Table 13**).

- Management Group 1: 26 sites (including one PAD) are currently located outside of the impact footprint. For these sites and for any additional sites where avoidance of harm be the chosen management, the following is recommended:
 - Inductions should be provided to workers as to the location and legislative protection of these sites. These inductions should be documented.
 - Appropriate measures should be in place to protect the site such as marking sure that all future activities avoid impacts to a site's location.
- Management Group 2a: Nine sites are currently under threat of harm from the proposed impacts that were assessed as being unlikely to yield further significant data about Aboriginal heritage. As these sites were determined to hold low scientific/archaeological values, the management recommendations are as follows.
 - An *Aboriginal Cultural Heritage Management Plan* (ACHMP), including a Statement of Commitments (SoC), documenting how each site is to be managed should be prepared following consultation undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs).
 - The ACHMP and SoC should include measures for the collection / salvage of surface artefacts from sites prior to works commencing.
 - A Care Agreement covering any artefacts from the salvage would be included in the ACHMP.
- Management Group 2b: Five sites (all culturally modified trees) are currently under threat of harm from the proposed impacts. Specific management of these sites include are as follows.
 - There are no archaeological deposits associated with these sites so further archaeological investigation is not warranted.
 - The scars should be recorded to archival quality prior to removal.
 - Salvage of these sites is not an archaeological recommendation, however it is the desire of the RAPs to retain the scar-bearing portions of the trunks. Should the Applicant and RAPs agree to salvage one or more of the scar-bearing portions of the trees, the methodology and Care Agreement would form part of the ACHMP.
- Management Group 2c: Eleven (11) sites are located closely adjacent to the proposed impact footprint and specific recommendations are applied to them to ensure that these sites are not impacted by the proposed works (**Section 6.2**).
- Management Group 2d: One site is located outside the proposed impact footprint but there remains the potential that the site could be indirectly impacted. Specific recommendations are applied to this site to ensure that these sites are not impacted by the proposed works (**Section 6.2**).
- Management Group 3: This group is now redundant (as test excavation is now complete) and no further sites are subject to Group 3 management.
- Proposed works should remain limited to the Application Area as assessed in the current report so as to eliminate the chance of encountering Aboriginal objects in unassessed areas.
- Should any other objects or Aboriginal sites be identified during the course of construction *The Unanticipated Finds Protocol* in **Appendix 5** should be followed.

- As this Proposal falls under Part 4 Division 4.1 of the EP&A Act, an AHIP is not required for the salvage of heritage sites if development consent is issued. Rather, approval for the undertakings should be sought through a Statement of Commitments and eventually incorporated into an *Aboriginal Cultural Heritage Management Plan*.
- One copy of this report should be sent to:
 - Binjang Wellington Wiradjuri Heritage Survey
 - Dubbo Local Aboriginal Land Council
 - Diane Stewart
 - Wirrimbah Direct Descendants
- Two copies of this report should be sent to:
 - Office of Environment and Heritage, AHIMS Registrar, Attention: Cheryl Brown, PO Box 1967, Hurstville, NSW, 1481.

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1 INTRODUCTION

1.1 BRIEF DESCRIPTION OF THE PROPOSAL

The Dubbo Zirconia Project (DZP; the Proposal) comprises the development, mining and processing of ore containing rare metals, zirconium and niobium, and rare earth elements (REEs) near Toongi, approximately 25km south of Dubbo (**Figure 1**).

The Proposal would comprise a small scale, open cut mine supplying approximately 1Mt of ore containing rare metals (zirconium and niobium) and rare earth elements (REE's) to a processing plant annually. The Proposal also incorporates the following four component areas which are collectively referred to as 'The Application Area'.

- The DZP Site.
- Toongi-Dubbo Rail Line and Natural Gas Pipeline Corridor.
- Macquarie River Water Pipeline.
- Public road network (Toongi Road and Obley Road).

The term 'DZP Site assessed area' reflects a very recent change to the Project Site boundary post OEH adequacy assessment. The DZP Site assessed area contains the preceding project site area of 2,507 hectares. This area was entirely assessed. The Application Area is now 2,864 hectares, reflecting the inclusion of an additional 357 hectares. This extended Application Area is shown in **Figure 54 (Appendix 6)** and **Figure 2**. The additional 357 hectares remain unassessed and will not be affected by the Proposal.

Australian Zirconia Ltd (AZL; the Applicant) has commissioned R.W. Corkery & Co Pty Ltd (RWC) to assemble a team of specialists to provide an assessment that will assist in the design of the Proposal and to undertake an assessment of the environmental impacts of the Proposal. OzArk Environmental & Heritage Management Pty Ltd (OzArk) has been commissioned by RWC to provide an assessment of the Proposal's impacts to Aboriginal heritage.

Associated with the Proposal would be the construction of a 132kV Electricity Transmission Line (ETL) from the Geurie – Dubbo 132kV power line. This 132kV ETL Corridor is to be assessed separately to the Proposal under Part 5 of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and is not considered as part of this Aboriginal Heritage Assessment.

1.2 TERMINOLOGY

The following terminology is used in this report to classify the Proposal:

- **Application Area:** The area which encompasses all aspects of the Proposal, including land that is owned by AZL but is not within the current design of the impact footprint.
- **Study Area:** The area which was studied for this assessment. This includes the impact footprint and some areas that are outside the Application Area which were surveyed before the current Application Area was finalised.
- Specific components of the Application Area are referred to as follows (refer to **Figures 1 to 5**).
 - The land on which the proposed mining, processing, waste management and associated operations would occur is referred to as the DZP Site (**Figure 2**).

- A proposed water pipeline between the processing plant of the DZP Site and Macquarie River is referred to as the Macquarie River Water Pipeline (**Figure 3**).
- The Dubbo East Junction to Toongi section of the Dubbo-Molong Rail Line to be re-instated is referred to as the Toongi-Dubbo Rail Line. A Compressed Natural Gas (CNG) pipeline is proposed for installation within this rail corridor, extending beyond Dubbo East Junction to Purvis Lane where the APA Group owned Central Wes Pipeline crosses the Merrygoen Rail Line. Combined this component of the Application area is referred to as the Toongi-Dubbo Rail Line and Gas Pipeline Corridor (**Figure 4**).
- The proposed realignment of portions of Obley Rd between the DZP Site and Dubbo are referred to as the Obley Road Alignment (**Figure 5**).
- **Survey Unit:** Discrete areas subject to physical inspection, with boundaries delineated by any combination of natural (topography, for example) and artificial (fences, for example) features, as well as arbitrary positions (impact zones).

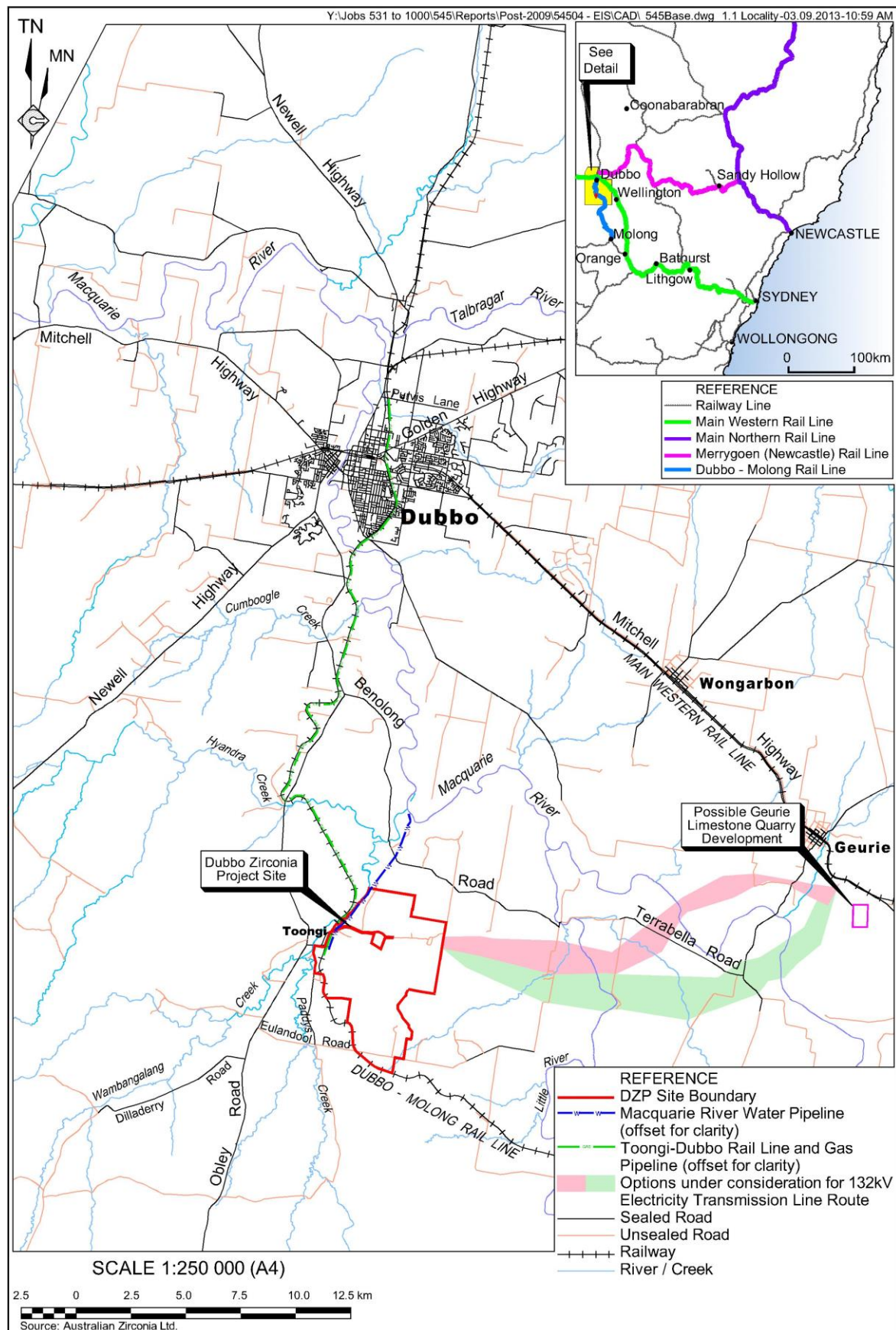
1.2.1 Location

The Proposal is located within the Dubbo Local Government Area (Dubbo LGA), in the Orana Region of New South Wales (**Figure 1**). The DZP Site extends over portions of seven farming properties to the north, east and south of the Village of Toongi (**Table 1**). The Macquarie River Water Pipeline traverses two farming properties on and to the north of the DZP Site (**Figure 3**). The Toongi-Dubbo Rail Line and Gas Pipeline Corridor would remain within the relevant rail easements (**Figure 4**). The Obley Road Realignment would occur wholly within the road reserve (**Figure 5**), i.e. no resumption of freehold land would be required and the properties include privately owned land and Crown land.

Table 1: Application Area Land Titles

DZP Site		Macquarie River Water Pipeline	Toongi–Dubbo Rail and Gas Pipeline Corridor
Part Lot 311 DP595631	Lot 271 DP593668	Lot 311 DP595631	Toongi – Dubbo Rail Reserve
Part Lot 35 DP753220	Part Lot 1 DP133581	Lot 27 DP753220*	Purvis Lane Reserve
Part Lot 18 DP753252	Lot A & B DP439352	Lot 62-63 DP753220*	Public Road Network
Lot 19 DP 753252	Part Lot A DP391069	Lot 30 DP753220*	Toongi Road Reserve
Lot 55 DP 753252	Lot B DP 391069	Lot 1-4 DP753226*	Obley Road Reserve
Lot X DP 405495	Lot 211 DP595631	Various public / crown road reserves	
Lot 1 DP818802	Lot 50 DP 753252		
Lot 7300 DP1149010 (Licensed for grazing)			
Unformed ‘Paper’ Road (Crown Land) separating Lot 311 DP55631 and Lots A & B DP439352			
Unformed ‘Paper’ Road (Dubbo City Council) separating Lot 1 DP818802 and Lot 7300 DP 1149010			
* By negotiation with landowner			

Figure 1: Locality Plan



1.3 PROPOSED WORKS

1.3.1 Objectives

The principal objectives of the Proposal are to:

- maximise the recovery of the rare metals and REE's contained within the Toongi ore body through efficient of mining and processing operations;
- minimise the consumption of water, power and chemical reagents required by the processing operations;
- minimise the disturbance footprint associated with the proposed activities;
- ensure that all waste by-products are managed to minimise the risk of pollution (short-term impact) or contamination (long-term impact);
- establish, re-establish and/or upgrade local/regional infrastructure for the purposes of the Proposal but which could also have beneficial uses for other industry/activities;
- undertake all activities in an environmentally responsible manner to ensure compliance with relevant criteria/goals or reasonable community expectations; and
- work cooperatively with the surrounding community, including the Aboriginal stakeholder groups and traditional owners, to build socio-economic capacity within communities affected by the Proposal.

1.3.2 Description of the Proposed Activities

As noted in **Section 1.1**, the Application Area for the Proposal incorporates four distinct areas, namely:

- the DZP Site;
- Toongi-Dubbo Rail Line and Natural Gas Pipeline Corridor;
- Macquarie River Water Pipeline; and
- Obley Road realignment.

The following provides an overview of the activities to be undertaken within each of these areas.

DZP Site Operations

The following provides an overview of principal components and activities to be undertaken on the DZP Site (and illustrated on **Figure 2**).

- Extraction of approximately 19.5Mt of ore at a maximum rate of 1.1Mt per year from a shallow open cut developed to a maximum depth of 32m (355m AHD) (remaining above the groundwater table). At the proposed rate of mining, the open cut design proposed would provide for a mine life of 20 to 22 years.
- Extraction and placement of approximately 3.5Mt of waste rock (weathered material or rock containing insufficient grades of rare metals or REEs for processing) within a small waste rock emplacement (WRE) to the southwest of the open cut.
- Haulage of ore to a Run-of-Mine (ROM) Pad for crushing and grinding.

- Processing of the crushed and ground ore by:
 - Sulphation roast of ore and leaching to dissolve sulphated metals.
 - Solvent extraction, precipitation, thickening, washing and drying of the various rare metal and REE products.

The sulphuric acid required as part of the sulphation process would be manufactured within the DZP processing plant from imported raw sulphur.

- Construction and operation of a rail siding from the Toongi-Dubbo Rail Line and a Rail Container Laydown and Storage Area for the unloading and temporary storage of reagents and loading of products for despatch.
- Other reagents would be transported to the DZP Site via the public road network, with sections of Obley Road and Toongi Road to be upgraded to accommodate the proposed increase in heavy vehicle traffic.
- Mixing of solid residues produced by the processing of the ore with crushed and washed limestone and transportation via conveyor to a Solid Residue Storage Facility (SRSF).
- Pumping of water used in the processing operations, which cannot be recycled, to a Liquid Residue Storage Facility (LRSF), comprising a series of terraced and lined crystallisation cells.
- Recovery and disposal of an estimated 6.7Mt of salt which would accumulate within the LSRF within a series of Salt Encapsulation Cells adjoining the WRE and SRSF.
- Other ancillary activities including equipment maintenance, clearing and stripping of the areas to be disturbed and rehabilitation activities.

The maximum development footprint on the DZP Site would be approximately 808ha (within the DZP Site of 2 864ha; see **Figure 2**). Component areas of disturbance are as follows:

- Open Cut Mine – 40.3ha.
- Waste Rock Emplacement Area – 20.4ha.
- ROM Pad – 4.2ha.
- Processing Plant and DZP Site Administration Area (incorporating the processing plant and associated reagent storage areas, rail siding and container laydown areas and site offices and administration complex) – 43.3ha.
- Solid Residue Storage Facility – 102.8ha.
- Liquid Residue Storage Facilities (Evaporation Ponds) – 425.4ha.
- Salt Encapsulation Cell – up to 34.6ha.
- Soil Stockpile Areas – up to 129.4ha.
- Internal Haul Roads – 7.3ha

The ore body to be mined is a roughly elliptical stock in shape with outcrop dimension of 600m x 400m. Exploration completed by AZL has identified the ore body extends below a thin veneer of soil and recent sediments to be approximately 900m (east-west) x 500m (north-south) (surface area of 36ha) and appears to be a near vertical body of indeterminate depth.

While there is limited scope to modify the area of impact associated with the open cut, in order to minimise the impact of the mining operations, the Applicant has designed the mining sequence such that the initial 10 year mine plan develops the western half of the open cut with the eastern half developed and mined during the second 10 year mining period (see **Figure 2**).

The size and location of the other components of the DZP Site have been the subject of more detailed review, with impact minimisation a key consideration.

Macquarie River Water Pipeline

Processing operations would require up to 4.05GL of water annually which would be sourced (partially or completely) from the Macquarie River (under licence) and transferred to the DZP Site by water pipeline.

Figures 3 and 55 (Appendix 6) provide details of the proposed alignment of the Macquarie River Water Pipeline. The proposed alignment of the northern section of the pipeline has been recently altered so that is now up to 150m east of its previous position (**Section 4.5**). The key features of this are as follows.

- A pumping station which incorporates a dual water inlet, wet well and vertical mounted axial flow pump configuration.
- A 400mm to 450mm diameter HDPE pipeline within an embedded trench.

The easement to be created for the Macquarie River Water Pipeline Corridor would be approximately 15.2ha (20m x 7.6km), although the actual area of disturbance within this corridor would be much less. An area not exceeding 2 500m² would be disturbed on the river frontage of the "Mia Mia" property to allow for the construction of the pumping station for water from the Macquarie River.

Toongi-Dubbo Rail Line and Gas Pipeline Corridor

The processing operations require significant volumes of chemical reagents and other raw materials. While significant volumes of these reagents and materials would be delivered by road, the Applicant has identified the upgrade and use of the Toongi to Dubbo section of the currently disused Dubbo-Molong Rail Line as an opportunity to reduce the volume of traffic on the public road network.

Figure 4 provides the proposed alignment of the Toongi-Dubbo Rail Line, the key features of which are as follows.

- Upgrade of the Toongi to Dubbo section of the Dubbo-Molong Rail Line to a Class 1 track (92t gross/67t pay load capacity).
- Replacement or upgrade of steel bridges, culvert structures, and timber bridges.
- Reinstatement, civil works and installation back to the required standard at each of the 26 level crossings. Of these, seven are major crossings (of local roads), four of which occur in Dubbo (Wingewarra Street, Cobra Street, Boundary Road and Macquarie Street) and three (Cumboogle, Glengerra and Toongi) between the Macquarie River and the proposed DZP Rail Siding.

Figure 4 also identifies the proposed natural gas pipeline between the Central West Pipeline (of APA Group) at Purvis Lane, Dubbo, and the DZP Site which would deliver up to 970TJ/year of natural gas for the heating of various circuits within the processing plant.

Proposed Road Upgrades

Significant quantities of the processing reagents and other raw materials would be delivered by road, via the Newell Highway, Obley Road and Toongi Road. To accommodate the proposed heavy vehicle traffic associated with this transport, the alignment and pavement depth of the

two roads would be improved in several locations, with a number of creek crossings, rail level crossings and intersections to be upgraded. **Figure 5** provides the locations of these works.

A more detailed description of the Proposal is provided by Section 2 of the EIS, of which this assessment forms Part 8 of the accompanying Specialist Consultant Studies Compendium.

1.4 STUDY AREA

The Study Area measures approximately 3 171ha. It encompasses those areas of the Application Area to be impacted, as well as areas that are outside but nearby to the current Application Area. The Study Area is divided into Survey Units (**Table 2; Figures 6 and 7**). Most of the Survey Units are named after the properties on which they occur. The Survey Units fall within four components of the proposal: DZP Site, Toongi-Dubbo Rail Line and Gas Pipeline Corridor, Macquarie River Water Pipeline, and proposed road upgrades.

Figure 2: DZP Site Layout

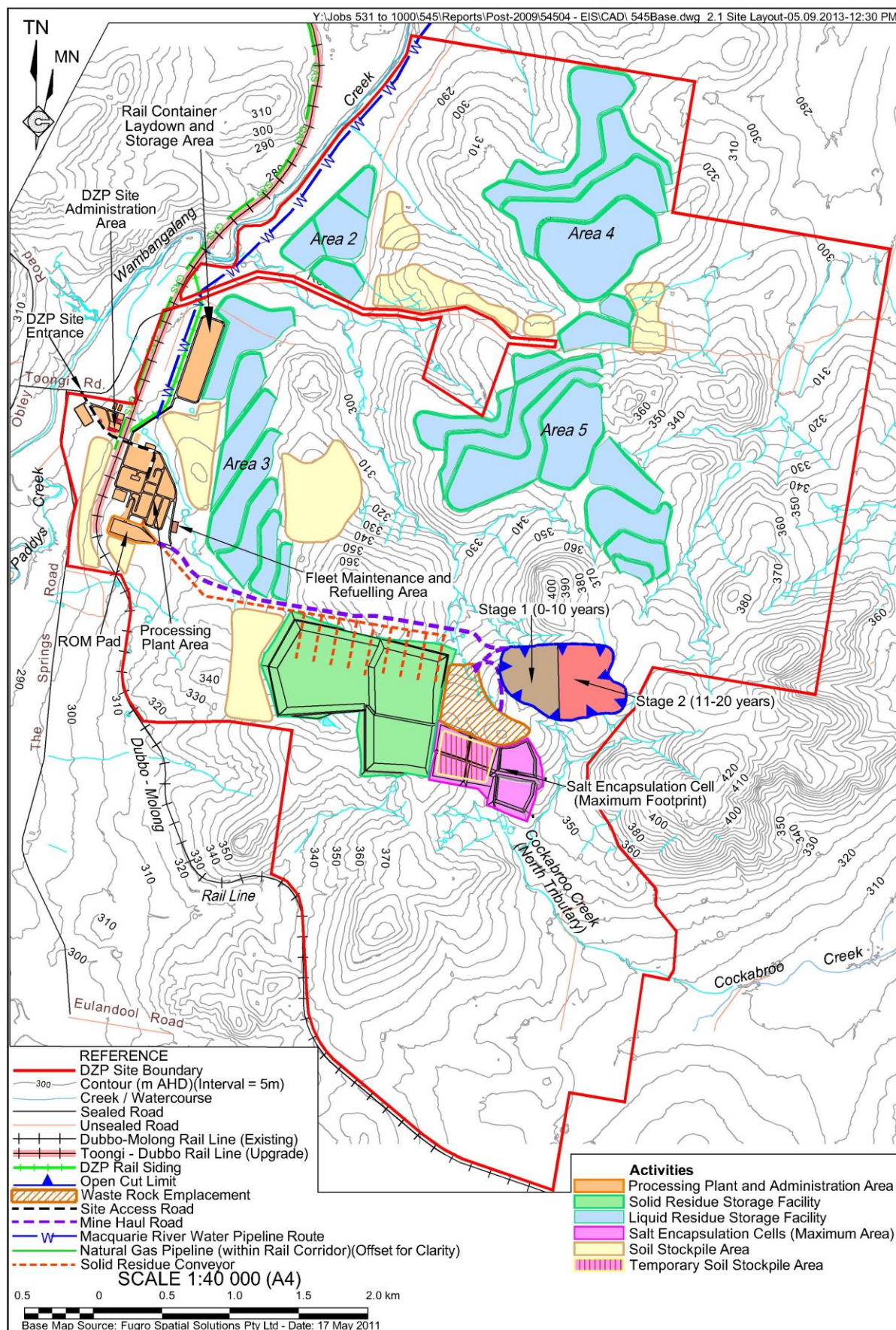


Figure 3: Macquarie River Water Pipeline and Pump Station North of the DZP Site Boundary

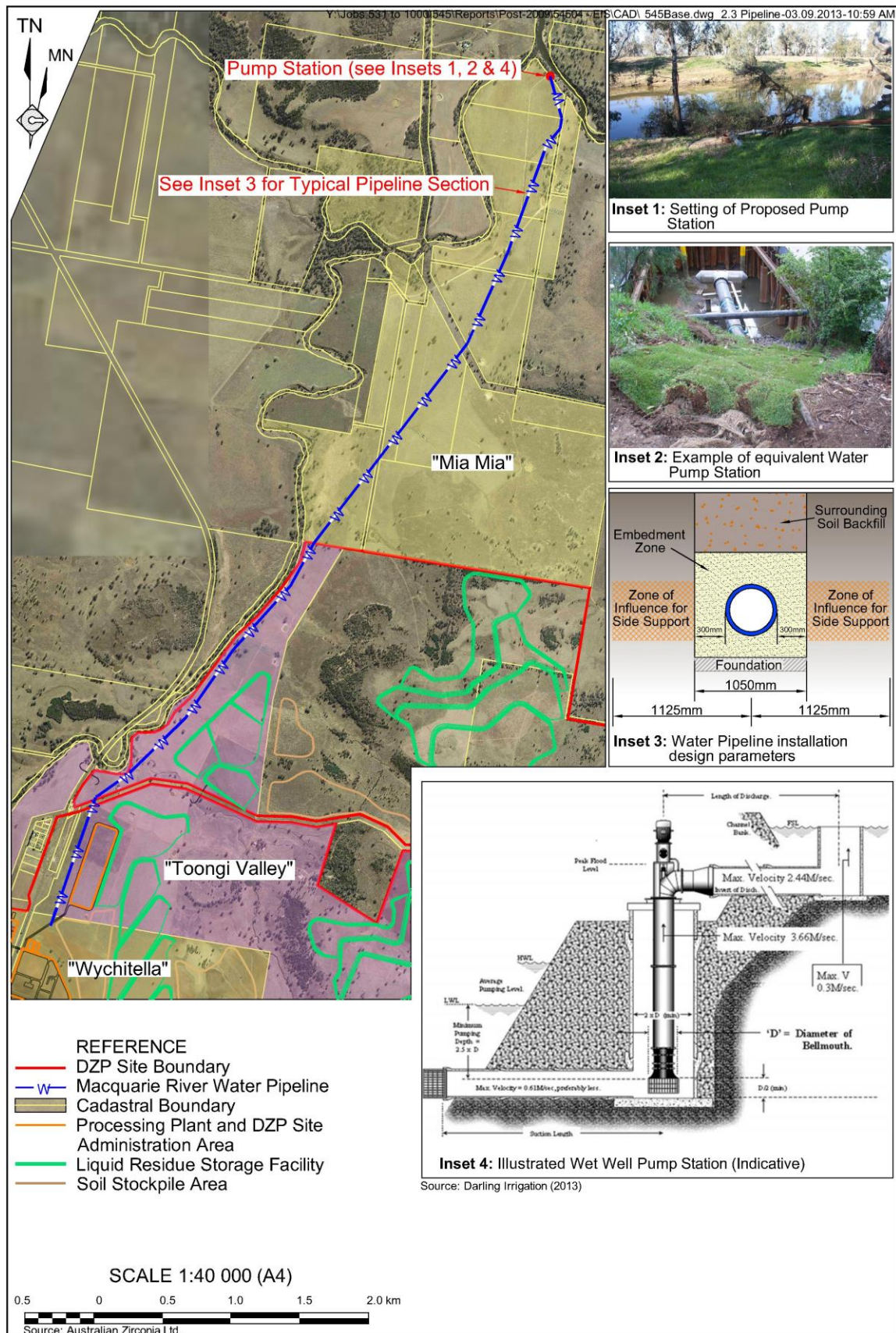


Figure 4: Toongi – Dubbo Rail Line and Gas Pipeline Corridor

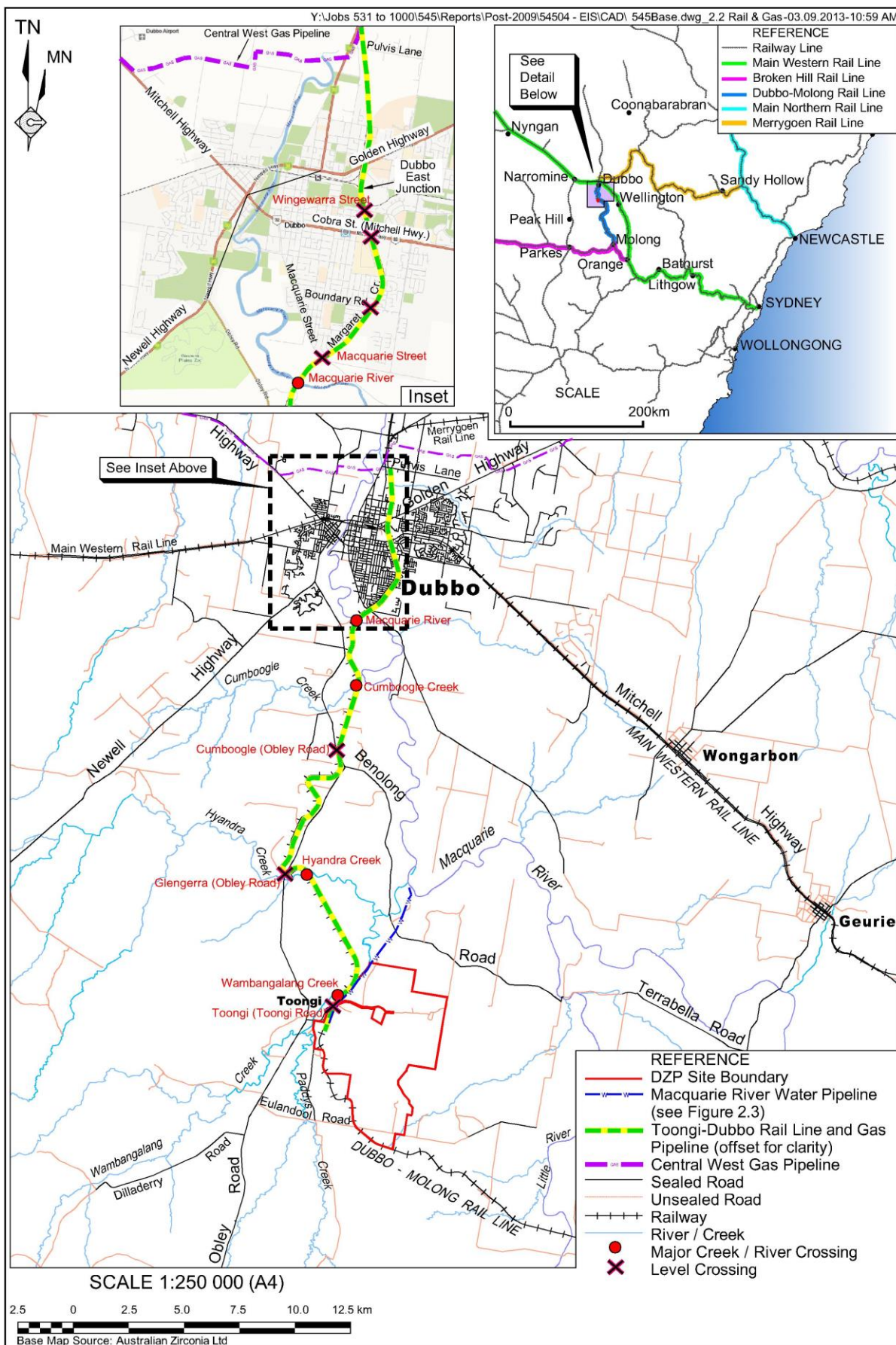


Figure 5: Public Road Network Upgrades

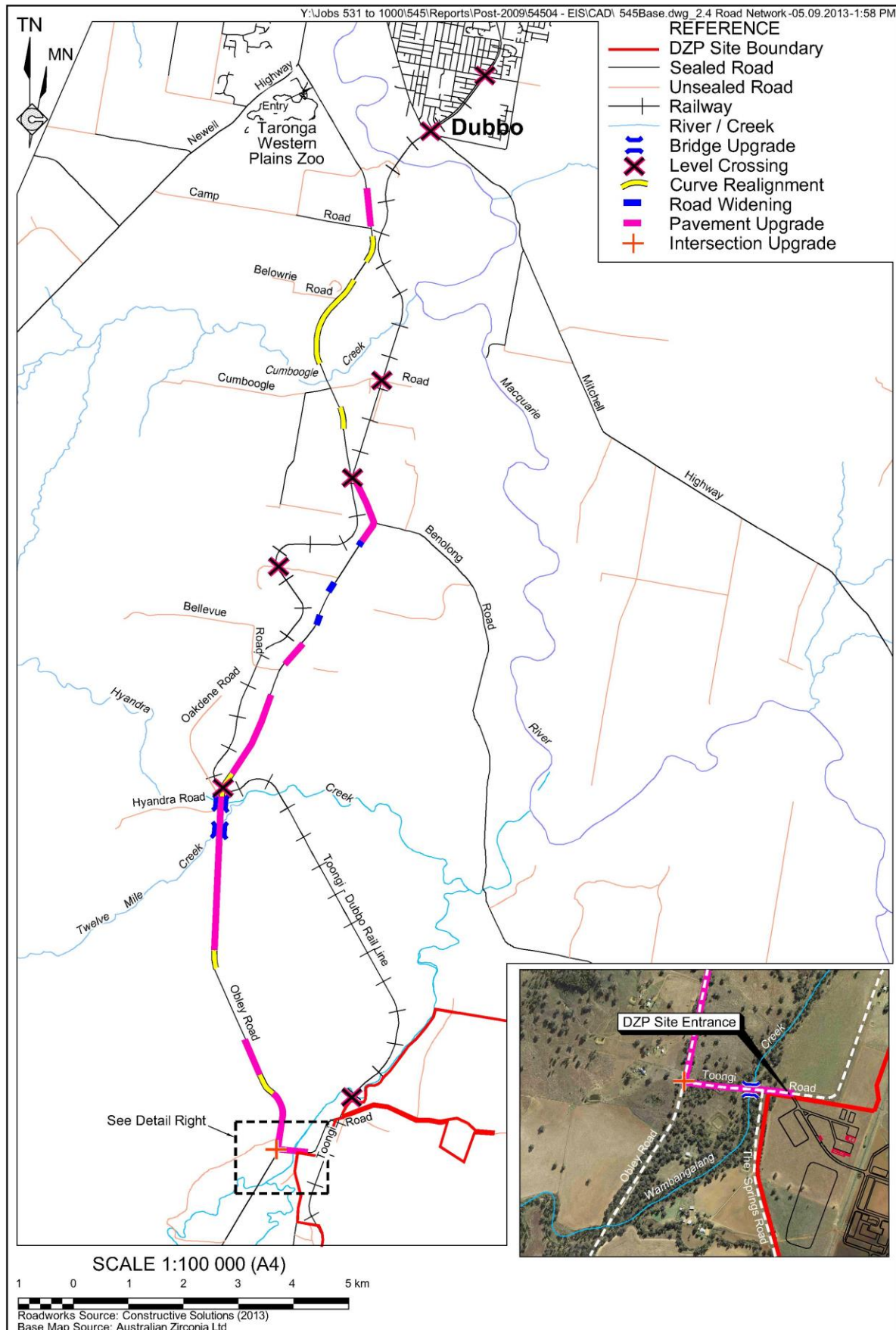


Table 2: Survey Units¹

Survey Unit	Size (ha)	Plate		Survey Unit	Size (ha)	Plate
DZP Site				DZP Site (cont'd)		
UG-1	116.7	-		TV-5	24.5	-
UG-2 ²	247	1		G-1	41.3	-
K-1	76.4	-		G-2	186.7	-
K-2	40.3	-		G-3	29.8	-
K-3	33.5	-		G-4	70.1	-
K-4	146.8	-		G-5	23.57	-
K-5	77.5	-		G-6	11.9	-
K-6	18.6	-		G-7	6.1	-
K-7 ³	48.6	2		G-8	5.9	7
K-8 ⁴	48.4	-		Toongi-Dubbo Rail Line and Gas Pipeline Corridor		
K-9	6.2	-		Dundullimal RB	NA: Area spot checked to confirm disturbance from existing rail line.	8
K-10	11.8	-		Cumboogle RB		-
W-1	19.3	-		Hyandra RB		9
W-2	18.8	3		Macquarie River Water Pipeline: Surveyed with a 20m buffer from centreline.		
W-3	3.0	-		MM-1	2.8 (703m L)	-
W-4	29.4	-		MM-2	1.2 (290m L)	10
W-4a	9.4	-		MM-3	1.6 (394m L)	-
W-5	23.5	-		MM-4	2.7 (668m L)	-
W-5a	8.2	-		MM-5	5.1 (1287m L)	-
W-6	26.5	-		MM-6	2.0 (496m L)	-
W-7	23.2	-		MM-7	3.5 (865m L)	-
W-8	18.9	-		MM-8	1.7 (422m L)	-
W-9	55.4	-		TV-H2O	2.3 (587m L)	11
W-10	37.5	-		Obley Road Alignment: Surveyed with a 20m buffer from centreline.		
GI	45.6	4		OR-1	2.3 (586m L)	12
PH-1	11.9	-		OR-2	7.5 (1874m L)	-
PH-2	41.6	-		OR-3	2.4 (602m L)	-
PH-3/4	26.6	-		OR-4	1.1 (266m L)	-
PH-5	2.6	5		OR-5	0.9 (230m L)	-
PH-6	31.5	-		OR-6	1.5 (364m L)	-
TV-1	56.5	6		OR-7	2.6 (645m L)	-
TV-2	85.0	-		OR-8	1.8 (449m L)	-
TV-3	86.1	-		OR-9	2.4 (603m L)	-
TV-4	47.5	-				

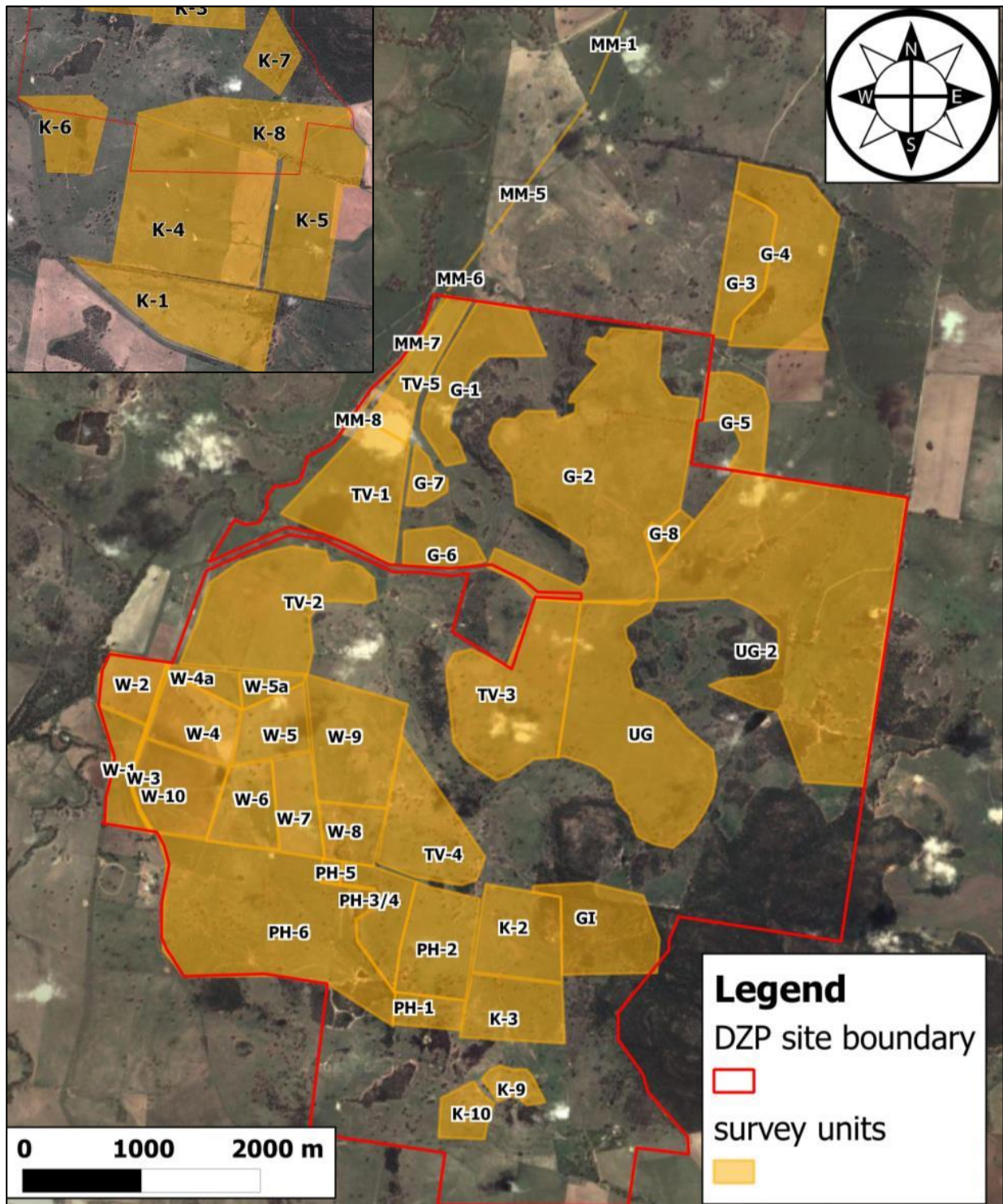
¹ G = "Grandale", GI = "Glen Idol", K = "Karingle", PH = "Pacific Hill", TV = "Toongi Valley", UG = "Ugothery", W = Wychitella, RB = Rail Bridge, MM = "Mia Mia", OR = Obley Road.

² Survey Unit includes land on "Ugothery" and "Grandale" properties.

³ Incomplete survey.

⁴ Incomplete survey.

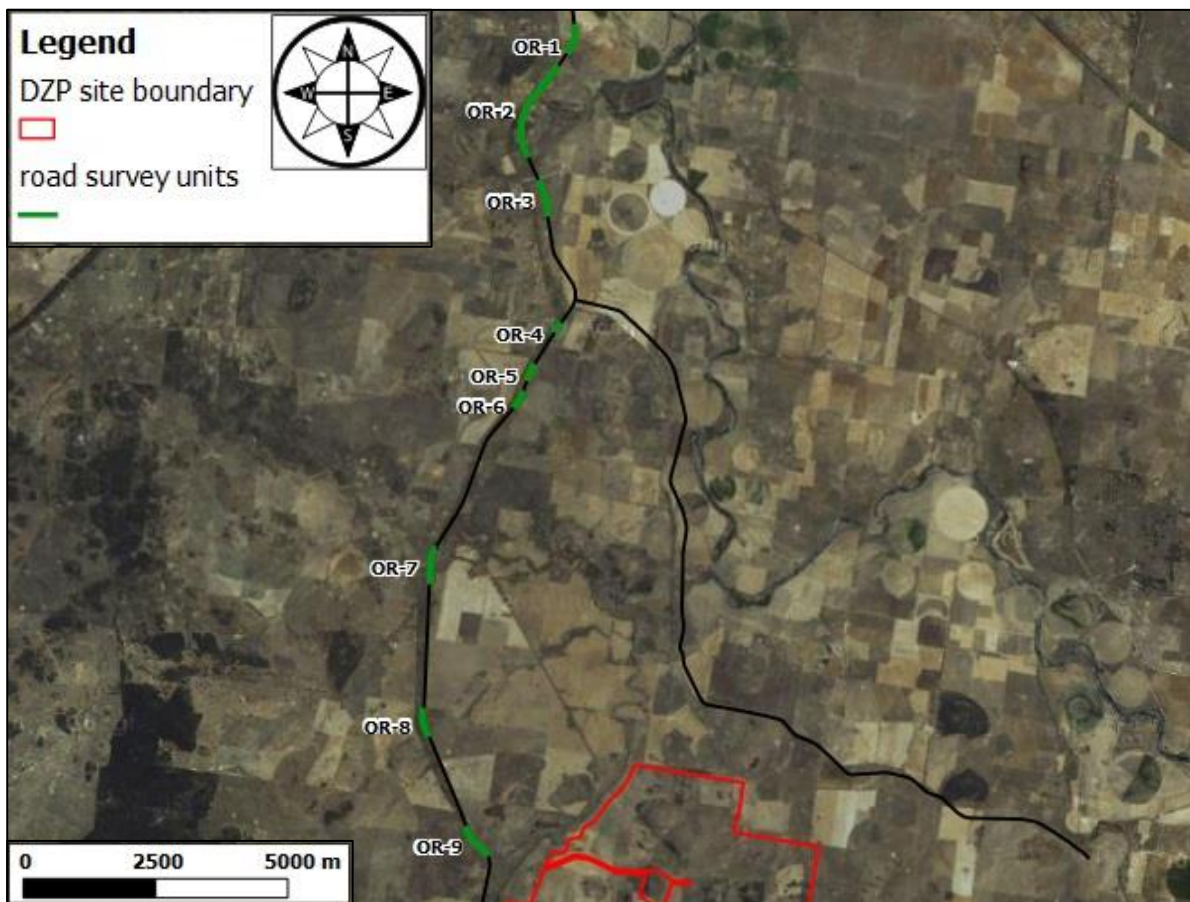
Figure 6: Survey Units of the DZP Site and Macquarie River Water Pipeline⁵



Note: Image presents the DZP Site assessed area.

⁵ The inset indicates the configuration of survey units in the south of the DZP Site, prior to the survey of K-9 and K-10, which corresponded to previous impacts.

Figure 7: Public Road Network Field Survey



Note: Image presents the DZP Site assessed area.

2 THE STUDY

2.1 PURPOSE AND OBJECTIVES OF THE ARCHAEOLOGICAL INVESTIGATION

The purpose of the current study is to:

1. identify and assess Aboriginal resources within the Proposal's impact zones in order to mitigate effects to them by the Proposal; and
2. incrementally add to our understanding of archaeological and cultural resources of the area.

The objectives of the current study are to:

- **Objective One:** Identify archaeological resources in the impact zones of the Application Area and assess the significance of identified resources.
- **Objective Two:** Engage local Aboriginal stakeholders to gain their input on the investigation and their knowledge pertaining to the Aboriginal cultural values in the area.
- **Objective Three:** Recommend methods to mitigate or eliminate impacts to cultural resources through responsible management, or alternatively, determine the requirement for further study and salvage prior to construction.

2.2 ABORIGINAL COMMUNITY INVOLVEMENT

Consultation for the purpose of the DZP Aboriginal Heritage Assessment has and continues to be is being undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements* (ACHCRs), Department of Environment, Climate Change and Water (DECCW 2010).

An expression of interest (EOI) advertisement was placed in the Daily Liberal to appear in the publication on the 7th January, 2012. To establish a broad base of Aboriginal people or organisations who may hold cultural knowledge relevant to the Application Area, contact details were sought from the Office of Environment & Heritage (OEH), Dubbo City Council, Native Title Services Corporation Limited (NTSCORP), Central West Catchment Management Authority (CMA), National Native Title Tribunal (NNTT), Dubbo LALC and the Register of Aboriginal Owners. In addition letters were sent to known Aboriginal Stakeholders associated with previous projects in the vicinity of the Study Area, so that these individuals / organisations could to be advised of the proposed Proposal and invited to register interest. A log of all Stage 1 consultation is presented in **Appendix 1**.

A second round of letters was sent to additional groups identified as a consequence of the agency contact. At the conclusion of the Stage 1 notification phase of this process, three Aboriginal groups or organisations registered an interest, Binjang Wellington Wiradjuri Heritage Survey, Wirrimbah Direct Descendants and Diane Stewart. It is noted that in early September 2012, Mr Charlie Trindall registered interest on behalf of Dubbo LALC.

The Registered Aboriginal Parties (RAP's) for the DZP are as follows.

- Binjang Wellington Wiradjuri Heritage Survey (BWWHS);
- Wirrimbah Direct Descendants (WDD);
- Diane Stewart; and
- Dubbo LALC

It is noteworthy that the Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC) withdrew their initial registration of interest as they ascertained the Study Area was outside their traditional boundaries.

The Stage 2 / 3 letters, presenting information about the proposed Proposal and describing the proposed heritage assessment methodology, were sent to the RAPs with a request for input on the methodology proposed. Included with this correspondence was an invitation to attend an inception meeting to introduce the Proposal and discuss the proposed methodology. Subsequently this meeting was held Tuesday 24th April, 2012 and attended by Diane Stewart and Dot Stewart (BWWHS). Steve Ryan (WDD) was unable to be present at the meeting due to a last minute commitment. A log of consultation and a copy of the minutes from the April 2012 meeting are provided in **Appendix 1**.

Feedback from the consultation meeting and Stage 2 / 3 letters were incorporated into the methodology prior to fieldwork being initiated. Several positions were made available for Aboriginal community to allow all stakeholders to be represented during the assessment period. It is noteworthy that the non-provision of relevant insurances excluded Diane Stewart from participating in the physical component of the heritage assessment. Irrespective of which representatives participated in the field survey, all RAPs have been kept informed of the results, invited to attend meetings and to comment on draft documents prepared for the Proposal.

The initial fieldwork was undertaken over two days, Monday 21st May and Tuesday 22nd May, 2012. Representatives Ashley Hill (WDD), Jamie Gray and Eric Fernando (BWWHS), took part in the survey with archaeologists Dr Jodie Benton and Jenni Streatfield (OzArk).

The same organisations were formally invited to participate in two subsequent rounds of field survey. Ashley Hill and Gary Riley (WDD), Brett Hill and Jamie Gray (BWWHS) participated in the assessment on 24th and 25th July, 2012 accompanied by Josh Noyer and Emily McCuistion (OzArk). The second deployment, 7th and 8th August, involved Emily McCuistion and Morgan Wilcox (OzArk), assisted by Brett Hill and Jamie Gray (BWWHS) and Robert Hill and Ashley Hill (WDD).

A meeting was held on 10th August 2012, to which all RAPs were invited, to discuss the management of sites and obtain any cultural knowledge that may be associated with the Project Site. This meeting was attended by Binjang representatives Dot Stewart and Jamie Gray, in addition to OzArk and Australian Zirconia Ltd (AZL) staff. Dot discussed the high cultural significance of The Springs site, and her association with this area. Although it was agreed that the avoidance of sites is the preferred option, should this not be feasible it is important that RAPs are involved in the management process.

As a consequence of late registration, an informal meeting was held between representatives from Australian Zirconia Ltd, OzArk and Dubbo LALC in September 2012. The aim of this meeting was to familiarise DLALC with the Proposal and provide up-to-date information about the assessment process thus far.

Additional fieldwork to assess all Proposal impact areas was undertaken by OzArk and RAP representatives on the following dates:

- 11th September – 13th September
 - Wirrimbah Direct Descendants / Mr Ashley Hill
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Brett Hill
 - Dubbo LALC / Mr Michael Toomey

- 18th October – 19th October
 - Wirrimbah Direct Descendants / Mr Robert Hill
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Brett Hill
 - Dubbo LALC / Mr Michael Toomey
- 17th – 19th December
 - Dubbo LALC / Mr Edward Ryan
 - Dubbo LALC / Mr Terry Toomey
 - Dubbo LALC / Mr Ray Smith
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Jamie Gray
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Fonua Havili
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Tim Stewart
 - Wirrimbah Direct Descendants / Mr Ashley Hill
 - Wirrimbah Direct Descendants / Mr Robert Hill
- 5th February, 2013
 - Binjang Wellington Wiradjuri Heritage Survey / Mr Brett Hill
 - Wirrimbah Direct Descendants / Mr Malcolm Burns

Following the February 2013 fieldwork, WDD submitted a brief report which documented the result of this one day assessment. Over the course of the entire fieldwork program, discussions were held on-site each day regarding the findings of the field survey. The topics covered included cultural significance, management options and recommendations.

Discussion was held with Coral Peckham regarding her wish to hold a meeting on site with OzArk and Alkane to talk about the cultural heritage values and proposed management. The idea was favourably received by OzArk and AZL, but this meeting did not happen until the Aboriginal Focus Group Meeting (AFGM) on Tuesday 13th August 2013. It was considered by OzArk that a management meeting should wait for the results of the test excavation and the finalisation of the impact footprint, such that impacts were appropriately understood. By this time Coral was unable to attend the meeting, but other representatives of WDD were able to be present (see below).

An invitation to attend the AFGM to discuss the test excavation of two sites of sites (TS-OS3 with PAD and TS-OS5 with PAD) was sent to all RAPs on 13th May 2013 with the research design document being sent through separately on 20th May 2013. The AFGM was held on 29th May 2013 at the OzArk office in Dubbo with Jodie Benton and Sheridan Baker representing OzArk. Although all RAPs were invited, Darren Toomey was the only one able to attend. Minutes were distributed from the AFGM to all RAPs and no further feedback was received.

The test excavation was scheduled for 25th and 26th June 2013. An invitation to supply a site officer was sent to all RAPs on 12th June 2013. Terry Toomey (DLALC) and Mal Burns (Wirrimbah) attended both days.

Phone calls were made and correspondence was sent out to all RAPs for a further AFGM to be held on 13th August 2013. This was to discuss the cultural values and management of sites that will be affected by the Project. The AFGM was held on 13 August 2013 and was attended by:

- OzArk Jodie Benton, Nick Harrop, Sheridan Baker
- DLALC Darren Toomey, Willie Carr
- WDD Ray Smith, Geoff Ryan
- Alkane Michael Sutherland

Apology was received from Dianne Stewart. Jamie Gray and Dot Stewart (Binjang) were also unable to attend. A tour of selected sites within the proposed impact area was conducted to help participants contextualise the sites, how they will be affected by the Project and to inform site management discussions. This included a visit to a site within the Biodiversity Offset Area which will be protected. Cultural Values (**Section 5.8.2.3**) and management of sites (**Section 6**) were discussed with clear outcomes. The prospect for local employment resulting from the proposed works, specifically the employment of Aboriginal people, was also discussed with Mike Sutherland of AZL.

Discussion and comments as noted in the minutes were incorporated into a draft document which was distributed both by mail and email to the RAPs on 19th August 2013. Follow up for any further feedback or comments was conducted, along with the issue of the draft report and minutes.

Feedback was received from all RAPs between 20th August and 22nd August 2013. Geoff Ryan of WDD and Darren Toomey of Dubbo LALC both approved of the report and the minutes of the recent AFGM. Feedback was also received from Dorothy Stewart of Binjang WWHS and Diane Stewart. The latter two RAPs expressed their wish to be included in the formation of the Care Agreement and to be involved in determining the ultimate fate of the objects salvaged from the sites to be impacted. They also proposed a management option of relocating the salvaged items to Wiradjuri Park and marking them on site with a plaque and aerial photograph. OzArk responded by suggesting that these options would be further discussed with the other RAPs during the development of the *Aboriginal Cultural Heritage Management Plan* (ACHMP) that would be required should approval for the DZP be granted. Other issues included concern that they had not been able to access photos of the sites, and OzArk undertook to distribute these photos to them (note, copies were available at the AFGM). Further concern was raised regarding possible impacts to creeks/springs near the project, and as a result OzArk undertook to obtain information from the Environmental Impact Statement regarding groundwater-surface water interactions and impacts to be forwarded to both RAPs.

A log and copies of correspondence with Aboriginal community stakeholders is presented in **Appendix 1**.

2.3 OZARK EHM INVOLVEMENT

2.3.1 Field assessment

The fieldwork component of the current study was undertaken over several fieldwork sessions by the following:

- Fieldwork director: Dr Jodie Benton (BA[Hons] & PhD- University of Sydney);
- Fieldwork director: Jenni Streatfield (BA[Hons]- Australia's National University);
- Fieldwork director: Emily McCuiston (BA- University of Texas at Austin);
- Fieldwork director Nick Harrop (BA[Hons]- University of Sydney);

- Archaeologist: Joshua Noyer (BA- University of California, Santa Cruz);
- Archaeologist: Morgan Wilcox (BArch [Hons] - La Trobe University, Melbourne); and
- Operations Manager: Jenn McGhee.

As documented in **Section 2.2**, fieldwork was undertaken over 15 days between May 2012 and February 2013 (**Table 3**).

Table 3: Survey and test excavation dates

Survey Date(s)	Archaeologist(s)	RAPs	Survey Area
22 May 2012	Benton and Streatfield	Ashley Hill, Eric Fernando, Jamie Gray	DZP Site: Wychitella
23 May 2012	Streatfield	Ashley Hill, Eric Fernando, Jamie Gray	DZP Site: "Karingle"
24 and 25 July 2012	McCuistion and Noyer	Ashley Hill, Brett Hill, Gary Riley, James Gray	DZP Site: "Grandale" and "Toongi Valley"
7 and 8 August 2012	McCuistion and Wilcox	Ashley Hill, Brett Hill, James Gray, Robert Hill	DZP Site: "Glen Idol", "Toongi Valley", and "Ugothery"
11 to 13 September 2012	McCuistion	Ashley Hill, Brett Hill, Michael Toomey	DZP Site: "Pacific Hill" MRWP: "Mia Mia" / Waterline, and Wychitella
18 and 19 October 2012	McCuistion	Brett Hill, Michael Toomey, Robert Hill	ORA: Obley Road, Rail Bridges, and Wychitella
17 to 19 December 2012	McCuistion and Harrop	Robert Hill, Ashley Hill, Jamie Gray, Edward Ryan, Terry Toomey, Fonua Havili, Tim Stewart, Ray Smith	DZP Site: "Grandale", "Karingle", "Pacific Hill", "Toongi Valley", and "Ugothery"
5 February 2013	Harrop	Brett Hill and Malcolm Burns	DZP Site: "Karingle" and "Grandale"
25 and 26 June 2013	Harrop, Wilcox, and McGhee	Malcolm Burns and Terry Toomey	Macquarie River Water Pipeline sites: TS-OS3 and TS-OS5 ("Mia Mia")

MRWP = Macquarie River Water Pipeline

ORA = Obley Road Alignment

2.3.2 Reporting

The reporting component of the current study was undertaken by:

- Report authors: Emily McCuistion (BA – University of Texas at Austin); Nicholas Harrop (BA[Hons]- University of Sydney);
- Reviewer: Mr Kim Tuovinen (BA[Hons] – University of Sydney, Grad Dip Ed– Charles Sturt University, Grad Dip Arch – Flinders University); and
- Reviewer: Ben Churcher (BA[Hons] – University of Queensland, Dip Ed- University of Sydney).
- Reviewer: Jodie Benton (PhD – University of Sydney).

2.4 BACKGROUND RESEARCH

Background research consisted of the desktop database search, a review of reports for previous survey in the Study Area (**Section 4.3**) and resources relating to heritage in the greater Dubbo area (**Sections 4.2**).

A desktop search was conducted on the following databases to identify any potential issues. The results of this search are summarised here in **Table 4** and presented in detail in **Appendix 2**.

Table 4: Desktop-database search results

Name of database searched	Date of search	Type of search	Comment
Australian Heritage Database http://www.environment.gov.au/heritage/ahdb/	29 October 2012	Dubbo LGA	No Aboriginal sites are listed within the Application Area. Two sites are located within 5km of the Study Area: 'Indigenous Place'; 'The Springs Homestead and Outbuildings.'
NSW Heritage Office State Heritage Register and State Heritage Inventory http://www.heritage.nsw.gov.au/	29 October 2012	Dubbo LGA	No Aboriginal sites are listed within the Application Area. Three sites listed by Local Government are within 5km of Application Area: Cockleshell; Meadows (The) Homestead and Outbuildings; Springs (The) – Group Item.
National Native Title Claims Search http://www.nntt.gov.au/Applications-And-Determinations/Search-Applications/Pages/Search.aspx	29 October 2012	NSW	No Native Title Claims cover the Study Area.
Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) Protected Matters (EPBC Act) Database; http://www.environment.gov.au/erin/ert/epbc/index.html	30 October 2012	Map search	None of the Aboriginal places on the RNE occur near the Study Area.
Office of Environment & Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS);	29 October 2012	UTMS covering Study Area with buffer	131 sites are within the search area.
Local Environment Plan	29 October 2012	Dubbo LEP of 2000	No Aboriginal sites are listed within the Application Area. Three sites are within 5km of the Application Area: "The Meadows"; "The Springs"; Carved tree (indigenous item).
S170 RMS Heritage and Conservation Register http://www.rta.nsw.gov.au/environment/heritage/heritageconservreg/index.html?elid=2	29 October 2012	Western Region	No Aboriginal places on the search are within the Study Area.

2.5 STUDY CONSTRAINTS

Ground surface visibility, terrain, weather conditions, and property access commonly have an impact on the effectiveness of a survey.

Constraints to this study include vegetation cover and the presence of naturally occurring rock (cobbles and gravels), which obscure the ground surface and may distract from artefacts (referred to as background noise in this document). As a result, some survey units, e.g. Survey Unit K-3, were not inspected closely as it was found to have 0% ground surface visibility due to high grasses. **Section 5.1** discusses the ground surface visibility in greater detail. Weather did not hinder survey significantly, though fieldwork was cut short due to rainy and cold conditions on 13 September 2012.

Access restrictions constrained this survey, as the survey crew was asked not to enter cropped paddocks. As a consequence, three Survey Units (PH-5 and MM-5⁶ and W-10⁷) were not

⁶ Under crop at the time of survey.

⁷ Recently ploughed in preparation for cropping.

closely inspected. A small area at the northwest of TV-3 Survey Unit was also not closely inspected as it was cropped. None of these areas are likely to have intact archaeological deposits due to impacts from agriculture, i.e. clearing of native vegetation, ploughing and grazing.

A small area within the impact footprint of the Soil Stockpile Area was not surveyed. The area was designated as a soil stockpiling area following the completion of the last phase of survey and is between survey areas G-6 and TV-3. It was decided that survey was not necessary for several reasons. Firstly, the landform is marginal in terms of suitability for occupation. The landscape in this area is undulating and there are no stable water sources nearby. Also, disturbance was high here from agricultural impacts. Finally, no sites were located within 1km of the unsurveyed area.

The realignment of the northern section of the proposed Macquarie River Water Pipeline was also not surveyed (See **Figure 3** and **Appendix 6, Figure 55**). The realignment is mostly within close proximity of the survey area, but deviates by 150m to the east at one point. It is within the same landform as the survey area, which is an alluvial plain with little potential. Furthermore, there were no sites recorded elsewhere on the same landform and there are substantial agricultural land-use disturbances such as ploughing and vehicle tracks. For these reasons it was deemed unnecessary to survey the realignment.

While ground surface visibility, weather, and access affected the study, none of these constraints prevented an appropriate level of assessment from being carried out. These constraints are further detailed in **Section 4.5**.

3 LANDSCAPE CONTEXT

3.1 REGIONAL SETTING

An understanding of the environmental contexts of a Study Area is important in the development and implementation of survey strategies for the detection of archaeological sites. Environmental characteristics influence the nature of material culture that is distributed across a landscape by Aboriginal people in the past. These include the availability of water, the abundance and type of plant and animal food resources, the nature of stone and ochre resources, and the access and the availability of shade and shelter. In addition, natural geomorphic processes of erosion and/or deposition, as well as human-activated landscape processes, especially those associated with European occupation of Australia, influence the degree to which these material cultural remains are retained in the landscape as archaeological sites and the degree to which they are preserved, revealed and/or conserved.

The Study Area lies within three bioregions, which is comprised of many soil landscapes. The NSW South West Slopes Bioregion, Brigalow Belt South Bioregion, and Darling Riverine Plains Bioregion are represented in the Study Area. Four soil landscapes are represented within these bioregions: the Nangar Ranges, Dubbo Basalts, Goonoo Slopes, and Macquarie Alluvial Plains (as defined in *Mitchell landscapes*; **Figure 8**).

Nangar Slopes and Ranges

Steep structurally controlled ridges and peaks with low cliffs on Devonian and Silurian lithic sandstones, shales and occasional conglomerates. Small areas of granitic intrusions. Strong dendritic drainage pattern, General elevation 500m to 770m, local relief to 300m. Shallow stony soils on steep slopes with rubbly debris in gully lines, yellow texture contrast soils on lesser slopes. Grey box woodlands with red stringybark, red ironbark and tumbledown gum. Black cypress pine common on stony sites with white cypress pine in lower positions on better soils. Numerous acacia and shrubs.

Dubbo Basalts

Slightly elevated plains and low hills on flat lying Tertiary basalt and trachyte flows, roughly parallel to the present course of the Talbragar and Macquarie Rivers. General elevation 300m to 330m, local relief 10m. Shallow stony red-brown clay loam and clay, self-mulching and with moderate fertility. Open white box, yellow box and rough-barked apple with diverse grasses.

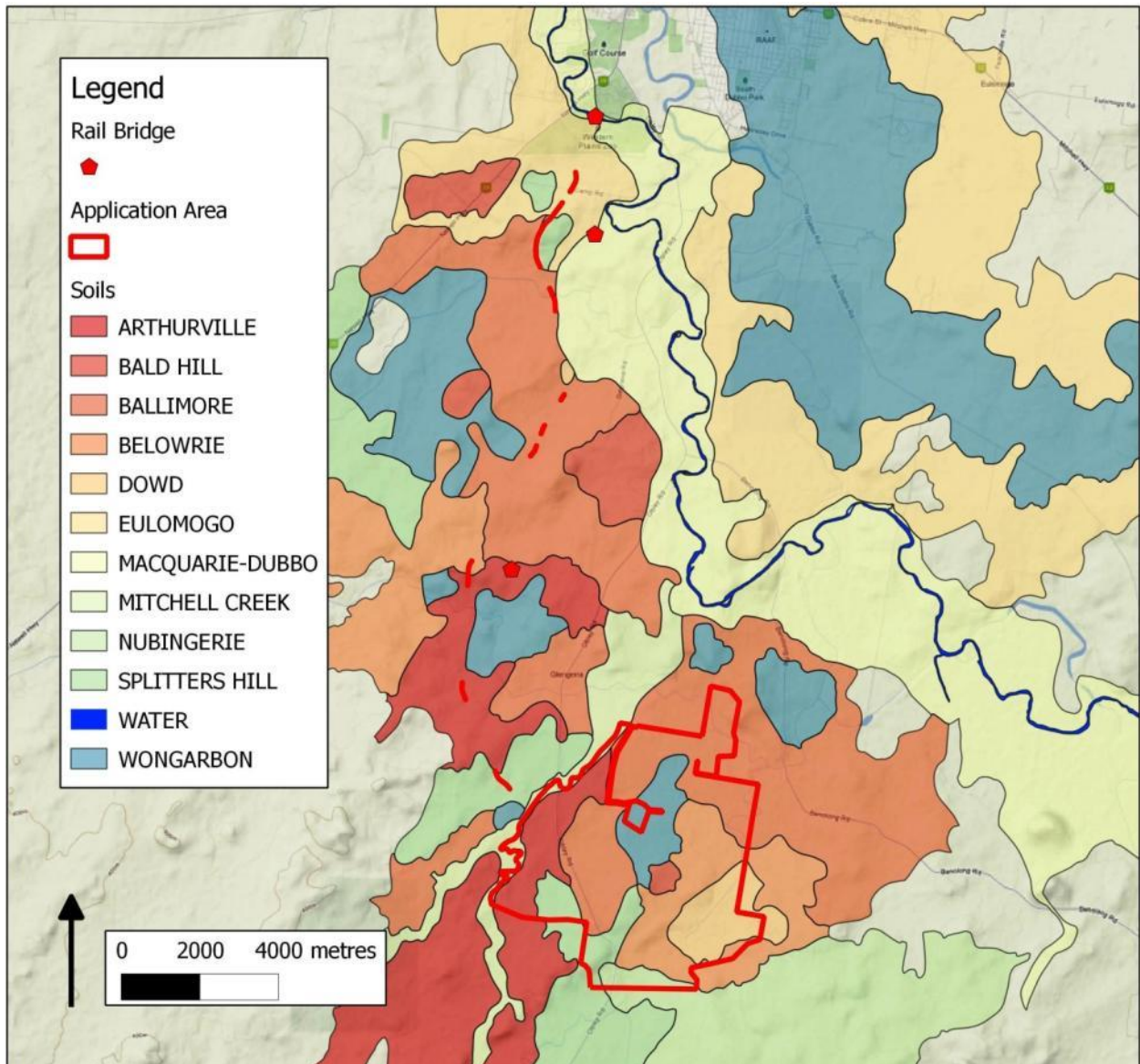
Goonoo Slopes

Extensive undulating to stepped low hills with long slopes on sub-horizontal Triassic/Jurassic quartz sandstone, conglomerates, siltstone, shale and some coal. General elevation 300m to 500m with overall westerly slope, poorly defined drainage network, local relief to 30m. Stony yellow earths with sandstone outcrop on ridgelines to yellow harsh texture-contrast soils in shallow valleys. Broad-leaved ironbark and black cypress pine on ridges, broad-leaved ironbark, narrow-leaved ironbark, mugga, fringe myrtle, spur-wing wattle, dainty phebalium, daphne heath on slopes with patches of green mallee, Dwyer's mallee gum and broombush. Grey box, mugga, red stringybark, fuzzy box and Blakely's red gum with knob sedge, and tall sedge along streams.

Macquarie Alluvial Plains

Holocene fluvial sediments of backplain facies of the Marra Creek Formation associated with the Macquarie River main alluvial fan and tributary stream system, relief 1 to 3m. Dark yellow-brown silty clay with patches of sand and carbonate nodules deposited from suspended sediments in floodwater, often with gilgai. Slightly elevated areas with red-brown texture-contrast soils. Open grasslands with scattered coolibah, black box, river cooba, bimbale box, belah, lignum and myall.

Figure 8: Soil Landscapes of the Study Area



3.2 TOPOGRAPHY

The topography of the Study Area ranges in elevation from 260m Australian Height Datum (AHD) at the Macquarie River to 400m AHD over the proposed open cut on the “Glen Idol” property. The highest point in the Application Area is 440m AHD at Dowds Hill. The topography of the Study Area is characterised by flat alluvial terraces and gently rolling hills, with a relief of between approximately 5m and 50m.

3.3 GEOLOGY AND SOILS

3.3.1 Soils

Eleven soil landscapes representing six soil groups are present in the Study Area (**Figure 8, Table 5**).

Table 5: Soil Groups, Landscapes (and Geology)

Soil Landscape	Geological Origin	Soil Group ⁸
Eulomogo		Red Earths: "Massive, reddish sandy profiles with a gradual increase in clay content with depth over a diffuse to gradual boundary."
Splitters Hill	Silurian shale	Red Podzolic Soils: "Soils with B horizons dominated by the accumulation of compounds of organic matter, aluminium and/or iron."
Belowrie	trachyte rocks	
Arthurville	Silurian felsic rocks	Red-Brown Earths: "The characteristic features of these soils are grey-brown to red-brown loamy A horizons, weakly structured to massive, an abrupt to clear boundary between A and B horizons, and brighter brown to red clay B horizons with well-developed medium prismatic to blocky structure."
Ballimore	Napperby Formation	
Macquarie-Dubbo		Alluvial Soils: "Soils developed from recently deposited alluvium, normally characterise little or no modification of the deposited material by soil forming processes, particularly with respect to soil horizon development."
Mitchell Creek		
Dowd	trachyte rocks	Shallow Soils
Bald Hill	basaltic rocks	Euchrozems: "Red, strongly structured clay soils with a somewhat lower clay content near the surface."
Nubingerie	Silurian felsic rocks	
Wongarbon	basaltic rocks	

3.3.2 Geology

The geological origin of the soil landscapes identified in **Figure 8** and **Table 5** is as follows.

- Felsic rocks in the oldest Silurian geology supported the Arthurville landscape, while less felsic geology of the same age supported the more clayey and productive Nubingerie landscape. Shale in the Silurian geology supported Spliters Hill landscape.
- Napperby Formation supported Ballimore landscape.
- Basaltic rocks supported well drained Bald Hill and clayey Wongarbon landscapes.
- Trachyte rocks supported shallow, unstable soil of the Belowrie landscape, and the rocky Dowd landscape.
- While there is large variation in soil properties of the DZP Site, a general pattern of light textured topsoil over clayey subsoil is displayed, mostly developed from sedimentary rocks (with some volcanic intrusions). Generally a sharp boundary between the topsoil and subsoil can be defined and as such the soils are considered as duplex soil.
- The duplex profiles can be separated into soil orders of Chromosols, Sodosols and Kurosols. Chromosols have relatively stable topsoil and nearly neutral soil pH. Red and Brown Chromosols develop on well drained sites, while Yellow and Grey Chromosols develop on sites with poorer drainage. Sodosols are generally unstable because of a high sodium content. The sodium generally comes either from parent material, or has been leached from higher parts of the landscape.

⁸ Definitions verbatim from: agriculture.science-dictionary.org (science-dictionary.org 2008).

Kurosols develop where rapid drainage has leached many minerals from the soil, and have low pH.

- Igneous rocks (of volcanic intrusion origin) have weathered to form a separate range of profiles. Some profiles with relatively low topsoil clay content were classified as Ferrosols. Ferrosols are rich in iron, and generally have very stable physical properties. Profiles with structured, clayey subsoil but limited shrink-swell capacity were classified as Dermosols, while strongly shrinking and swelling soil were classified as Vertosols.

3.4 HYDROLOGY

3.4.1 Creeks and Catchments

The Application Area is situated within the Central West CMA across two subregions (Upper Slopes and Talbragar). Several creeks traverse the area (**Figure 9**), the most relevant of which are as follows.

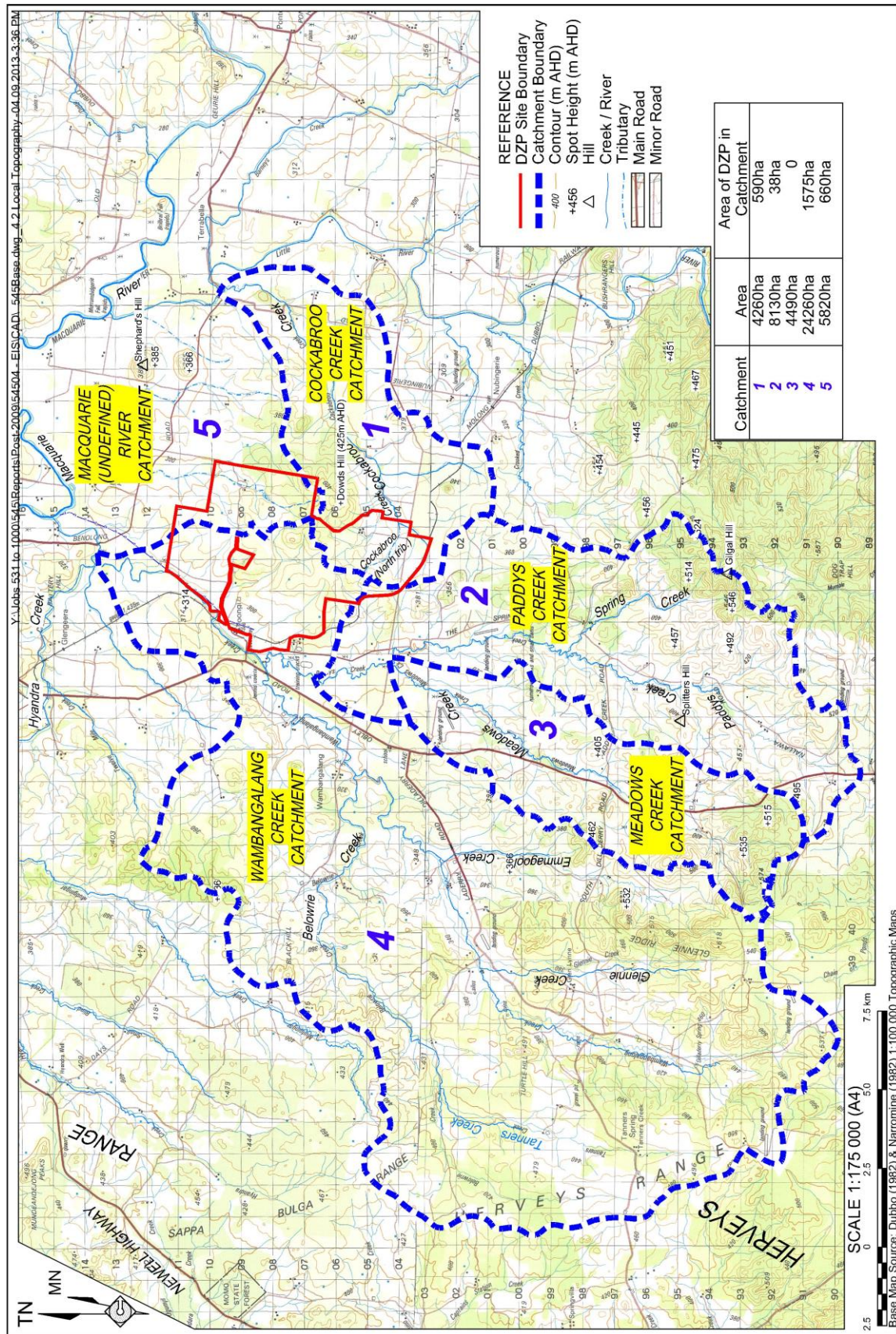
- Wambangalang Creek: is an ephemeral but relatively regularly flowing creek which forms the western boundary of the DZP Site to the north of Toongi Road. Wambangalang Creek flows into the Macquarie River approximately 4.5km north of the DZP Site. The Toongi Road crossing of Wambangalang Creek is proposed to be upgraded as part of the Proposal.
- Macquarie River: is a major river of the Murray Darling basin, emanating in the western slopes of the Great Dividing Range before flowing into the Darling River. The Applicant proposes to source up to 4.05GL of water annually from a point on the Macquarie River approximately 7.6km northwest of the processing plant.
- Cockabroo Creek: is an ephemeral creek which is located immediately south of the DZP Site and flows into the Little River to the east of the DZP Site.
- Little River: a perennial river which flows through Yeoval to the south of the DZP Site and joins the Macquarie River approximately 8km to the northeast of the DZP Site.
- Paddys Creek: is an ephemeral tributary of Wambangalang Creek which is located immediately west and south of the DZP Site.
- Hyandra Creek: is an ephemeral tributary of the Macquarie River which is traversed by Obley Road (see **Figure 1**).
- Twelve Mile Creek: is an ephemeral tributary of the Macquarie River which is traversed by Obley Road.

The DZP Site is located within three main local catchments (see **Figure 9**):

1. Wambangalang Creek catchment that flows into the Macquarie River;
2. Cockabroo Creek catchment that flows into the Little River immediately upstream of the confluence of the Little and Macquarie Rivers.
3. A catchment of poorly defined drainage channels flowing into the Macquarie River.

The following sections provide an overview of these three catchments, however, for further detail on the local hydrological setting, please refer to the Surface Water Assessment completed as Part 4 of the Specialist Consultant Studies Compendium (SEEC, 2013).

Figure 9: Hydrology of the DZP Site



3.4.2 Wambangalang Creek Catchment

The Wambangalang Creek catchment (including Paddys Creek and Meadows Creek catchments) drains north-northeast before joining the Macquarie River approximately 7km north of the DZP Site. The catchment drains an area of approximately 36,880ha and the DZP Site is located in the lower 10% of the catchment (near the confluence point with the Macquarie River).

Major Creeks draining into Wambangalang Creek (also identified on **Figure 9**) include the Belowrie, Glennie and Tanners Creeks from the upper western side of the catchment. The Emmagool and Meadows Creeks drain the upper central section of the catchment and Paddys and Spring Creeks drain the upper south-eastern area of the catchment. All flows are ephemeral but may have some degree of subsurface flow through unconsolidated alluvium.

3.4.3 Cockabroo Creek Catchment

The Cockabroo Creek catchment drains to east before joining the Little River approximately 4km east of the DZP Site. This small catchment of 4,240ha drains surface flows off a local high point, Dowds Hill, and other rockier, densely vegetated areas of the local setting.

3.4.4 Macquarie River (Undefined) Catchment

Water from a small section of the DZP Site, predominantly on the "Ugothery" property, flows via several ephemeral channels directly into the Macquarie River (approximately 7km to the north). While the catchment is bound by several isolated hills up to 385m AHD, the elevation is generally below 320m AHD.

3.5 VEGETATION

3.5.1 Introduction

The DZP Site can be generally described as supporting a mosaic of Box-Gum Woodland, Fuzzy Box Woodland, Inland Grey Box Woodland, derived native grasslands and cleared / cropped land. In areas of remnant vegetation or / and reasonable quality grassland. Grassy White Box Woodland is known to occur which is a component of the state and federally listed Box Gum Woodland.

River Red Gum along with scattered River Oak with Rough Barked Apple and Apple Box occurs along Wambangalang Creek with Yellow and Inland Grey Box found on outer edges of the floodplain.

Derived native grasslands, grazing country with scattered trees and tree clumps is the main vegetation community to be affected by the activity.

3.5.2 Vegetation Recorded

Seven *BioMetric* vegetation types and an additional five mapped communities occur within the DZP Site and on adjacent lands. Previous mapping of the DZP Site undertaken by Geoff Cunningham, Natural Resource Consultants (GCNRC) has been converted to 'best fit' *Biometric* communities and included in the mapping for the DZP Site. Communities include;

1. CW 138. Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201).
2. CW 202. Tumbledown Red Gum - Black Cypress Pine - Red Box low woodland of hills of the South Western Slopes.

3. CW 112 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277).
4. CW 121 Bulloak - White Cypress Pine woodland mainly in the NSW South Western Slopes Bioregion (Benson 54).
5. CW 212. White Box - Tumbledown Gum woodland on fine-grained sediments on the NSW central western slopes (Benson 270).
6. CW 213. White Box - White Cypress Pine - Inland Grey Box woodland on the western slopes of NSW (Benson 267).
7. CW143. Heathy shrublands on rocky outcrops of the western slopes
8. Derived Grassland, Grazing Country with Scattered Tress and Tree Clumps.
9. White Cypress Pine Monocultures.
10. Farm Dams / Water bodies.
11. Cleared land.
12. Buildings and Infrastructure.

Spot checks of the decommissioned rail corridor of the Dubbo-Molong Rail Line between Dubbo and Toongi undertaken in 2012 revealed that isolated eucalypts and shrubs (consistent with surrounding vegetation communities) have regrown in some areas in the corridor since this time. A Biometric BVT community could not be correlated to the vegetation in the corridor as it has been heavily invaded by introduced plant species (leased to adjoining landholder's for grazing purposes). Species recorded are consistent with those recorded by GCNRC (2002b) and a further list was not compiled.

Vegetation within the water pipeline easement between the DZP Site and the Macquarie River is predominantly cropped and grazed paddocks. The vegetation communities are highly altered from the native vegetation communities that originally covered the route and no attempt was made by GCNRC (2002c) or OzArk to identify and map remnant vegetation communities. A Biometric community could not be correlated to the vegetation in the easement, however, tree clumps and scattered trees indicate that this area was once Fuzzy Box, Yellow Box, Inland Grey Box associated communities.

Vegetation within the Obley Road reserve generally contains White Box, Yellow Box, Fuzzy Box Woodland or Inland Grey Box Communities that form part of the state and/or national listed Endangered Ecological Communities (EECs). Nine portions of road were identified as requiring realignment.

3.5.3 Flora Species Recorded

244 plant species were recorded by GCNRC during the 2001 and 2002 surveys within the DZP Site⁹, including 67 (27%) introduced species (GCNRC 2002a).

234 species of vascular flora were recorded during the 2012 survey, conducted as a series of BioBanking plots (in accordance with the BBAM) over the DZP Site, including 67 (28%) introduced species. The median number of plants recorded per BioBanking plot was 27, with the lowest number 9 (Plot 6) and highest 44 (Plot 26). The Medium percentage of weeds within the BioBanking plots was 61%. This reflects the effect of a long history of grazing and ploughing in some areas within the DZP Site.

⁹ It should be noted that the boundary of the GCNRC field survey differs from the DZP Site.

Flora survey was conducted along the decommissioned Toongi-Dubbo Rail Line in November, 2001 (GCNRC, 2002b) with additional survey for threatened species and regrowth completed in 2012. During the 2001 survey 260 plant species recorded within the corridor including 115 (44%) introduced species (GCNRC, 2002b). These introduced species account for the bulk of the ground cover and biomass present.

Flora survey was conducted along the Macquarie River Water Pipeline in May 2002¹⁰ with additional survey of access points completed in 2012 (GCNRC, 2002b). The abundance of weeds reflects the clearing, grazing and cultivation that have occurred along the route over the past 150 (plus) years. 94 plant species recorded were recorded within the corridor including 49 (52%) introduced species.

Additional species were not recorded along the Toongi-Dubbo Rail Line or Macquarie River Water Pipeline routes during the 2012 surveys conducted by OzArk.

3.6 CLIMATE

The Dubbo area experiences a sub-humid climate characterised by hot summers and lacking a dry season. The average rainfall of 585.2mm predominately occurs in the summer months. The Bureau of Meteorology reports that the average maximum summer temperature is 33°C and maximum winter temperature 15.2°C (BOM 2012).

3.7 LAND USE HISTORY

Aboriginal people in prehistory are known to have used fire-stick farming, or controlled burns, to alter vegetation ecosystems to promote the growth of desirable plants. Though it cannot be said at this time whether fire-stick farming was undertaken within the Study Area, it is becoming increasingly believed that Aboriginal fire regimes were widespread (Gammage 2011) and therefore should be considered as a possible early land-use practice.

Since settlers came to the area in the mid-1800s the landscape has been altered significantly. Homesteads, including habitation and farm structures, have been built, as have community buildings such as a school and a church. Perhaps the land-use with the greatest impacts, however, comes from grazing and cropping the land. Native vegetation has been cleared from the land, with some ring-barked trees still present in the landscape. Fences have been built and rocks removed from the soil and piled up to ease ploughing. Waterways have been modified and earth dams built. Crops have been planted, and livestock such as sheep and cows have been run on the land for generations.

Roads and rail lines have been installed to aid transportation of people and goods to the area. What is now known as Obley Rd was formerly a Travelling Stock Reserve (TSR) (notified 26 May 1894). It remained a TSR until before 1909 when the TSR was supplemented by a road. (Parish Maps 1884, 1899, 1909). Though the earliest map found which is labelled with 'Obley Rd' dates to the 1960s, 'Obley Rd' is mentioned by name in a 1905 advertisement seeking workers to install fence at The Meadows (The Dubbo Liberal 1905). In 1925 the Molong-Dubbo Railway was completed, which consisted of the railway line itself, several rail bridges, and associated small-scale infrastructure. The portion of the Molong-Dubbo Railway which extends into the Study Area ceased operation in 1987. In modern times roads and residences continue to be built. Cropping and grazing continues across most of the Study Area.

¹⁰ There has been some modification to the alignment of the Macquarie River Water Pipeline since November, 2001, however, the vegetation communities traversed remain equivalent.

3.8 EXISTING LEVELS OF DISTURBANCE

Review of the past and present land use patterns within the Study Area demonstrates that substantial parts of the landscape, especially along flats and low slopes (particularly associated with creek lines) have undergone significant physical modification as a result agricultural activities, particularly cropping, grazing and alteration of pre-European fire regimes. These activities have disturbed or destroyed ecological niches that may have been located in the resource rich creek areas in prehistory. Other processes have also been responsible for the modification/destruction of the environment, including increased erosion and soil movement as a result of white and black cypress pine monocultures and tree removal as well as the altered hydrological impacts of flooding, both of which may have contributed to the disturbance and/or redistribution of topsoils.

Much of the ground layer within the Study Area is invaded by weeds with some evidence of feral animals in more disturbed areas. Despite this, the abundance of native tussock grasses (in most areas) and scattered trees associated with Box-Gum Woodland EEC (White Box, Kurrajong, Yellow Box) mean that these areas are often consistent with the Threatened Species Conservation Act 1995 (TSC Act) listed White Box Yellow Box Blakely's Red Gum Woodland.

3.9 CONCLUSION

The environmental characteristics of the Study Area provide context for the archaeological findings, influencing the density and types of sites present as well as the conditions that sites are found in.

The Study Area is characterized by overall low local topographical relief comprising river flats (floodplains), gently undulating landscapes, and low hills. Soils vary throughout the area from alluvial river deposits to shallow soils on higher hills. Three hydrological catchments are present on the DZP Site alone. Vegetation consists of various gum and box tree species, shrubs, and grasses.

The proximity of water to the Study Area, the lack of an annual dry season, and the diversity of landscapes (and thus resources) together create conditions that would have attracted and sustained Aboriginal populations. These resources made the land attractive to European settlers as well, whose agricultural practices, roads, and railways have significantly altered the landscape.

The relationship between the landscapes and identified archaeological sites is discussed further in **Section 4.4**.

4 ABORIGINAL HERITAGE ASSESSMENT: BACKGROUND

4.1 ETHNO-HISTORIC SOURCES OF REGIONAL ABORIGINAL CULTURE

According to Tindale's map of tribal boundaries (1974), the Dubbo area falls within the northern limits of Wiradjuri country, as defined by the limits of the Wiradjuri language group. Bordering to the west is Wongaroon country, and to the north Kawanbarai country. According to Horton (1980), the boundary of the Wiradjuri extends somewhat further to the north and west to encompass Gilgandra, Nyngan and most of the Bogan River. Lloyd Nolan (2000) acknowledges the controversy surrounding delineating traditional boundaries, but states that the current Study Area 'is within the Dundullimal territory, a sub group of the Tubba Gah-Wiradjuri nation'.

It is important to note that the designation of lines on a map as 'tribal boundaries' has been a controversial issue (Bowdler 1983: 22). There is no doubt that there were distinctive groups that can be defined by their linguistic traits, but the designation of lines on a map as boundaries, although useful, must also be accepted as problematic. In contrast to Tindale's map, the map (from NSW NPWS) reproduced in Bowdler (1983: 17) shows a more general relationship of the language groups known to exist in NSW.

Early accounts of first contact between Europeans and Aboriginals in the Macquarie River area can be found in Oxley (1820) and Sturt (1828 and 1833). Although interesting, these sources provide only a small window into the lifestyle and customs of the Aboriginal people of the Dubbo area. Northwest of the current study area, near Whylandra Creek / Tanners Springs, one of the first encounters John Oxley had with the Indigenous inhabitants of the area was on August 13th 1817. It appears that this was the first time these Aborigines had seen white men, however they may have had knowledge of steel tomahawks as when they were presented with one as a gift they clutched it to their breast and demonstrated pleasure. At the time of the meeting the Aborigines were obviously hunting, having with them dead possums and snakes, which they offered to the white men. Markings on the skin of the young Aboriginal men were described as longitudinal scars over the back and body with barely any space between them (Oxley 1820: 171-2). Oxley noted that near Arthurville the animation of the whole scenery was increased by the smoke of the natives fires arising in every quarter, marking that they were in a country which afforded ample means of subsistence, which was far different from the low deserts and morasses to the south.

The following day a group of nine male aborigines came to Oxley's camp. One of the men possessed a stone-hatchet and Oxley presumed the women and children were in hiding nearby. He suspected that they were not the first white men they had seen or, alternatively, had heard about, as they were neither alarmed nor astonished at what they saw. Not all of the men had a missing upper front tooth, but all had a stick or bone protruding from the cartilage in the nose. Mr Evans drew a picture of a fish and the men pointed to the east. Oxley concluded that they appeared a harmless people, extremely cautious of giving offence, and never touching anything until they had first by sign obtained permission.

It is thought that prior to contact with Oxley and Sturt Aboriginal people were exposed to the European disease smallpox, causing an estimated 90% reduction in population due to death from the disease, and described by Sturt in 1829 (Lambert 2012).

With the increase in European settlement of New South Wales in the mid-1800s tensions between indigenous people and settlers intensified, resulting in conflict and massacre, though there is no record of such a conflict occurring in the vicinity of the Study Area. Post-contact Aboriginal people often worked 'as stockmen, at shearing and mustering, and in domestic services' (Heritage Office 1996: 80), likely maintaining some of their traditional lifeways. In 1898 an Aboriginal Reserve was officially created at the confluence of the Macquarie and Talbragar Rivers. Some families lived there, others moved to Dubbo (Koettig 1985: 19), and others lived in the rural communities.

Indeed, The Springs property (Heritage listed with local significance), just south of the Study Area, is a location of early contact between Aboriginal and European people in the Dubbo region. According to Koettig (1985), John Oxley made the first sighting of Aboriginal people in the district in 1817 at Whylandra Creek and on the 15th of August he camped on Paddys Creek near The Springs, where archaeological evidence of Aboriginal occupation remains. Records are scarce, but it is likely that Aboriginal people remained active in the vicinity of Toongi into the historical period. Many were employed by the Baird's (landowners at The Springs) as station-hands and/or helpers. At least three local Aboriginal men are named in the *Dubbo Liberal and Macquarie Advocate* as working on the neighbouring 'Meadows' property, viz. William Carr, William (King) Carr and Michael Mickey (DLMA 31 October 1916: 4). Michael Mickey, a prominent Dubbo boxer of the early twentieth century, is also mentioned in relation to 'The Springs' in the NSW Department of Mines (Dubbo Division) Annual Report of 1915 (Berry 2006: 4).

One of the most informative written sources available about the life of Aboriginal people in the Dubbo area after European settlement is that of Edward Garnsey, who was born in Dubbo in 1874. His interest in Aboriginal culture of the Dubbo area led him to record information he had gathered both from his father and from old Aborigines he knew in the Dubbo region.

The most relevant historical resource is the oral history passed down through the local Indigenous inhabitants, from parent to child. When such information becomes readily available it will likely replace Garnsey as the most valuable written resource on Aboriginal cultural practices at the time of European settlement. Until then Garnsey remains as a useful account covering many topics relating to both everyday life and religious/ceremonial practices, but must be taken as an eclectic, interpretative account rather than a true anthropological review. What follows is a brief summary of some of the information he presents.

The Dubba-Ga (Dubbo mob)

The Dubba-ga (Thubba-ga) group were part of the broader Wirruh-Jah-Mine tribe (Wiradjuri – Possum men territory). Such groups were thought to have comprised about 30 to 40 people, although various sized groups have been reported (Koettig 1985: 21-22).

The territory said to have been traversed by this group generally lies to the east of the Macquarie River, south of the Talbragar River and north of Eulomogo creek. The Indigenous community as represented by the Wirrimbah Direct Descendants (WDD) do not agree with Garnsey's division into tribes of the Aboriginal group that occupied the Dubbo area. According to Will Burns (previous Chairperson WDD), the Thubba-ga mob inhabited both sides of the Macquarie River.

According again to Garnsey, the Dubba-ga mob was named after a pigment called Dub-bo, which refers to the red or blood pigment found within their territory. This was a valuable and prized commodity, bartered widely and found at a place called Dub-am-bil (place of pigment) located about three kilometres up the Macquarie River, on its right bank.

Resources

The area of the Dubba-Ga is described as being rich in both flora and fauna resources with the following exploited for food (Garnsey 1942 and Pearson 1981 as quoted in Koettig 1985):

- Animal resources: possums, native bears (koala), wallabies, wombats (highly prized), bandicoots, kangaroos, rats, platypus, lizards and snakes. Bird species included emu, plain turkeys, water fowl, and many other bird species (Talbragar meaning plenty birds to eat). From the rivers and lagoons came fish (cod, perch and cat fish) as well as yabbies, shrimp and turtles. Grubs from the Casuarinas and Kurrajongs were also exploited; and
- Plant resources: Kurrajong seeds, growing tips and berries, honey, roots, acacia gum, bulrush, pulp, nuts (quandong) and yams.

Camp life

According to Garnsey (1942: 6) camp life was communal, with individuals working together for the benefit of the mob. The mob was presided over by a chief or 'Eulomogo' (which means 'big man belonga stone spirit'), who was the dispenser of ancestral tribal rites and ceremonies and through whom the ancestral traditions were handed down. The 'Billum' or king was next in terms of power, and generally acted in a civil capacity.

Each mob had its own camp site or 'whurlie' which consisted of a series of bark or bush 'gunyahs' (huts). These were placed in a semi-circle opening to the east, and in the centre was the spirit fire 'Wengel-go'. The gunyahs were said to house between eight and ten people, although other references note smaller shelters, and the relationship between these different shelter types is difficult to ascertain (Koettig 1985: 22). Men were said to occupy gunyahs to the north of the circle, women in the central ones and children in the southern gunyahs.

According to Pearson (as referenced in Koettig 1985: 23), camps were moved frequently, sometimes only a short distance, or up to several kilometres away. Reasons for such relocations are numerous, including changing social relations, weather factors, hygiene or just the desire for change. More large scale movement was usually determined by the need for a large scale gathering (ceremonial or warfare) or changing resource availability. An excerpt from a letter written in 1899 also indicates that the death of a king may precipitate a movement of camp and thereby prevent the group from camping in that location for the subsequent twelve months (Koettig 1985: 23).

All ages and sexes contributed to the procurement of food, with the men generally hunting large game and women and children hunting smaller game, such as goanna, and foraging for grubs, seeds and yams.

Ceremonial Life

By as early as the 1890s, Garnsey notes that the 'mob' structure had disintegrated to the degree that only the older men still had the tribal markings and memories of some of the ceremonies. As a result, his descriptions of some of the ceremonies are a composite of various accounts, the authenticity of which is unknown (Garnsey 1942: 14).

The rituals and ceremonies tended to relate to the changes in social status that occurred with the progression from infancy to adulthood. Prior to initiation at puberty several smaller rites of passage must have already been undertaken. These were known as the 'Co-Pi Rah' (whitemake) ceremonies, which involved air, water and fire. During these ceremonies children were instructed of the rules by which they must live. At puberty both male and female children underwent a series of ceremonies which issued them into adulthood. The male ceremonies are known as the 'Bo-rah' (red/bloodmake) and the 'Co-bo-rah' (bloodmake). Detailed descriptions of these ceremonies can be found in Garnsey (1942: 16-23).

Several references to a great corroboree held at Dundullimal in 1839 are cited in Koettig (1985: 24). These describe a ceremony attended by between 600 and 800 individuals, which involved dancing and yelling and the presentation of a 2m by 1m piece of bark which had been painted with red and white pigment.

Burial Practices

According to Garnsey (1942: 23ff), human burial was undertaken after sundown but before dark. The body was placed in a squatting position, with the elbows placed on the knees and the head between the hands. In this position, the body was placed at the foot of a Coolabah tree (Box) facing east. In the burial of an important individual, a strip of bark about five foot long and two foot wide was stripped from the eastern side of the tree and placed in a slanting position over the corpse, with some saying that the man's tribal markings were painted onto the bark in red pigment. The blaze on the tree was also carved in tribal markings to show the man's status. These carved trees were apparently only associated with the graves of the spiritual leaders (the Eulomogo) and kings or Eulas. For the period of mourning, the body

remained out of the ground, and there are several stories as to the manner in which the decomposing juices of his body were used (Garnsey 1942: 24). A carved tree of the eulomogo is said to have been surrounded by other carved trees known as Cobba-da 'blood brother trees' in a particular pattern, and one such group of seven trees was remembered by Garnsey as standing 'just outside the town' [of Dubbo], with several more being located within the township.

Another account of an Aboriginal burial from Dubbo, dating to 1845, sees the body placed in the same position as described above, but with the body wrapped in a skin cloak that was tied together by the belts of people attending the ceremony. The body was then placed in a sandy deposit about a mile from the river, a mound of sand built up over the grave and several trees subsequently carved. Possum skin cloaks were also noted in burials recorded at Wellington and Bathurst (Pearson 1981: 535 as quoted in Koettig 1985: 25).

Material Culture

The majority of material remains relating to past Aboriginal culture no longer exist, as most of them were made from organic materials that have not survived the ravages of time. Some objects were collected by early settlers and have since passed into museum collections, while descriptions of others can be found in early historic accounts. Archaeological evidence is limited to objects of stone and occasionally bone or wood. Koettig (1985: Table 2) provides a fairly comprehensive list of objects reported to have been used by the Aborigines of the Dubbo region, and can be briefly summarised as follows:

- Throwing stick or spear – some long (2.4m to 3.6m) for war or hunting; others short (20cm to 36cm) for hunting only.
- Spear thrower – c. 76cm to 91cm long, 8cm wide, triangular in cross-section and notched at one end to hold a spear.
- Clubs – around 76cm long and of varying shapes, made for hand to hand combat.
- Boomerang – 90cm long and axe shaped at one end, made for ceremonial, throwing or utilitarian uses.
- Digging stick – a pointed stick about 1.2m to 1.5m long used by women for digging up yams.
- Skin cloaks – from kangaroo, possum, koala, rat etc., sewn together with kangaroo tail sinews, scraped soft, applied with emu fat and ash to the flesh and then kneaded. These were of varying sizes and were used for warmth and the lining of shelters.
- Wooden spades – used for digging.
- Belts – used for tying up skins and for burials.
- Nose bones or reeds – for ornamentation, noted at Toongi.
- Axes – stone, steel (after European settlement), for hunting and other purposes (bark removal).
- Stone knife – a chip of quartz inserted into a cleft of a stick and bound with sinew from a kangaroo tail was said to have been used for wood-working.

Other items not recorded in the historical accounts but likely to have been used include shields, wooden dishes, bags and baskets made of grass, bark or skin, nets, bull-roarers for ceremonies and items of personal adornment including headbands, necklaces and cloaks. The only record of artistic expression comes from the decoration of utilitarian or ceremonial objects. Designs were incised onto skin cloaks and bark paintings were recorded lining shelters and in ceremonial contexts. The designs carved into the trees as burial markers provide the most obvious remaining artistic expression (Koettig 1985: 43).

4.2 REGIONAL ARCHAEOLOGICAL CONTEXT

Prior to 1985 no systematic, regional based archaeological studies had been undertaken in the Dubbo area. There were, nonetheless, many sites recorded, generally by interested locals or amateurs. In the late nineteenth and early twentieth century, individuals such as Milne, Gresser and to a lesser extent Garnsey, recorded site data and made collections of artefacts, thereby contributing to the body of archaeological data now available to the researcher. In the last 30 years many archaeological studies have been undertaken in the Dubbo area, usually as part of an environmental impact assessment. A handful of the hundreds of sites recorded in and around Dubbo have been listed on local heritage databases.

Site types present in the region, listed from most frequent to least frequent, are: artefact scatters, scarred trees, grinding grooves, burials, stone quarries, ochre quarries, ceremonial rings, stone arrangements, shell middens, hearths, ceremonial/dreaming site, and a waterhole (OzArk 2006).

Relevant to a scientific understanding of the archaeology of the Dubbo region are five studies undertaken over the past thirty years. These are Pearson (1981), Koettig (1985), Balme (1986), the NPWS WRA Brigalow Belt South Bioregion Assessment (NPWS 2000), and a study commissioned by the Dubbo City Council (OzArk 2006). Many smaller assessments have been undertaken in recent years in the Dubbo area, including some that fall near the Obley Road Alignment, such as those by Kelton (1997) and Nolan (2000). Together these provide baseline data for placing past Aboriginal sites within a regional landscape context. Following is a summary of the salient points learned from these studies:

Pearson: Pearson (1981) worked primarily in the Upper Macquarie region, the western boundary of his study area being Wellington. The proximity of this area to the current study area and the general topographic similarities make the findings of this work relevant. According to Pearson archaeological sites could be divided into two main categories, occupation sites and non-occupation sites (which included grinding grooves, scarred or carved trees, ceremonial and burial sites etc.). An analysis of the location of these sites led him to build a model for site prediction which saw occupation sites occurring in places that had access to water, good drainage, level ground, adequate fuel and appropriate localised weather patterns for summer or winter occupation. Such places were most frequently found on low ridge tops, creek banks, gently undulating hills and river flats and usually in open woodland vegetation (Pearson 1981: 101 as quoted in Koettig 1985: 47). He notes that this pattern may differ somewhat as you head west (towards Dubbo and beyond) into the drier plains where there was a greater dependence on the larger, more permanent water supplies.

The location of non-occupation sites were dependent on various factors relating to site function. For example, grinding grooves only occur where there is appropriate outcropping sandstone, but as close to the occupation site as possible. Scarred trees were variably located with no obvious patterning, other than proximity to watercourses, where camps were more frequently located, hence these provided a focus of human activity.

Although a useful study, Koettig (1985: 49-50) considers Pearson's findings as preliminary, mainly due to the unsystematic nature of the recording of most sites used in the analysis. In her view, this would have skewed both site type (obvious manifestations) and location (areas of disturbance), therefore biasing the sample. Further the sample size of both the Wellington and other areas were considered too small to yield significant results.

Koettig: More relevant to the current study's scope is Koettig (1985), who undertook a comprehensive study of evidence relating to Aboriginal occupation within the Dubbo City area, including an area approximately 4km south of the current Study Area. Koettig determined there was need for systematic survey to ensure that all topographic landform units and different stream order associations were explored in terms of site type and location. This field work included detailed recording of various site types, ensuring the presence of comparative, quantifiable data. The field survey was undertaken by dividing the broader Dubbo study area

into five sample Survey areas covering the three major physiographic zones, but was constrained by time and an inability to access privately owned land.

As a result of this study, Koettig (1985: 81-82) concluded that:

- Aboriginal sites may be expected throughout all the landscape units surveyed.
- The most frequently occurring site types were open artefact scatters, scarred trees and grinding grooves. Less common but present were hearths, shell lenses, and carved trees.
- The location of sites and their relative size were determined by various factors, predominantly environmental and social. Although social factors cannot be explained through archaeological research, some of the environmental issues may be. These are:
 - Proximity to water: the largest campsites were located close to permanent water, nonetheless, sites were found all over the landscape including hills and ridges away from obvious water.
 - Geological formation: Certain sites require specific conditions, e.g. grinding grooves occur where appropriate sandstone outcrops, quarries are found where suitable stone resources are accessible, burials tend to be found in sandy sediments such as alluvial flats etc.
 - Availability of food resources: The widest range of potential foods was found along the main water courses due to the supply of permanent water. Some foods would have been seasonal and required foraging away from water courses.

In predicting intensity of occupation, Koettig suggests that larger and more constantly occupied sites are likely to occur along permanent watercourses, while less intense and sporadic occupation evidence is seen along ridge tops or temporary water sources e.g. creek headwaters.

Upon conducting survey in the vicinity of The Springs, a homestead just south of the current Study Area, Koettig recorded 17 sites, including artefact scatters, carved and scarred trees, and a hearth. Sites were generally found to be extensive in this area, with high densities of artefacts in localised areas, though artefacts were being displaced via erosion (1985: 128). The landforms of this area were described by Koettig as 'gentle slopes and small hills, narrow river flats and in places bedrock was outcropping along the ridges' (Koettig 1985: 111). Impacts noted consist of ploughing and sheet wash erosion.

Balme: The North-Central Rivers study undertaken by Balme (1986), contributed to our knowledge of the archaeology of the region by looking at site location with reference to preservation, both in the face of natural and incursive processes. Findings concluded that apart from the effect of historic impacts on sites, the greatest influence on the distribution of sites is that of geomorphic processes affecting site preservation and subsequent processes leading to site exposure (Balme 1986: 182 as quoted in Jo McDonald CHM: 1998: 17). Balme also found there was little scope for the assessment of the chronology of prehistoric sites as so few datable contexts have been located. Finally, and relevant to the current study, was Balme's finding that a number of sites recorded on the Aboriginal Site Register from ethnographic accounts (e.g. Etheridge 1918) are no longer likely to be found.

NPWS WRA Brigalow Belt South Bioregion Aboriginal Cultural Heritage Assessment: The Brigalow Belt South Bioregion Aboriginal Cultural Heritage Assessment (Stage 1) focussed on assessment of the Pilliga and Goonoo State Forests, in an attempt to determine areas of Aboriginal sensitivity. Results of this assessment for the Goonoo State Forest, which is located within the Dubbo LGA, showed that of the twelve landforms present across the LGA only seven are present within the Goonoo forest. 106 Aboriginal sites were recorded and were found to be more frequent within alluvium landforms, which include creeks, swamps and

chains of ponds surrounded by floodplains and terraces (NPWS 2000: 1). The results were interpreted as providing a representative picture of Aboriginal site distribution for the area, indicating that sites did occur within all mapped landforms, but in varied frequencies. The results of this study allowed the tabulation of data relating to site location with reference to distance from water, showing that 90% of sites were recorded within 200m and 300m of water (Purcell 2000: 31).

OzArk: In 2006 OzArk reported on Indigenous heritage resources in the Dubbo LGA with the aims of consolidating previous surveys and assessments of Indigenous heritage across the LGA so as to set a baseline for further study and undertake field survey primarily of areas zoned 11 (future expansion) to assist the Dubbo City Council (DCC) in planning. A total of c.1,120ha of land was surveyed. Twenty-six new Aboriginal sites were recorded and eight of twelve previously recorded sites were located as a result of the 2006 field investigation, giving a total of 34 Aboriginal sites documented during the assessment.

The study found that the ratio of newly located sites by type follows previous studies reasonably closely. More scarred trees may have been expected, but can be explained by the study area's land-use history. Intensive agriculture has probably resulted in a higher tree clearance in the study area than the average for the Dubbo LGA. The absence of grinding groove sites is explained by the fact that this site type comprises just 3.61% of previously located sites in the Dubbo LGA. Scarred tree distribution adhered to the predictive model in that they exclusively followed waterways and fence-lines, which is more a reflection of land clearing practises than any true Indigenous site patterning. Isolated finds and open sites followed a similar pattern and were largely limited to watercourse edges and elevated terraces within 500m of the Macquarie River or other permanent to semi-permanent waterway. No real pattern emerged in terms of site size or quality, as surface manifestations of sites are not always a true reflection of their size or complexity.

The study met some but not all of its aims. Namely, the sampled survey areas did not cover enough different landforms to make firm correlations between site types and landform sensitivity. The main findings about site type distribution are as follows:

- Lower / intermediate terraces, floodplains, and hill crests were not represented well enough in terms of Estimated Survey Coverage (ESC) to make a good assessment of archaeological potential.
- Despite poor ESC, elevated terraces provided relatively high site numbers. This landform only occurred in areas that included a segment of the Macquarie River.
- Creek / river banks and edges ranked highly as well. This is consistent with the predictive models.
- All sites were located within 500m of a permanent water source or 100m of an ephemeral water source. However, around 25% of the study area falls within this zone, and generally has a much higher ESC than portions of land further away from water. Nonetheless, water sources seem to be the primary influence behind site location.
- Despite good ESC, hill slopes / sloping plain and flat plain yielded low artefact numbers.
- The majority of all site types recorded (63.2%) were on Quaternary alluvium, the soils once supported the more complex ecological communities in the region. This geological unit in the region occurs near major waterways such as Macquarie and Castlereagh Rivers and the major creek lines and as such water is found within close proximity and consequently, the likelihood of associated Aboriginal sites increases.

Obley Rd Assessments: Many smaller assessments have been undertaken over the years on Obley Rd, primarily for environmental impact assessments for road alignment projects. Kelton (1997), Nolan (2000), OzArk (2003) as well as amateur archaeologist Warren Bluff,

among others, contributed to the recorded total of 33 AHIMS-listed sites on the edges of Obley Rd between the DZP Site and town of Dubbo. The overwhelming majority of these sites are scarred trees.

Sites listed on Heritage Databases: No Aboriginal sites are listed on any national, state or local heritage databases within the Study Area prior to the current investigation. However, there are several listed sites nearby. These consist of:

- Indigenous Place at Brocklehurst – bora ground (Australian Heritage Database/ Register of the National Estate)
- Indigenous Place at “Toongi Valley” – carved tree (Australian Heritage Database/ Register of the National Estate)
- The Springs at Toongi – while the significance of this Australian Heritage Database listing is based primarily on historic occupation, it is noted that the place is also important for its relationship to Aboriginal and early settler contact (NSW Heritage 2012).
- Dundullimal at Dubbo – while the significance of this Australian Heritage Database listing is based on historic occupation and not Aboriginal occupation, it is included here as there is a known extensive Aboriginal site located on the property, Aboriginal people were employed there in the 1891 (NSW Heritage 2012b), and there is an ethnographic report of a corroboree held there in the 1840s, attended by 600 to 800 people (OzArk 2006: 33). The Aboriginal site located on the Dundullimal property, while not listed on any heritage register, is reported to have had Aboriginal ceremony and dreaming components, a ceremonial ring, a hearth, grinding grooves, and artefacts associated with an open camp site/ artefact scatter (AHIMS site #36-1-0021).

4.3 LOCAL ARCHAEOLOGICAL CONTEXT

As the Study Area is large, the local context is discussed separately for the DZP Site and Macquarie River Water Pipeline, the Obley Road Alignment, and the Toongi - Dubbo Rail Line and Gas Pipeline Corridor.

DZP Site and Macquarie River Water Pipeline

Two previous Aboriginal heritage assessments have been undertaken in the DZP Site component of the Study Area, both by Lloyd Nolan. Another important assessment was undertaken by Margrit Koettig in 1985 which included portions of Paddys and Spring Creeks, approximately 4km to 5km south of the current Study Area. Koettig's findings are discussed in **Section 4.2**.

In 2000, Lloyd Nolan undertook a survey of 6ha which overlaps the impact footprint of the proposed open cut. Two Aboriginal sites were recorded during this assessment, TS-IF-01 and TS-GG-01, an isolated artefact and a grinding groove site, respectively.

The most extensive assessment undertaken within the DZP Site of the current Study Area was Lloyd Nolan's 2002 assessment for an earlier version of the DZP. As a result of his assessment, 22 Aboriginal sites were recorded (11 scarred trees, six open artefact scatters, three grinding groove sites and two isolated artefacts).

Obley Road Alignment

Three assessments have been previously undertaken in the vicinity of the Obley Road Alignment. M. Koettig (1985) reported on the earliest of these for an *Assessment of the Distribution of Archaeological Sites in the Dubbo City Area*. One of her sites is located near the current Study Area, a moderate-sized artefact scatter and a scarred tree on the banks of Hyandra Creek.

Four scarred tree sites (all named 'Obley Rd') were recorded by Warren Bluff along Obley Road in 1991, near the impact footprint. There is no report to accompany the recordings. They do not plot within the impact footprint for the Obley Road Alignment, however, due to the early date of recording it is likely that the sites are not plotting correctly and that they could be closer to the road corridor than they appear on a map. None of these sites were identified during the course of field survey as part of the current assessment.

OzArk conducted the most recent assessments (both in 2003) that fall within the impact footprint, the *Obley Rd Water Mains* project and the *Obley Road, Toongi* indigenous heritage study. Two scarred trees near the Study Area were recorded during each assessment, however, neither fall within the current impact footprint.

Toongi - Dubbo Rail Line and Gas Pipeline Corridor

No previous assessments have been undertaken within the impact footprint of the Toongi - Dubbo Rail Line, however, three assessments are close to the Study Area.

As part of Koettig's 1985 assessment for the Dubbo City Council (discussed in **Section 4.2**) two sites were recorded north of the Cumboogle Rail Bridge, near the confluence of Cumboogle Creek and the Macquarie River. These sites are camp sites with shell middens, one of which has a scarred tree onsite as well. In the same vicinity as Koettig's assessment two modified (carved or scarred) trees were recorded by Kelton, though a report is not associated with them in the AHIMS database.

Several scarred tree sites were recorded by Warren Bluff, an amateur archaeologist, near the intersection of Benolong Rd and Obley Rd. No report accompanied the recordings, and it has been found that other sites recorded by Warren do not plot correctly (due in part to the fact that reliable GPSs were not widely available in the early 1990s), and that some of his scarred tree recordings do not meet established criteria for Aboriginal scarred trees. For these reasons there is little scientific reliability to his site recordings.

Additional sites were recorded near the Toongi - Dubbo Rail Line, north of the Macquarie River, by OzArk (2006). These consist of open artefact scatters, one of which is adjacent to the rail line. This low density artefact scatter (two artefacts within 10m of each other) is thought to have possibly once extended across the rail easement, however, the rail easement has significantly disturbed the area and no artefacts are present within its bounds (the fences).

4.4 PREDICTIVE MODEL FOR SITE LOCATION

Predictive modelling aims to establish a theoretical model for site location and distribution within a given area. This model provides a comparative situation against which the results of the investigation can be discussed, taking into account the effects of post formation processes such as visibility and land use.

Proximity to a permanent water supply is generally considered the primary factor determining the location of Aboriginal camp sites. Stream ordering has been used to predict the potential for site occurrence, and the possible complexity of these sites. Results of an integrated series of studies including serious excavation components (Jo McDonald 1997), suggests a high correlation between the permanence of a water source and the permanence and/or complexity of the areas' Aboriginal occupation. This was further reflected in the lithic assemblages from sites close to permanent water which suggested that a greater range of activities were represented (e.g. tool use, manufacture and maintenance, food processing and quarrying). Sites near ephemeral water sources had evidence for one-off occupation (e.g. isolated knapping floors or tool discard), and creek junctions were also proven to be centres for site activity.

Using the concept of stream ordering, previous research within the general area, and the knowledge gained from a review of the local context, the following general predictions can be made regarding the nature of sites and their location in the current Study Area:

- On major creek lines and rivers archaeological evidence will tend to indicate more permanent or repeated occupation. Sites may be complex, with a range of lithic activities represented, and may be stratified from repeated occupation. Proximity to resource rich zones also indicates a higher likelihood of the presence of complex occupation sites.
 - Several second order creeks and the Macquarie River traverse the Study Area. The close proximity of water increases the likelihood of finding large or complex sites on the elevated knolls, spurs and terraces near the major creeks.
- Further from water, sites are likely to be smaller, less complex and more likely to be the result of one-off occupation episodes.
 - The components of the Study Area that are more distant from water have lower potential for site occurrence, which is compounded by the fact that the majority of the ground not immediately adjacent to creek lines has been impacted by vegetation removal and agricultural activities.

In terms of the local and regional archaeological contexts, scarred trees and grinding grooves could be expected to be well-represented. An abundance of scarred trees have been identified locally and regionally (**Sections 4.2 and 4.3**). While grinding grooves constitute what could be considered to be a typical proportion of site types regionally, they are much more common locally. Both site types are more frequent at a local level than is typical of most regions in NSW.

Based on this archaeological context and the landform potential as detailed above, it is possible to say that the likelihood of encountering different site types in the Study Area are as follows.

- Open sites may be found on elevated terraces and low spurs close to water; such as Wambangalang Creek. These sites may be complex and/or extensive.
- Scarred trees are frequently found close to creeks and rivers but also found further afield. Most of the old-growth woodlands have been removed from the landscape, although some isolated old-growth trees which may bear scars occur in the cleared paddocks and along the creek lines, as well as along the road corridor of Obley Rd.
- Natural mythological or cultural/ceremonial sites may occur anywhere.
- Shelter sites with art and/or deposit may occur wherever there are appropriate sandstone overhangs. The Study Area does not contain escarpments, and the only locality within the Study Area with potential for suitable rocky overhangs is on the "Glen Idol" property (proposed Open Cut).
- Grinding groove sites will only occur where there are appropriate outcropping sandstone formations, usually near water, and therefore may be found near any of the waterways in the Study Area.
- Isolated finds may occur anywhere, especially in disturbed locations near water sources or in areas close to ephemeral water – i.e. headwaters.

For the purposes of the current study, site type definitions can be found in **Appendix 3**.

4.5 SAMPLING STRATEGY

The Study Area was surveyed with a combination of pedestrian transects and spot checks. Areas with high potential for archaeological sites were targeted by undertaking more closely spaced transects. Areas that have very low potential to yield intact sites or had no visibility were not closely examined (Survey Units K-3, W-10, PH-5, and MM-5).

Areas that were more closely examined consist of terraces adjacent to creeks and the creeks themselves, and areas of exposure, such as road cuts and areas of erosion. All trees old enough to bear scars were inspected. Rocky outcrops were examined for grinding grooves.

Cleared paddocks are not landforms with a high probability to contain intact open sites, as disturbance levels to archaeological deposits in these areas are generally high. Additionally, ground visibility in these areas is often poor due to dense vegetation growth. These areas were therefore surveyed with wider transects. When ground visibility was zero, pedestrian transects were abandoned in favour of vehicle transects with spot checks at exposures and old-growth trees capable of bearing scars.

Areas not examined consist of paddocks which were cropped at the time of survey as the survey crew was asked to stay out of them. Cropped paddocks have a negligible likelihood of revealing open sites, as the sites would be obscured by the crop. The following Survey Units were not entered due to these restrictions:

- W-10 Survey Unit was not surveyed because it was recently ploughed.
- PH-5 Survey Unit was not surveyed because it was cropped.
- MM-5 Survey Unit was not surveyed because it was cropped.
- K-3 Survey Unit was not surveyed because it had zero ground visibility due to high grasses.
- The realignment portion of the proposed Macquarie River Water Pipeline was not surveyed (**Section 2.5**). Several factors such as low landform sensitivity, an absence of nearby sites and high prior land use disturbance contributed to the decision not to survey.

4.6 FIELD METHODS

Transects were walked at variously spaced intervals, dependent on ground visibility and archaeological potential (**Section 4.5**). These intervals ranged from 5m distance in areas with narrow impact zones (such as the Obley Road Alignment), to approximately 20m intervals in areas with moderate potential for site occurrence. As noted in the previous section, areas with zero ground visibility were traversed in vehicles, with inspection at areas of exposure and old-growth trees. Obley Road Alignment and Macquarie River Water Pipeline impact footprints were inspected to approximately 20m from the centreline of the proposed pipeline and road respectively, although this was constrained occasionally by private property boundary fences.

Representatives of the RAPs assisted the archaeologists by placing flags at artefacts and/or alerting the archaeologists that an artefact had been found. A located site was then more closely examined and all artefacts observed on the surface were flagged. For newly recorded sites, all artefacts and features were located with a GPS and tallied. For previously recorded sites GPS points were taken on boundary artefacts to help identify the surface extent of the scatter, although the sites were not re-recorded in full.

Sites were recorded with digital photography and by Ashtec GPS units loaded with Mobile Mapper software and were described on field recording sheets. General notes pertaining to the survey and ground covered by the archaeologists were kept as well.

5 RESULTS OF ABORIGINAL HERITAGE ASSESSMENT

5.1 EFFECTIVE SURVEY COVERAGE

Two of the key factors influencing the effectiveness of archaeological survey are ground surface visibility (GSV) and exposure (**Table 6** and **Table 7**). These factors are quantified in order to ensure that the survey data provides adequate evidence for the evaluation of the archaeological materials across the landscape. For the purposes of the current study, these terms are used in accordance with the definitions provided in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales: Part 6 National Parks and Wildlife Act 1974* (DECCW 2010).

Ground surface visibility is defined as:

... the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like vegetation, plant or leaf litter, loose sand, stony ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals' (DECCW 2010: 39).

Exposure is defined as:

... different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the age of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals' (DECCW 2010: 37).

Four generalised landform types are present in the Study Area:

- Hilly landforms are those with relatively high local relief. Most of the areas in the Nangar Slopes and Ranges *Mitchell landscape*, as well as some of the areas in the Dubbo Basalts *Mitchell Landscape*, which has a local relief of 300m, are characterised as 'hilly'.
- Gently undulating landforms are those with moderate local relief. Most of the areas in the Goonoo Slopes *Mitchell Landscape* as well as some of the areas in the Dubbo Basalts *Mitchell Landscape*, which have local reliefs of between 10m and 30m, are characterised as 'gently undulating'.
- Floodplain landforms are the flat areas near major creeks and rivers. The Macquarie Alluvial Flats *Mitchell landscape*, which has a local relief of 1m to 3m, is characterised as 'floodplain'.
- Creeks or waterways may occur within any of the above landforms.

As can be seen from **Tables 6** and **7**, effective coverage was generally low, a result of vegetation obscuring the ground surface. Those areas inspected during summer months generally had better visibility due to die-back of grasses and harvesting of cropped land. W-3 and MM-2 Survey Units stand out as exceptions, as they were exposed as a result of ploughing in the winter months. Four areas were not inspected due to agricultural constraints (cropping and ploughing).

Exposures in the Study Area are the result of both natural processes and human impacts. Sheet washing erosion was common, revealing the ground surface. Human-caused exposures include dirt roads and tracks and agricultural activities such as ploughing and grazing. Some exposures were the result of natural processes exacerbated by human activities, such as sheet washing in areas in which top soils have been trampled by cattle as a result of intensive grazing.

Table 6: Survey Coverage Data

Survey Unit ¹¹	Landform	Survey Unit Area (sq m)	Visibility (%)	Exposure (%)	Effective Coverage Area (sq m) (= Survey Unit Area x Visibility % x Exposure %)	Effective Coverage (%) (= Effective Coverage Area / Survey Unit Area x 100)
DZP Site Survey Units¹						
UG-1	gently undulating to hilly	1167000	10	5	5835	0.5
UG-2	gently undulating to hilly	2470000	72	8	142272	0.6
K-1	gently undulating	764000	5	5	1910	0.25
K-2	gently undulating	403000	5	15	3022.5	0.75
K-3	gently undulating	335000	NA	NA	NA	Not surveyed-zero ground surface visibility due to high grasses.
K-4	gently undulating	1468000	1	5	734	0.05
K-5	gently undulating	775000	5	10	3875	0.5
K-9	floodplain and gently undulating	62000	80	10	4960	8
K-10	hilly	118000	80	5	4720	4
W-1	floodplain	193000	15	5	1447.5	0.75
W-2	floodplain	188000	95	100	178600	95
W-3	floodplain	30000	20	50	3000	10
W-4	floodplain and gently undulating	294000	15	5	2205	0.75
W-4a	floodplain and gently undulating	94000	1	5	47	0.05
W-5	gently undulating	235000	15	5	1762.5	0.75
W-5a	gently undulating	82000	1	5	41	0.05
W-6	gently undulating	265000	90	95	226575	85.5
W-7	gently undulating	232000	20	5	2320	1
W-8	gently undulating to hilly	189000	5	10	945	0.5
W-9	gently undulating to hilly	554000	5	5	1385	0.25
W-10	Floodplain and gently undulating	375000	NA	NA	NA	Not surveyed- recently ploughed paddock
GI	hilly	456000	5	15	3420	0.75
PH-1	hilly	119000	5	5	297.5	0.25
PH-2	hilly	416000	5	10	2080	0.5
PH-3/4	gently undulating	266000	10	10	2660	1
PH-5	gently undulating	26000	NA	NA	NA	Not surveyed- cropped paddock
PH-6	hilly	315000	15	15	7087.5	2.25
TV-1	floodplain	565000	5	5	1412.5	0.25

¹¹ Note that K-6, K-7, and K-8 have been omitted. Survey was incomplete in these areas due to alterations to the Proposal's impact footprint.

Survey Unit ¹	Landform	Survey Unit Area (sq m)	Visibility (%)	Exposure (%)	Effective Coverage Area (sq m) (= Survey Unit Area x Visibility % x Exposure %)	Effective Coverage (%) (= Effective Coverage Area / Survey Unit Area x 100)
TV-2	floodplain to gently undulating	850000	5	5	2125	0.25
TV-3	gently undulating to hilly	861000	5	5	2152.5	0.25
TV-4	hilly	475000	10	5	2375	0.5
TV-5	floodplain	245000	10	5	1225	0.5
G-1	hilly	413000	5	8	1652	0.4
G-2	hilly	1867000	5	5	4667.5	0.25
G-3	hilly	298000	5	5	745	0.25
G-4	hilly	701000	20	10	14020	2.0
G-5	hilly	235700	10	5	1178.5	0.5
G-6	hilly	484000	70	1	3388	0.7
G-7	hilly	62000	90	1	558	0.9
G-8	gentle slope	118000	50	15	8850	7.5
Dubbo-Toongi Rail Line and Gas Pipeline Survey Units						
Macquarie RB	creek bank	NA: spot checked	NA	NA	NA	NA
Cumboogle RB	creek bank	NA: spot checked	NA	NA	NA	NA
Hyandra RB	creek bank	NA: spot checked	NA	NA	NA	NA
Macquarie River Water Pipeline Survey Units²						
MM-1	floodplain	28000	5	5	70	0.25
MM-2	floodplain	12000	5	10	60	0.5
MM-3	floodplain	16000	90	100	14400	90
MM-4	floodplain	27000	10	15	405	1.5
MM-5	floodplain	51000	NA	NA	NA	Not surveyed- cropped paddock
MM-6	floodplain	20000	1	10	20	0.1
MM-7	floodplain	35000	15	5	262.5	0.75
MM-8	floodplain	17000	5	5	42.5	0.25
Obley Road Alignment³						
OR-1	hilly	23000	5	20	230	1
OR-2	floodplain to hilly	75000	5	10	375	0.5
OR-3	floodplain to hilly	24000	1	10	24	0.1
OR-4	hilly	11000	5	5	27.5	0.25
OR-5	hilly	9000	5	10	45	0.5
OR-6	hilly	15000	5	20	150	1
OR-7	floodplain to hilly	26000	5	10	130	0.5
OR-8	hilly	18000	10	15	270	1.5
OR-9	gently undulating	24000	5	5	60	0.25
<p>Note 1: refer to Figures 6 and 7 for location of noted Survey Units</p> <p>Note 2: refer to Figures 6 and 8 for location of noted Survey Units</p> <p>Note 3: refer to Figure 8 for location of noted Survey Units</p>						

Table 7: Landform Summary — Sampled Areas

Landform	Landform area (sq m)	Area Effectively Surveyed (sq m) (= Effective Coverage Area)	Percent of Landform Effectively Surveyed (= Area Effectively Surveyed / Landform x 100)
floodplain	2071000	203773	9.8
gently undulating	7227000	252517.25	3.5
hilly	6308700	32551.75	0.5

Hilly areas had the lowest effective survey coverage, due in part to it being less suitable land for agriculture than floodplains and gently undulating terrain, and thus having more vegetation cover. Gently undulating landscapes comprised the majority of the Study Area. This landscape had low effective survey coverage due largely to high grasses in paddocks. Some of these areas were grazed but not ploughed, contributing to lower ground surface visibility than the ploughed areas. The floodplain was the least represented of the three major landform types. It has the highest effective survey coverage, due in part to good ground exposure in some of the ploughed paddocks.

5.2 ABORIGINAL SITES OF THE STUDY AREA

A total of 52 Aboriginal sites have been recorded in the Study Area. 33 of these sites have been recorded as part of this study and nineteen (19) are previously recorded (**Figure 10; Figure 11; Figure 39; Figure 40; Table 8; Table 9**). One newly recorded site is a potential archaeological deposit (PAD 12) has been designated in an area where no artefacts were recorded. All coordinates given in the main body of this report are in GDA94 Zone 55. Tables summarising the coordinates of the sites and the PADs in both GDA and AGD are presented in **Appendix 4**.

Five further locations (possible scarred trees) were initially recorded in the field but on review these possible scarred trees were deemed to not have met the relevant criteria (**Appendix 3**) to be registered as an Aboriginal site.

Table 8: Aboriginal Sites and associated PADs newly documented

Site Number	Feature(s)	Survey Unit	Landform
DZP Site			
UG-AS1	lithic scatter	UG-1	gently undulating
UG-AS2	lithic scatter	UG-2	floodplain
UG-AS3	lithic scatter	UG-2	gently undulating
UG-AS4	lithic scatter	UG-2	gently undulating
UG-ST1	scarred tree	UG-1	gently undulating
UG-ST2	scarred tree	UG-2	gently undulating
UG-IF1	isolated lithic artefact	UG-1	floodplain within gently undulating
UG-IF2	isolated lithic artefact	UG-2	gently undulating
UG-IF3	isolated lithic artefact	UG-2	floodplain
UG-IF4	isolated lithic artefact	UG-2	gently undulating
UG-IF5	isolated lithic artefact	UG-2	gently undulating
UG-IF6	isolated lithic artefact	UG-2	gently undulating
UG-IF7	isolated lithic artefact	UG-2	gently undulating
K-AS1 with PAD	lithic scatter	K-5	gently undulating
K-AS2 with PAD	lithic scatter	K-7	floodplain and creek
K-OP1	ochre processing area ¹²	K-7	floodplain within gently undulating
K-IF1	isolated lithic artefact.	K-7	floodplain within gently undulating
PAD 12	potential archaeological deposit	K-9	floodplain
GI-AS1	lithic scatter	GI	gently undulating
GI-AS2	lithic scatter	GI	gently undulating
PH-IF1	isolated lithic artefact	PH-6	gently undulating
TV-AS1	lithic scatter	TV-3	gently undulating
TV-AS2 with PAD	lithic scatter	TV-1	floodplain
TV-AS3 with PAD	lithic scatter	TV-4	floodplain within gently undulating
TV-IF1	isolated lithic artefact	TV-3	gently undulating
G-AS1	lithic scatter	G-5	gently undulating
G-IF1	isolated lithic artefact	G-4	gently undulating
Toongi-Dubbo Rail Line and Gas Pipeline Corridor			
No Aboriginal sites have been recorded in the impact zone for the Toongi-Dubbo Rail Line in the areas assessed.			
Macquarie River Water Pipeline			
MM-AS1	lithic scatter	MM-3	floodplain
MM-AS2	lithic scatter	MM-7	floodplain
MM-IF1	isolated lithic artefact	MM-7	floodplain
MM-IF2	isolated lithic artefact	MM-8	floodplain
Obley Road Alignment			
OR-AS1 with PAD	lithic scatter	OR-7	floodplain
OR-ST1	scarred tree	OR-2	floodplain

¹² Further confirmation required.

Figure 10: Aboriginal Sites Recorded in and Nearby to the DZP Site Boundary

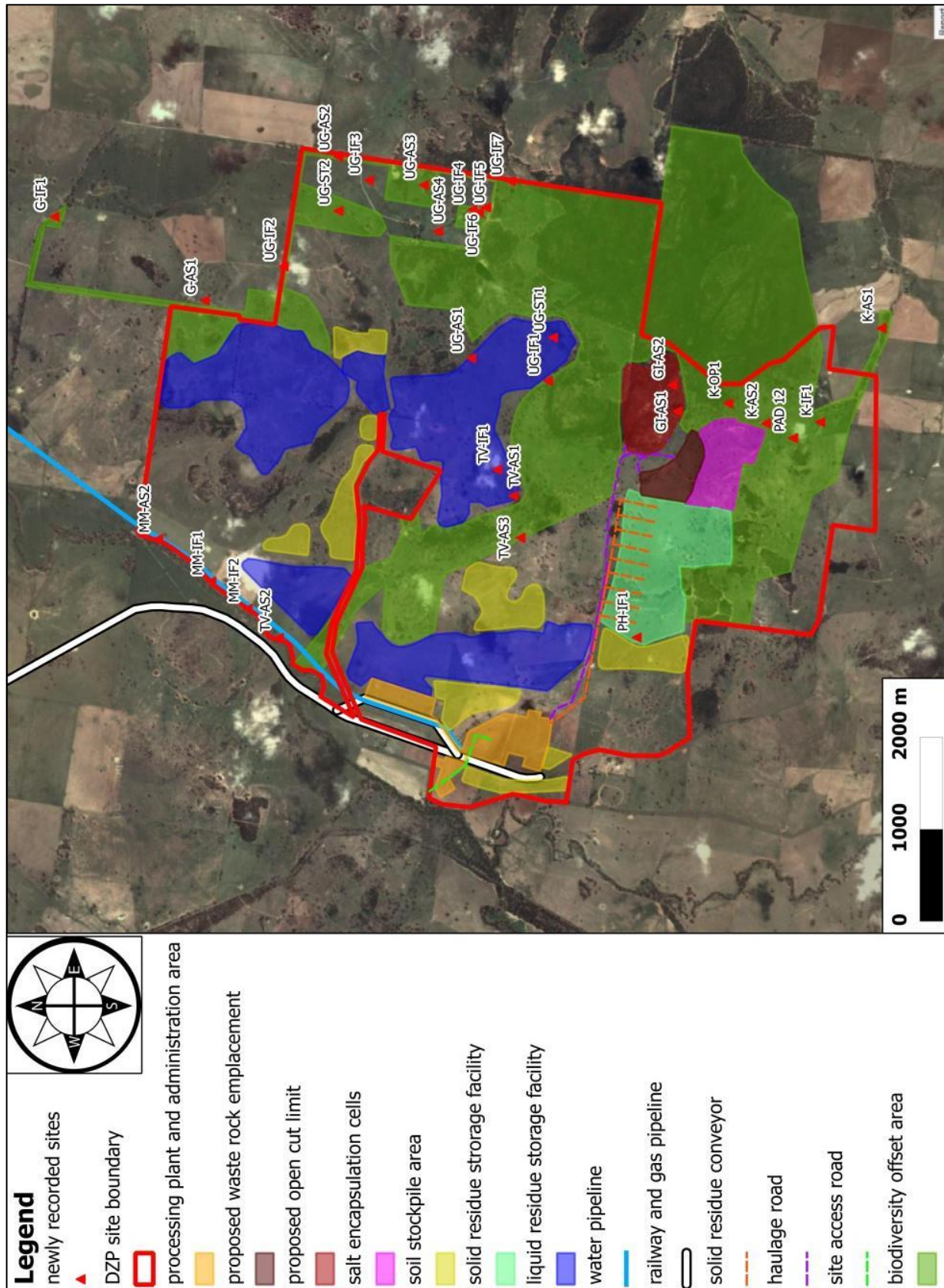
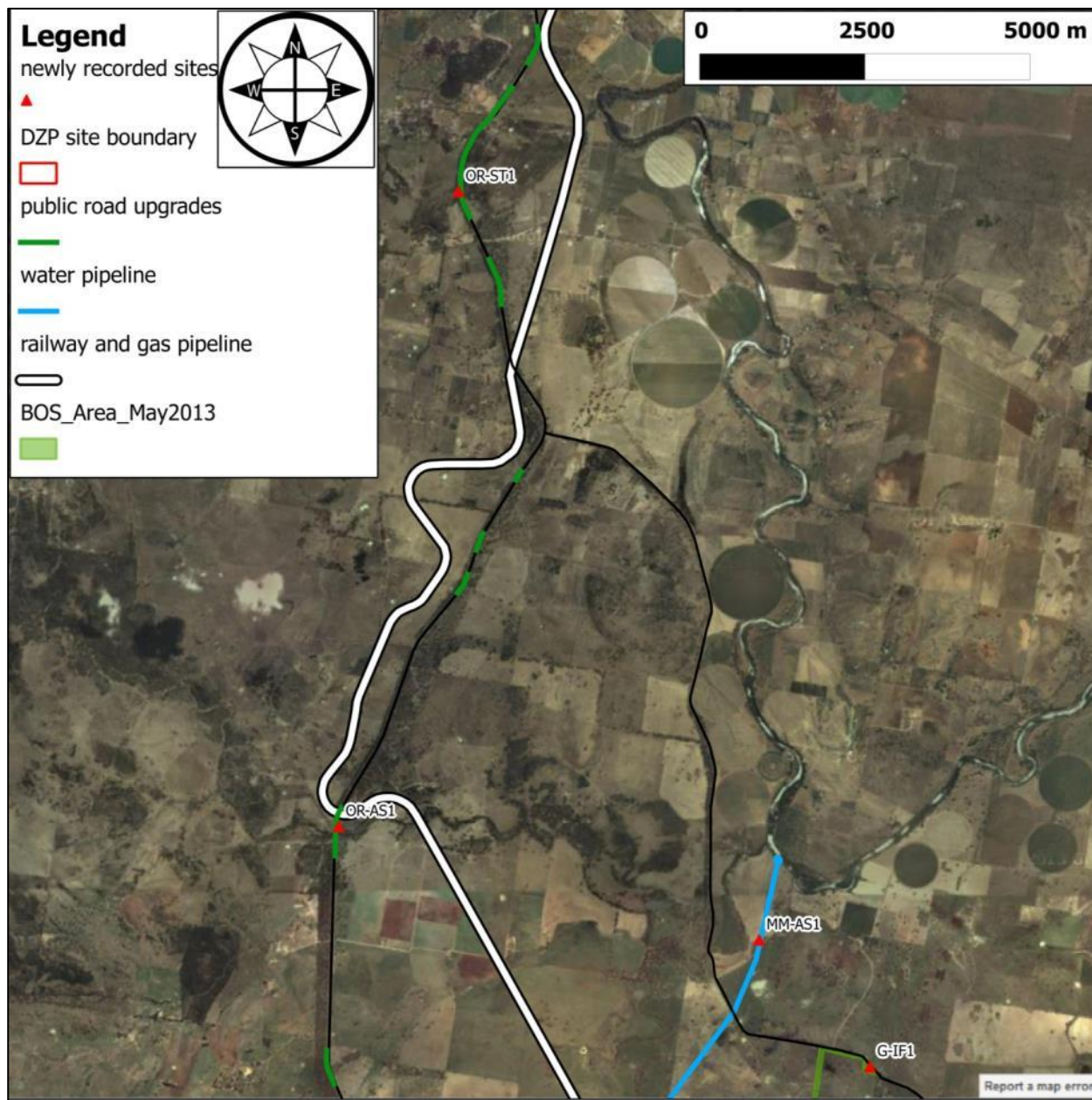


Figure 11: Aboriginal Sites Recorded North of the DZP Site Boundary



Note: Image presents the DZP Site assessed area.

5.3 ABORIGINAL SITES RECORDED (THIS STUDY)

5.3.1 “Ugothery” Aboriginal Site 1 (UG-AS1)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 653276E / 6408524N.

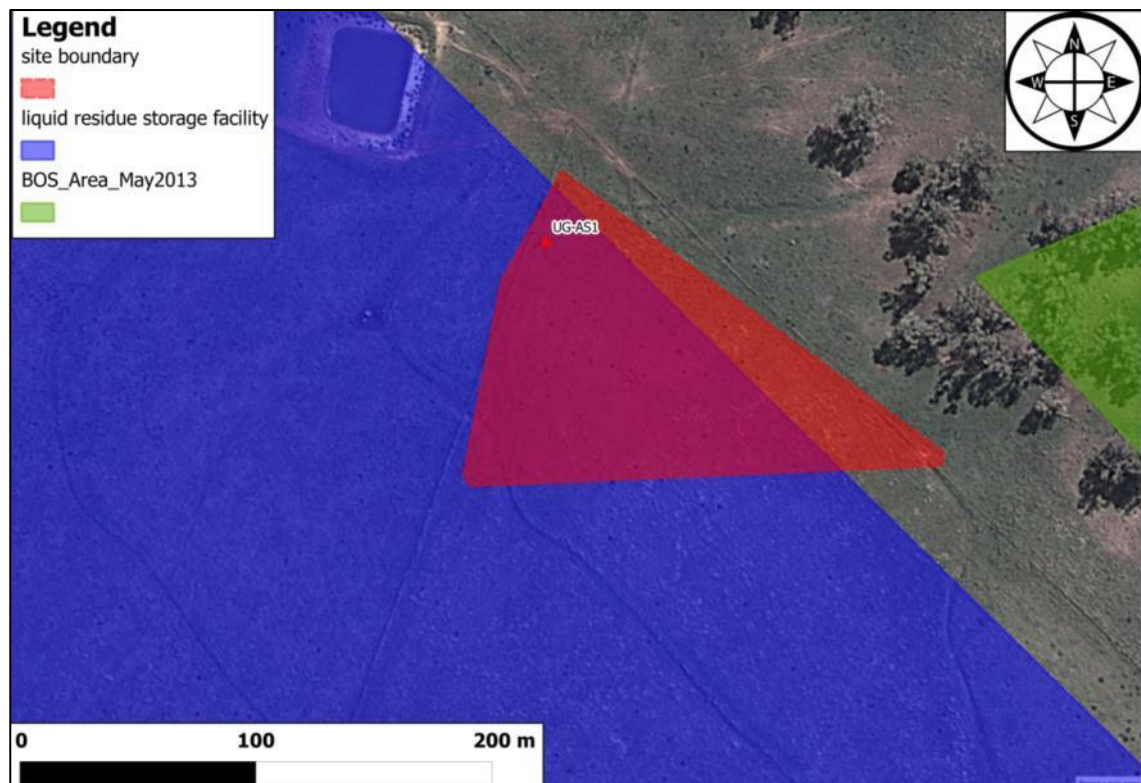
Location of site: Located on the “Ugothery” property just south of an earthen dam, approximately 1km south-southwest of the “Ugothery” house complex (UG-1 Survey Unit; Figure 10).

Description of site: The site consists of a sparse artefact scatter in a ploughed field at an elevation of 380m AHD (Figure 12; Plates 1 to 2). Markings on some boulders within the site

were interpreted as possible grinding grooves (**Plate 3**). However, these were deemed to be a result of ploughing or a rock-rake after subsequent survey and analysis. The site is dissected by fences on the northern and eastern ends. Soils are dark brown and loamy with gravels. Artefacts consist of:

- A cobble of heavy dark material (possibly ironstone) flaked at one end: 95 x 74 x 50mm
- Tan coarse grained cobble flaked at one end: 175 x 55 x 75mm, one end of this elongated artefact has numerous flakes removed to form a point and the opposite end has only two flakes removed.
- Chalcedony flake shatter with 25% cortex (50% of one side)
- Tan chert test cobble/flaked piece with cortex
- Possible grinding grooves are located on boulders in a small draining to the south-east end of the lithic scatter. Lichen grows thickly on the boulders, covering the grooves.

Figure 12: UG-AS1 plan view map



Ground surface visibility is approximately 10% to 20% on-site. Impacts to the site consist of ploughing, fencing, and displacing boulders (possible grinding grooves) to form a small dam in a first order drainage to the east of the site. The boulders are affected by heavy lichen growth.

Due to disturbance to the soils from extensive ploughing at this site, it is assessed that intact sub-surface deposits are unlikely.

5.3.2 “Ugothery” Aboriginal Site 2 (UG-AS2)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 655142E / 6409706N.

Location of site: Located along a dirt road extending north from “Ugothery” house complex. From the north end of the house complex drive approximately 0.98km north along the dirt track, bearing left when the road splits (UG-2 Survey Unit; **Figure 10**).

Description of site: Site is a small artefact scatter located in a dirt track at an elevation of 327m AHD (**Figure 13; Plates 4 to 5**). The artefacts cover an area of 50m by 5m. Soils onsite are sandy clays with inclusions of ironstone, sandstone, and quartz. The closest water source is a 2nd order drainage located 10m away. Native vegetation has mostly been cleared for agriculture and low grasses dominate. Remnant box and other eucalypt trees are in the area.

Figure 13: UG-AS2 plan view map



Artefacts consist of four artefacts: a chalcedony flake, mudstone flake, and two rhyolite flakes.

The artefacts are located in a vehicle track exposure measuring 5m width. Visibility on the exposure is 95% with very low background noise and visibility off the exposure is 10%, with low background noise. Impacts to the site include vehicle use on the dirt track and grazing.

While other artefacts are likely to be located off of the track, it is unlikely that intact archaeological deposits are present due to impacts to the area.

5.3.3 “Ugothery” Aboriginal Site 3 (UG-AS3)

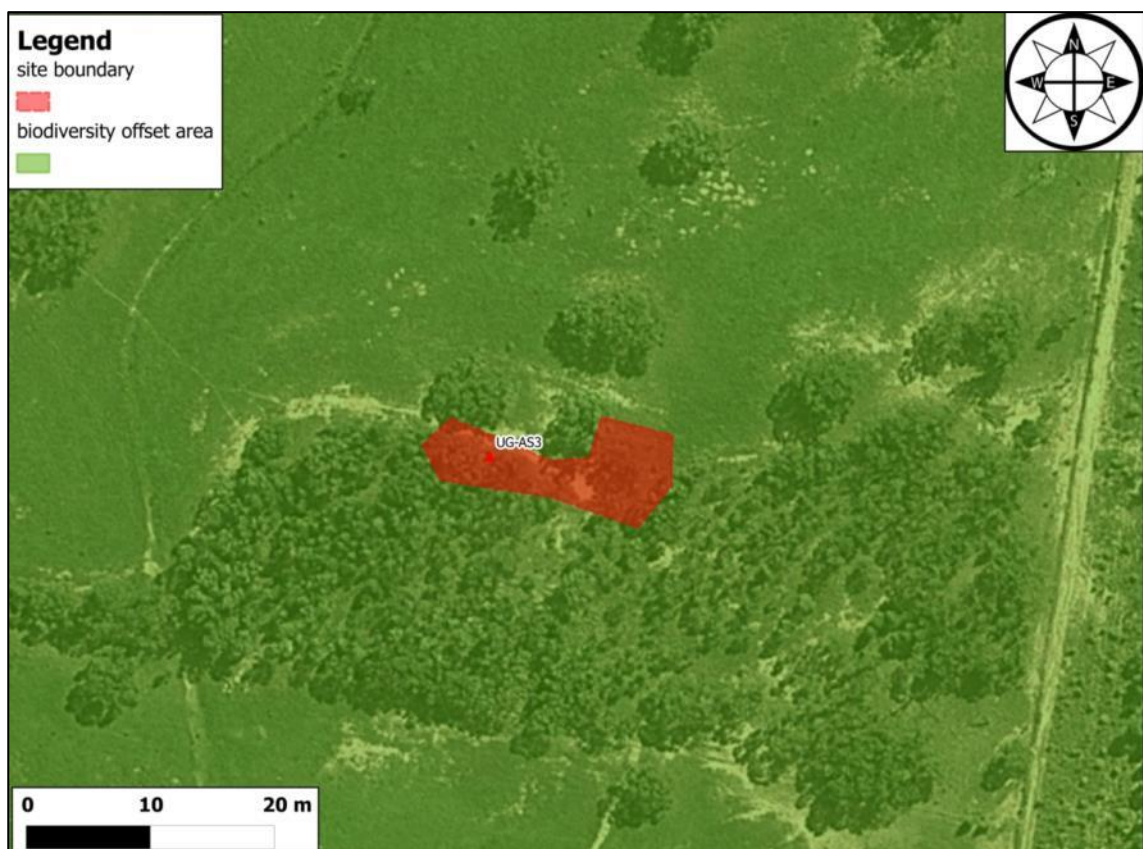
Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 654868E / 6408931N.

Location of site: Located 400m east-southeast of the “Ugothery” house complex (UG-2 Survey Unit; **Figure 10**).

Description of site: Site is a small lithic artefact scatter on a mid-slope at an elevation of 357m AHD (**Figure 14; Plates 6 to 7**). Soils in the area are sandy clays with sandstone. The nearest water source is a 2nd order ephemeral creek 470m west. Native vegetation has largely been cleared for agriculture and grasses dominate, though remnant eucalypts and pines are present in the landscape as well.

Figure 14: UG-AS3 plan view map (sketch map not to scale)



Artefacts consist of a broken axe head, a hammerstone, a quartz flake, and two flakes of unknown material. Primary, secondary, and tertiary flakes are represented in this assemblage.

Artefacts are located in an exposure 80m x 5-10m with 70% visibility on the exposure and 10 to 20% off of the exposure. Background noise is low across the landscape. Disturbances to the site consist of agricultural land use and erosion. It is unlikely that subsurface archaeological deposits are present as the artefacts appear to have arrived at their current location via erosion and agricultural impacts.

5.3.4 “Ugothery” Aboriginal Site 4 (UG-AS4) with PAD

Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 654444E / 6408809N.

Location of site: Located 300m south of the “Ugothery” house complex, on the east bank of an ephemeral drainage (UG-2 Survey Unit; **Figure 10**).

Description of site: Site is a small lithic scatter located on the bank of a 2nd order creek at an elevation of 341m AHD (**Figure 15**; **Plates 8 to 9**). The site measures 45m by 10m. The soils onsite are red-brown sandy clays with sandstone. Native vegetation has largely been cleared for agriculture. Grasses dominate, though remnant eucalypts and pines are present in the landscape as well.

Figure 15: UG-AS4 plan view map (sketch map not to scale)



Artefacts consist of a basalt core, two mudstone flakes (one is backed and exhibits use-wear), and at least five quartz flakes. Four other quartz pieces were identified, but did not have sufficient flake anatomy to be definitely identified as cultural in origin. Flakes identified include primary, secondary, and tertiary types.

The Aboriginal representatives present wished to include possible grinding grooves within the site. It is the opinion of Ozark that these markings were created by ploughing or a rock rake (**Plate 66**).

The artefacts are located in three erosion exposures, each measuring approximately 5m x 10m. Visibility on the exposures is 90% and off the exposures is 20%. Background noise is generally low. Impacts to the site include erosion, grazing, and agriculture.

Although impacts are present, the site maintains well-defined areas of activity suggesting some integrity. Adjacent areas are likely to contain shallow archaeological deposits with no stratigraphy, but the horizontal distribution of artefacts is likely to be relatively intact and therefore warrants the assignment of a PAD. The edges of the PAD are uncertain as the landform extends some distance away from the artefacts and the waterway, and visibility is lower to the east. The extent of the PAD is determined to be in close proximity to the site because although the constituent artefact scatter may be larger, there will be limited value in extensive excavation based on the disturbances in the area.

5.3.5 “Ugothery” Scarred Tree 1 (UG-ST1)

Site type: Scarred tree.

GPS Coordinates: (GDA94 Zone 55) 653454E / 6407774N.

Location of site: Located more than 500m southeast of site UG-AS1 in a cleared paddock (UG-1 Survey Unit; **Figure 10**).

Description of site: Site is comprised of a single box eucalypt tree in a cleared paddock (**Figure 16; Plate 10**). A small creek is located >100m east of the tree, at an elevation of 394m AHD.

The tree.

- Box Eucalypt, alive, with several trunks.
- Approximately 15m tall.
- Approximately 1.5m wide at height of scar.

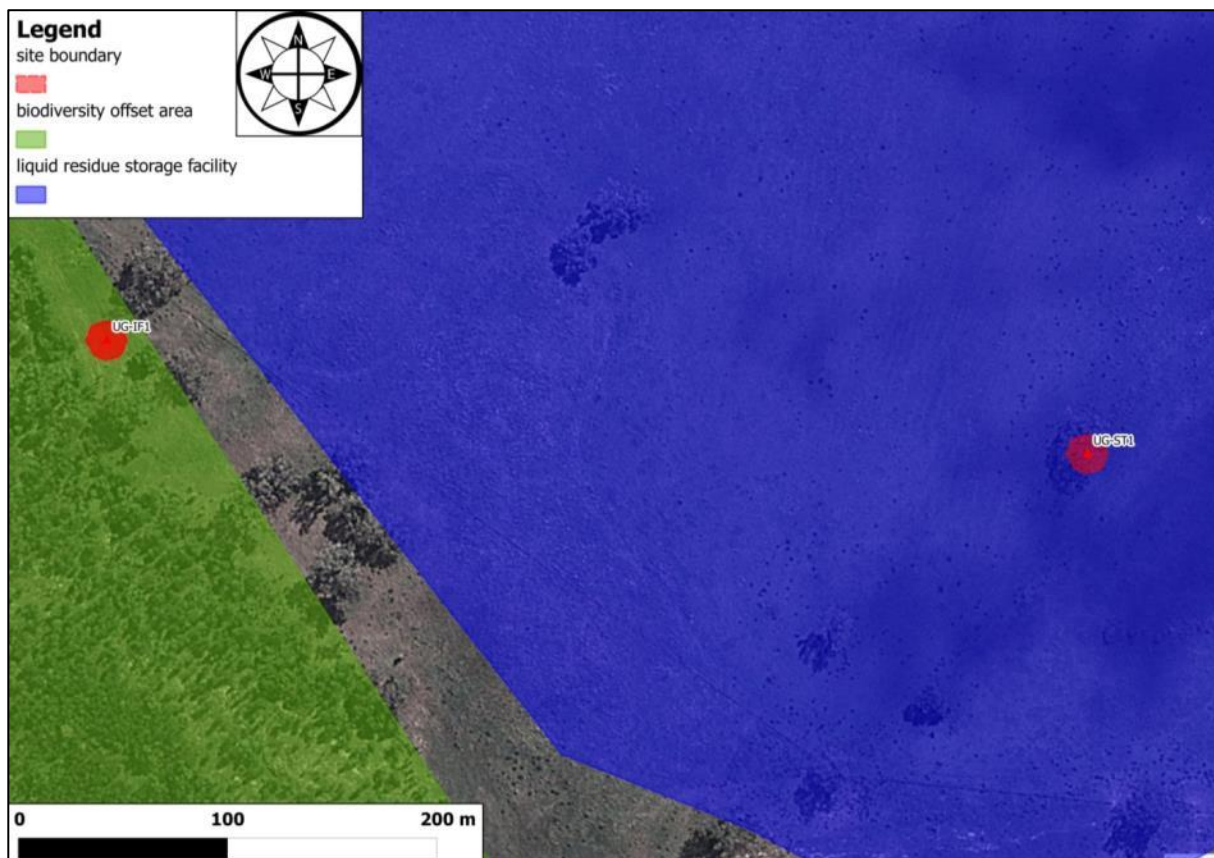
The scar.

- 80cm max height by 13cm max width.
- Oblong shape.
- Approximately 30cm from base of tree on largest trunk.
- Oriented to the southwest.
- No axe marks or grub holes present.

The scar is consistent with most of the criteria set out in **Appendix 3**. This includes:

1. The scar is above ground.
3. The scar is roughly symmetrical, but this is obscured by the heavy regrowth.
4. The length of the scar was on the same axis as the length of the tree.
5. The tree was sufficiently old.
6. There were no obvious signs of other causes for the scar.
7. The tree was a box.

Figure 16: UG-ST1 and UG-IF1 plan view map



It is difficult to determine the authenticity of this scar due to extreme regrowth. However, the obvious age of the scar, its consistency with the criteria (**Appendix 3**), and the absence of features that disprove its status as a scar, all support the authenticity of the scar.

Disturbances to the site include land clearing and grazing. No artefacts are associated with the site, and it is unlikely that intact sub-surface deposits are present.

5.3.6 “Ugothery” Scarred Tree 2 (UG-ST2)

Site type: Scarred tree.

GPS Coordinates: (GDA94 Zone 55) 654645E / 6409715N

Location of site: Located 300m north-northeast of a dam situated to the north of the “Ugothery” house complex (UG-2 Survey Unit; **Figure 10**).

Description of site: Site is comprised of a single Aboriginal scarred box tree located at an elevation of 335m AHD (**Figure 17**; **Plate 11**). A large ephemeral 2nd order drainage is located 50m away from the tree. Native vegetation has largely been removed from the landscape, though trees remain along the creek line.

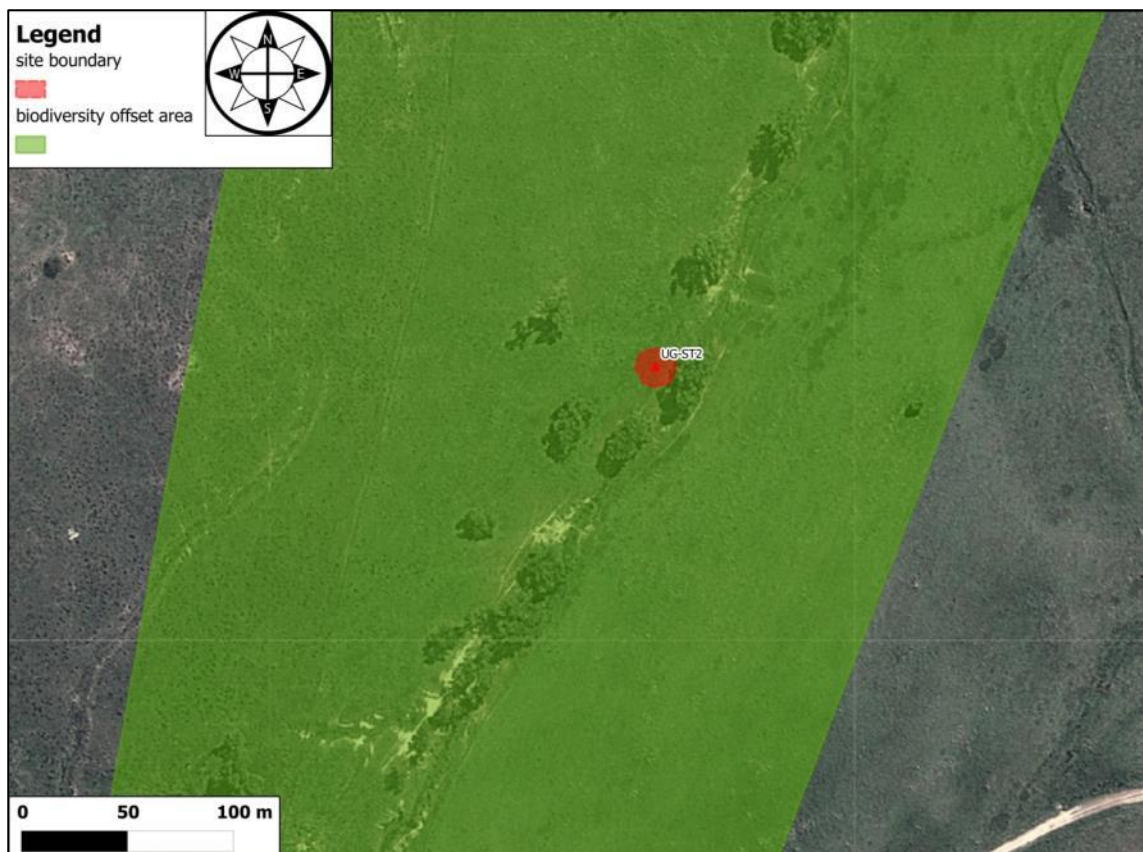
The tree.

- 20m height.
- 1.3m diameter.
- The tree is alive and in good condition.

The scar.

- Oriented to the north.
- Elongated shape.
- Length with regrowth: 105cm.
- Interior length: 75cm.
- Width with regrowth: 50cm.
- Interior width: 35cm.
- Maximum width of regrowth: 30cm.
- Maximum depth of regrowth: 30cm.
- Height of base of scar above the ground: 105cm.
- 1-2 axe marks.

Figure 17: UG-ST2 plan view map



The scar is consistent with most of the criteria set out in **Appendix 3**. This includes:

1. The scar is above ground.
3. The scar is roughly symmetrical, but this is obscured by the heavy regrowth.
4. The length of the scar was on the same axis as the length of the tree.
5. The tree was sufficiently old.

6. There were no obvious signs of other causes for the scar.
7. The tree was a box.

The terminations at the top and bottom of the scar were different, but both were regularly shaped. It was almost certainly artificial as there were axe-marks within the scar (**Plate 12**). The cut was quite clean and so it is possible that this was made by a steel axe. The scar is very old though, and the shape of the scar is consistent with bark removal for traditional Aboriginal uses.

Potential for intact sub-surface deposit is low as the landform is degrading and has been impacted by clearing for agriculture, and as no surface artefacts are located in the vicinity of the tree.

5.3.7 “Ugothery” Isolated Find 1 (UG-IF1)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 653058E / 6407827N.

Location of site: Located on the “Ugothery” property, to the northeast of a prominent unnamed hill (UG-1 Survey Unit; **Figure 10**). The hill is also bordered by “Toongi Valley” property to the west and “Glen Idol” property to the south. The site is not on the hill, but rather across a small drainage from the hill.

Description of site: The site consists of an isolated utilised flake in open eucalypt woodland on a terrace approximately 10m from a creek (**Figure 16; Plates 13 to 14**).

- Tertiary flake with edge wear on one edge: 97 x 54 x 21mm, has tan coloured repatination with a grey interior, possibly a rhyolite.

Ground surface visibility is 15%. Impacts to the site consist of grazing. The area does not appear to have been ploughed, however, it is assessed that intact sub-surface deposits are unlikely, due to the scarcity of artefacts in conjunction with the moderate ground exposure.

5.3.8 “Ugothery” Isolated Find 2 (UG-IF2)

Site type: Isolated find.

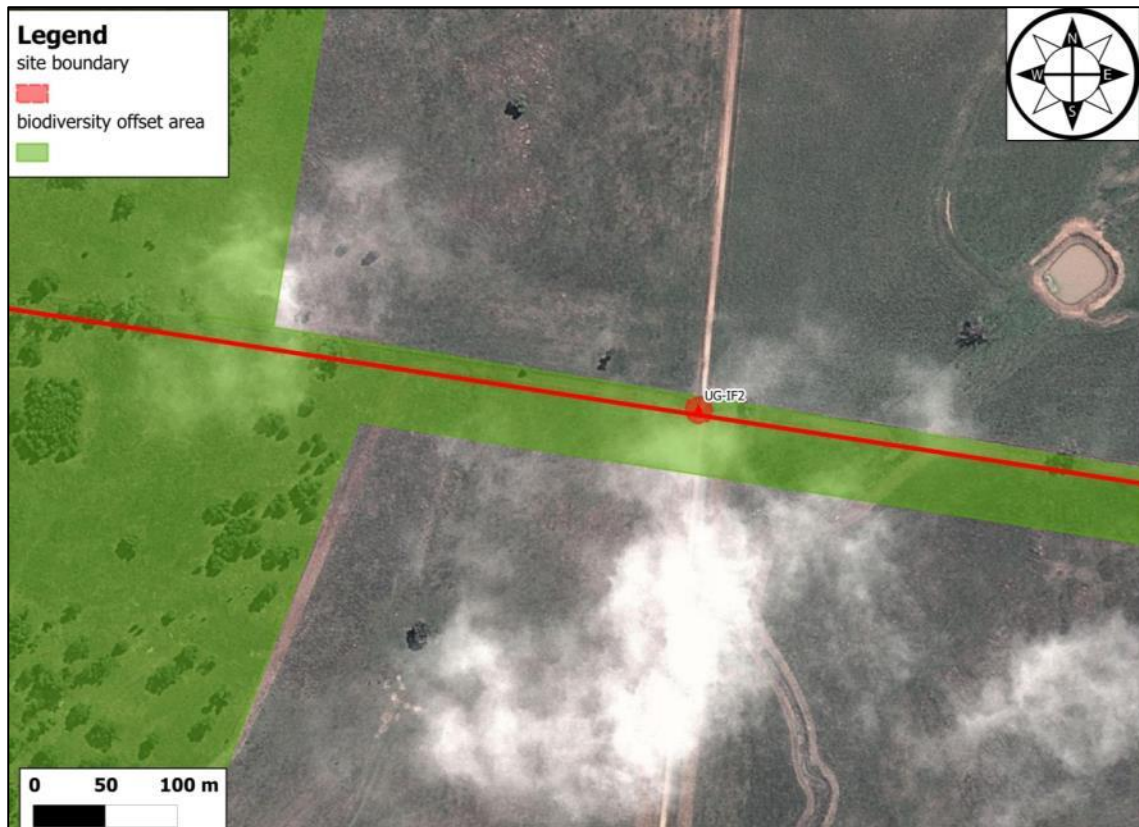
GPS Coordinates: (GDA94 Zone 55) 654142E / 6410222N.

Location of site: Located 2.6km south from Benolong Rd on the dirt access track for the “Grandale” property, approximately 6m south of a cattle guard and 3m west of the dirt road (north end of UG-2 Survey Unit; **Figure 10**).

Description of site: The isolated retouched flake (of uncertain material, possibly rhyolite), is located on a low slope at an elevation of 329m AHD (**Figure 18; Plates 15 to 16**). Vegetation in the area consists of short grasses, as the area falls within a paddock. The nearest water source, an ephemeral drainage, is approximately 100m away.

The artefact is located in a vehicle track with erosion, measuring 15m by 8m. Soils are sandy clays. Visibility on the exposure is 60% and off the exposure is 20%. Impacts to the area include agricultural activities, such as clearing of native vegetation and grazing, and vehicle movement. It is unlikely that subsurface deposits are present, as the area has been impacted and no other artefacts were revealed in the large exposure.

Figure 18: UG-IF2 plan view map



5.3.9 “Ugothery” Isolated Find 3 (UG-IF3)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 654921E / 6409431N.

Location of site: From the north edge of the “Ugothery” house complex go 0.58km up a dirt road. The site is 80m south of the dirt road (UG-2 Survey Unit; **Figure 10**).

Description of site: Site consists of a single hammerstone, a grey river cobble with bashing evident on one end (**Figure 19; Plates 17 to 18**). It is situated on a low slope at an elevation of 334m AHD. The nearest water source is 100m away, a 2nd order stream. Vegetation onsite consists of grasses, and native vegetation has been cleared.

The artefact was found in an area with no exposure. It is unlikely that intact sub-surface deposits are present, as the area has been impacted by agriculture.

5.3.10 “Ugothery” Isolated Find 4 (UG-IF4)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 654636E / 6408490N.

Location of site: Site is located 600m south-southeast of the “Ugothery” house complex, east of a small stand of trees (UG-2 Survey Unit; **Figure 10**).

Figure 19: UG-IF3 plan view map



Description of site: Site consists of a large basalt flake with flaking (possible retouch) on the dorsal side (**Figure 20; Plates 19 to 20**). The artefact is located on a 20 degree hill slope at an elevation of 362m AHD. Soils are sandy clay soils of a light reddish-brown colour. Vegetation on-site consists of grasses, new growth after land clearing and remnant mature trees (a grey box tree is located nearby). The nearest water source, a 2nd order ephemeral stream, is located approximately 500m away.

Figure 20: UG-IF4, UG-IF5 and UG-IF6 plan view map



The artefact was found within an erosion exposure measuring approximately 10m x 5m, with 60% ground visibility. Given the moderate ground visibility and the lack of other surface artefacts, coupled with disturbances from land clearing activities and grazing, it is unlikely that the site has intact sub-surface deposits.

5.3.11 “Ugothery” Isolated Find 5 (UG-IF5)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 654611E / 6408432N.

Location of site: Site is located 650m southeast of the “Ugothery” house complex, east of a small stand of trees (UG-2 Survey Unit; **Figure 10**).

Description of site: Site consists of a quartz flaked piece with one negative flake scar on the small cobble. The remainder of the artefact is cortex. The artefact is located on the slope of a low hill at an elevation of 364m AHD (**Figure 20; Plates 21 to 22**). Soils are a light red-brown sandy clay. Vegetation consists of grasses, remnant mature eucalypt trees and a stand of new growth trees is located to the west. The nearest water source is a 2nd order waterway located 360m west.

The artefact is located in a 3m by 3m erosion exposure with 90% ground surface visibility and low levels of background noise. Visibility is 5-30% off the exposure. Disturbances consist of land clearing activities and grazing.

5.3.12 “Ugothery” Isolated Find 6 (UG-IF6)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 651651E / 6408365N.

Location of site: Site is located 700m southeast of the “Ugothery” house complex, east of a small stand of trees (UG-2 Survey Unit; **Figure 10**).

Description of site: Site consists of a tertiary mudstone flake with use-wear and backing (thumbnail scraper). Site is situated on the upper slope of a low hill at an elevation of 369m AHD (**Figure 20, Plates 23 to 24**). The landscape is degrading with frequent sandstone and light red-brown coloured sandy clays. Vegetation consists of grasses, remnant mature eucalypt trees and a stand of new growth trees is located to the west. The nearest water source is a 2nd order waterway located 400m northwest.

The artefact is located in a 10m by 5m exposure with 50% ground surface visibility with high background noise. Visibility off the exposure is 5%. Agricultural disturbances are present in the area.

5.3.13 “Ugothery” Isolated Find 7 (UG-IF7)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 654892E / 6408139N.

Location of site: Site is located 950m southeast of the “Ugothery” house complex, on the eastern edge of the application area (UG-2 Survey Area; **Figure 10**).

Description of site: Site consists of a quartz tertiary flake located on a low slope at an elevation of 366m AHD (**Figure 21; Plates 25 to 26**). Soils are a grey-brown sandy clay. Geology of the area is evidenced in sandstone and ironstone materials. Vegetation has largely been cleared for agriculture, though nearby is a clearing with mature eucalypts, regrowth and tussocks. The nearest water source is a 1st order drainage 10m from the artefact.

Figure 21: UG-IF7 plan view map



The artefact is located on an erosion exposure and vehicle track, measuring 40m by 5m. Visibility on the exposure is 70% with moderate background noise. Off the exposure is 10% ground surface visibility with low background noise. The landform is degrading. It is possible that other artefacts are present in the area but obscured are by background noise and vegetation. However, intact sub-surface deposits are unlikely as due to impacts to the land.

5.3.14 “Karingle” Artefact Scatter 1 with PAD (K-AS1 with PAD)

Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 653494E / 6404781N.

Location of site: Site is located south of Dowds Hill and north of Eulandool Road, on the “Karingle” property, on the banks of a tributary of the Cockabroo Creek which drains from Dowds Hill (K-5 Survey Unit; **Figure10**).

Description of site: Site is a small artefact scatter comprised of ten lithic artefacts on an elevated terrace 20m from a creek on the north side (**Figure 22; Plates 27 to 28**). Box trees grow on the creek line and the area is grassy. The artefacts cover an area approximately 15m x 10m.

Figure 22: K-AS1 with PAD plan view map



Visibility on the exposure is 80% and off the exposure it is <10%. There are grazing impacts the site. The PAD at this site is likely to extend out of the exposure into the grassy areas adjacent. It was recommended by RAPs that K-AS1 with PAD be further investigated along with a tree noted as a possible scarred tree (temporarily called “ST-2” in the field on the 23 May 2012). However, due to subsequent changes to the mine’s design, excludes K-AS1 from the impact footprint, this site was not revisited.

5.3.15 “Karingle” Artefact Scatter 2 with PAD (K-AS2 with PAD)

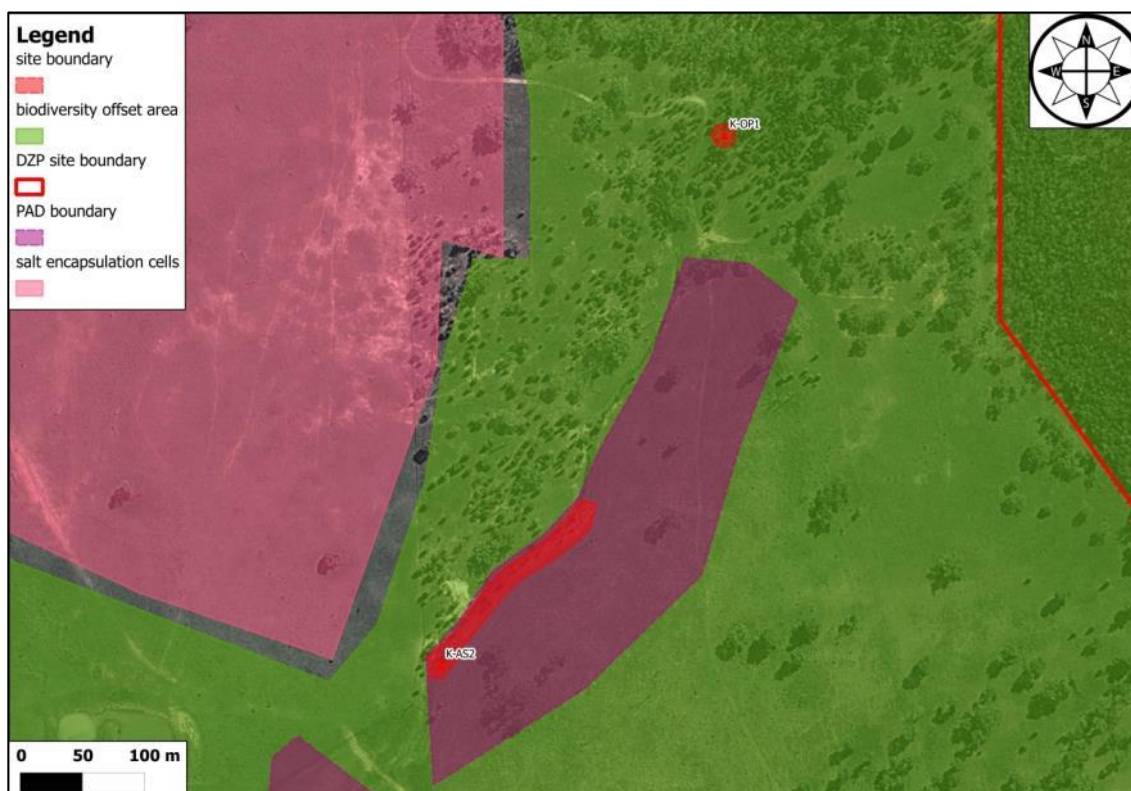
Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 652632E / 6405846N.

Location of site: K-AS2 and its associated PAD are roughly 500m north of the “Karingle” homestead and are situated along a creek line that runs through DP 753252 lot 55 (K-7 Survey Unit; **Figure 10**). The PAD is c. 400m long and c.70m wide. The width is somewhat arbitrary due to low visibility to the southeast of the creek.

Description of site: Several flakes of various materials were recorded within and adjacent to the bank of a dry creek (**Figure 23**; **Plate 29**). The Aboriginal representatives accompanying the survey wished for furrows in outcropping rock to be recorded as grinding grooves although no definitive attributes typically seen in grinding grooves were noted in a preliminary investigation by the OzArk archaeologist (**Plate 67**).

Figure 23: K-AS2 with PAD and K-OP1 plan view map



A likely scarred tree was also identified in close proximity to the site (**Plate 29**). It exhibits axe marks and several attributes that are consistent with the DEC Western region criteria given in **Appendix 3** (DEC & Long 2005).

1. The scar is above ground.
2. The ends of the scar are evenly tapered.
3. The scar is roughly symmetrical.
4. The length of the scar is on the same axis as the length of the tree.

5. The tree was sufficiently old.

7. The tree was a box.

The axe mark was somewhat clean, suggesting the possibility that it was made by a steel-axe. Also, an offshoot-trunk from the base of the scar is known to occur in some authentic scarring.

The ground rises steeply to the northwest from the creek line and it is unlikely that this area was extensively occupied. Level ground stretched to the southeast of the creek line though. This area has been intensively farmed but the presence of the site and suitable landscape features make this area a likely campsite. Testing would be needed to establish if there were intact soil levels that have avoided agricultural impacts, but there is a reasonable likelihood of archaeological deposits with some degree of reasonable integrity.

5.3.16 “Karingle” Ochre Processing (K-OP1)

Site type: Ochre processing area.

GPS Coordinates: (GDA94 Zone 55) 652826E / 6406187N.

Location of site: The site is c. 50m north-northeast of the PAD associated with K-AS2 (K-6 Survey Unit; **Figure 10**). It is between the northwest bank of the creek line in this area and a dirt track which crosses the creek to the south of K-OP1 and passes to the south of the PAD where it continues toward “Karingle” homestead.

Description of site: The site is a small mound of multi-coloured pigmented clay, measuring roughly 1m by 1m in area (**Figure 23; Plates 30 to 31**). It is uncertain if this was locally extracted or if it was the result of activity such as drilling. However, the high variation in colour and separation of these colours indicates it is not a natural occurrence. More investigation is required to assess provenance of the ochre. This area is outside of the impact footprint.

5.3.17 “Karingle” Isolated Find 1 (K-IF1)

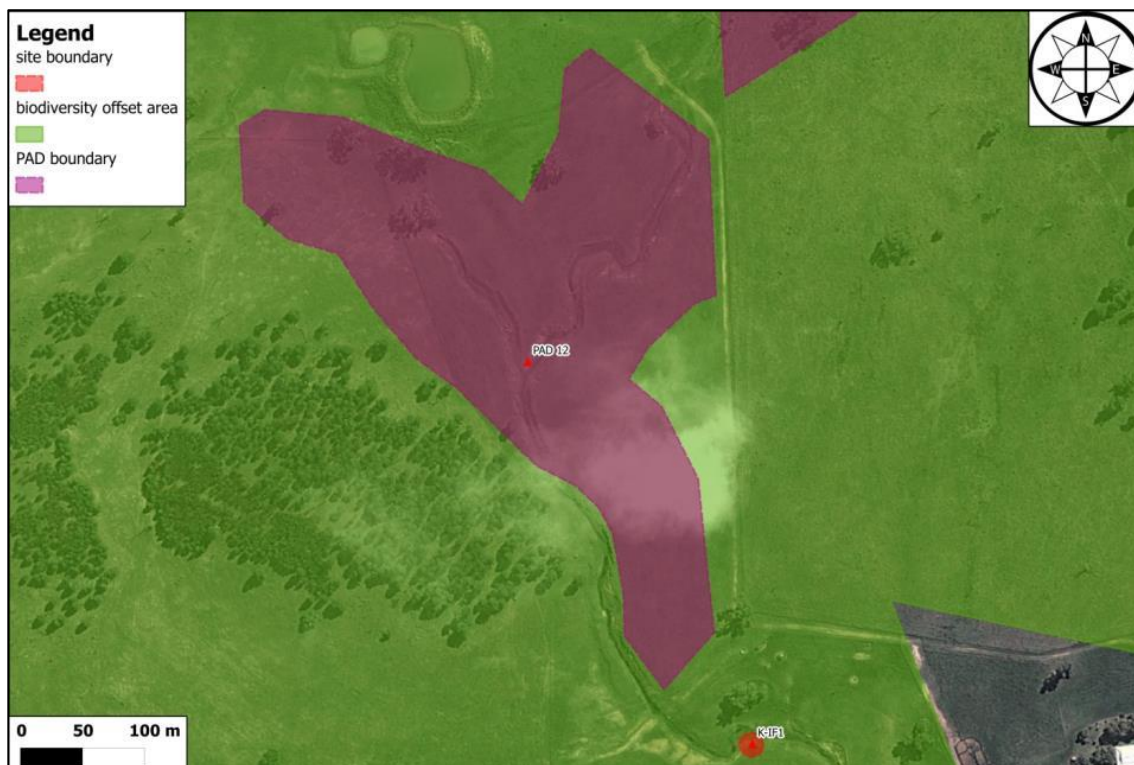
Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 652642E / 6405350N.

Location of site: The site is c. 200m west of the entrance driveway to the “Karingle” property which extends to Eulandool Road to the south (K-6 Survey Unit; **Figure 10**). It is directly west of the Karingal homestead.

Description of site: A single artefact was recorded on the edge of a dry creek at an elevation of 356m AHD (**Figure 24; Plates 32 to 33**). The artefact is a silcrete secondary flake. It is possible that there are more artefacts nearby, but there was no time for an extensive search on the day it was identified. It was subsequently decided that the area would not be subject to impacts and so the site was not revisited.

Figure 24: PAD 12 and K-IF1 plan view map



5.3.18 Potential Archaeological Deposit 12 (PAD 12)

Site type: Potential Archaeological Deposit.

GPS Coordinates: (GDA94 Zone 55) 652500E / 6405600N.

Location of site: This PAD is c. 250m northwest of the “Karingle” homestead. It partly overlaps with survey unit K-9 (Figure 10 and Figure 43). It roughly follows a creek line and one of its branches, with a 50m buffer from the waterways where there are suitable landforms.

Description of site: PAD 12 is set on a floodplain adjacent to a creek line and one of its branches (Figure 24; Volume 2: Plates 34 to 35). No sites were identified in the PAD, but visibility was poor in this area and a PAD had been designated in the general area on three separate surveys, each by a different surveyor. The creeks were largely dry at the time of survey, with some water pooling remnant. Despite this, water could be expected in these waterways in wetter periods, and they stand out in the local area as relatively prominent streams.

5.3.19 “Glen Idol” Aboriginal Site 1 (GI-AS1)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 652761E / 6406650N.

Location of site: Located northwest of Dowds Hill and south of a smaller but prominent hill. The area can be accessed by driving through the “Karingle” property to the west of “Glen Idol” and continuing on a dirt track that bends to the east, just south of the aforementioned smaller prominent hill until one has entered the “Glen Idol” property (Survey Unit GI; Figure 10).

Description of site: The site consists of two artefacts 10m apart. They are situated on a rise above a third order waterway, which is small and dry with a rocky outcrop at its head (Figure 25; Plates 36 to 37). To the south of the site the rise drops to a flat area. Vegetation

onsite is open eucalypt woodland, at an elevation of 408m AHD. Soils are brown silt with low levels of cobbles and gravel. Shallow soils are likely as bedrock is exposed on portions of the site. Artefacts are:

- Grey mudstone tertiary flake; Banded dark grey FGS flake shatter. There is also some rhyolite in the area, though it does not exhibit flake anatomy.

Ground surface visibility within the exposure (sheet wash erosion) is 20%. Off the exposure there is nil ground surface visibility. The site is affected by erosion, vegetation growth, and bioturbation (termites and animal digging). A borehole is located near the site. There is moderate potential for sub-surface deposit in the flat area to the south of the artefacts.

5.3.20 “Glen Idol” Aboriginal Site 2 (GI-AS2)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 653003E / 6406694N.

Location of site: Located northwest of Dowds Hill and south of a smaller but prominent hill. The area can be accessed by driving through the “Karingle” property to the west of “Glen Idol” and continuing on a dirt track that bends to the east, just south of the aforementioned smaller prominent hill until one has entered the “Glen Idol” property (Survey Unit GI; **Figure 10**).

Figure 25: GI-AS1 and plan view map



Description of site: Site consists of two lithic artefacts on a small rise of partially exposed bedrock at an elevation of 410m AHD (**Figure 26; Plates 38 to 39**). Vegetation consists of open woodland of young pine (regrowth), grasses, and sparse eucalypt. Soils are brown silt. Artefacts are:

- Flake shatter of coarse red-brown material.
- Small quartz cobble with flake scars on the tip, creating a sharp edge.
- Other quartz in the area does not exhibit flake anatomy.
- Visibility on the exposure (sheet wash) is 50% and off the exposure is 10%. Soils are too thin to make subsurface deposits likely. Impacts include erosion and recreation (a campfire ring was observed).

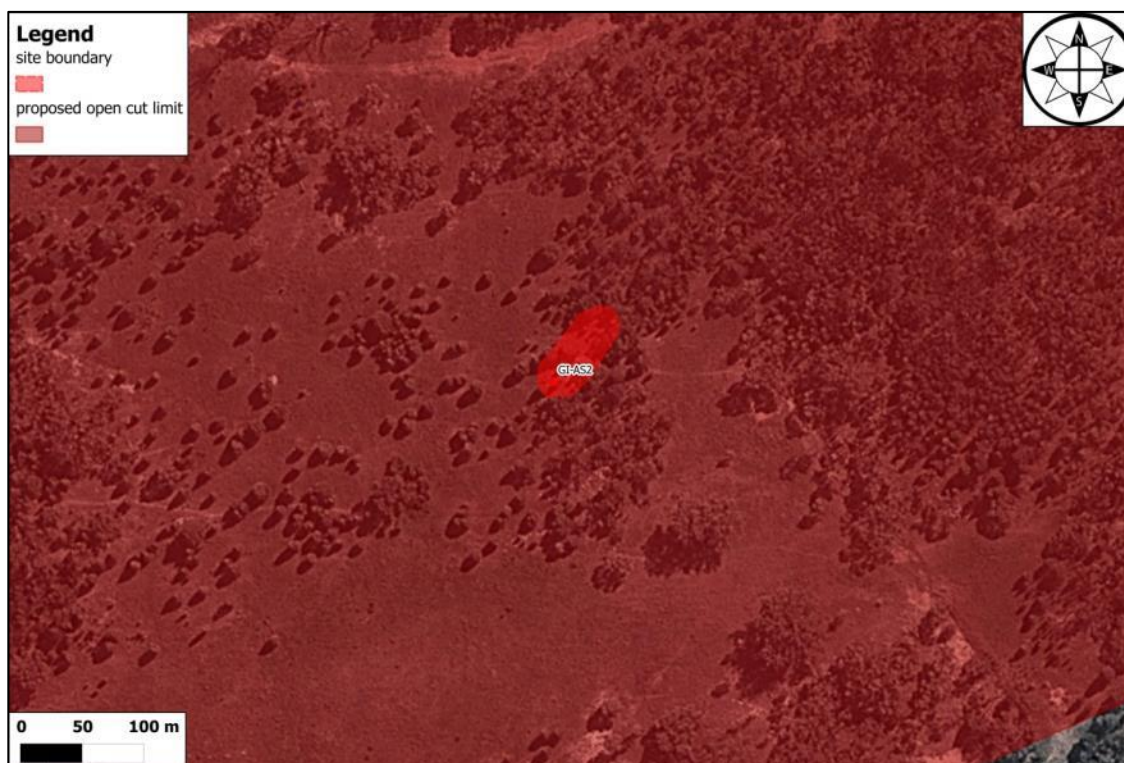
5.3.21 “Pacific Hill” Isolated Find 1 (PH-IF1)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 650695E / 6407055N.

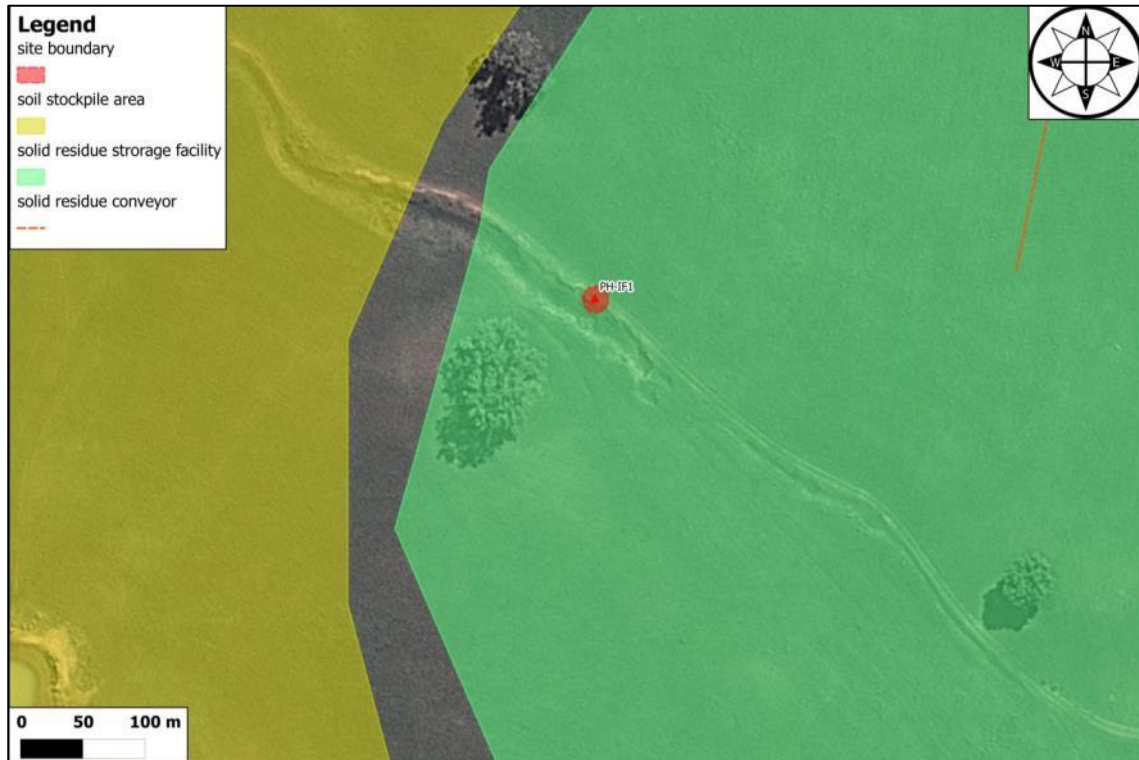
Location of site: The site is located in the second paddock east of the railway on the “Pacific Hill” property (PH-6 Survey Unit; **Figure 10**). It can be accessed by dirt tracks which extend east from the house complex at “Pacific Hill”.

Figure 26: GI-AS2 plan view map



Description of site: Site consists of an isolated piece of beige chert flake shatter in a dirt road exposure on the north bank of an ephemeral creek at an elevation of 351m AHD (**Figure 27; Plates 40 to 41**). Vegetation in the area is grassy crop land with occasional remnant trees.

Figure 27: PH-IF1 plan view map



Impacts to the site include the dirt vehicle track, vegetation removal, cropping and grazing, and erosion. Visibility on the dirt exposure is 80% and 10% off the exposure. The road and erosion-caused exposure measures approximately 4m wide. The A-horizon at this site likely has been destroyed by these impacts.

5.3.22 “Toongi Valley” Aboriginal Site 1 (TV-AS1)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 652009E / 6408159N.

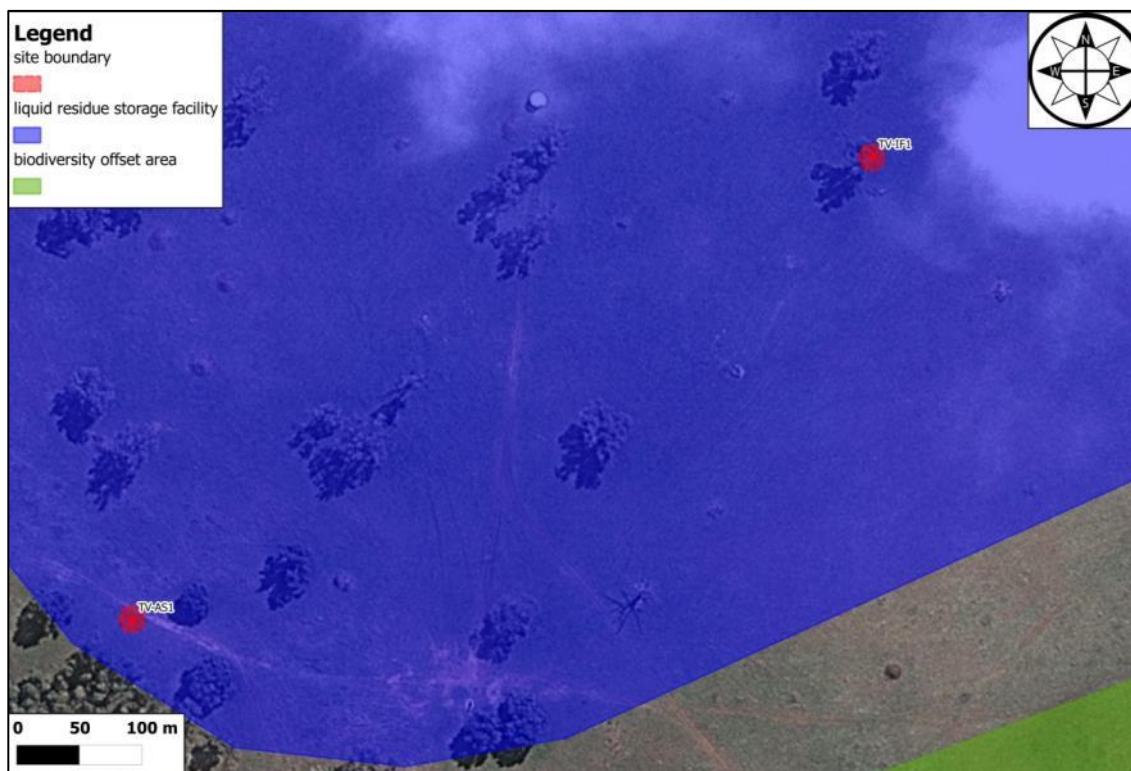
Location of site: Located in the eastern portion of the “Toongi Valley” property, northeast approximately 100m of an unnamed but sizable tributary of Wambangalang Creek (TV-3 Survey Unit; **Figure 10**).

Description of site: Site consists of two artefacts within a metre of each other at 380m AHD (**Figure 28; Plates 42 to 43**). Soil is dark brown and loamy. A stand of young-growth pines is nearby. Vegetation consists of grasses, clover, and sparse low shrub. The site is located 1m from a barbed wire fence with the identified artefacts as follows.

- Quartz core: 40 x 52 x 40mm, cortex is present on one side. Flakes are removed multi-directionally, but none are removed from the side with cortex, which was clearly used as a platform.

- Quartz shatter, without diagnostic features but quartz is unusual in the area and proximity to the core makes it likely to be associated. It cannot be ruled out that the shatter was broken off the core by animal trampling or other non-cultural means however.

Figure 28: TV-AS1 and TV-IF1 plan view map



The artefacts were not found in an exposure and ground surface visibility was almost nil. A road exposure nearby did not contain artefacts. Impacts to the site include grazing and fence construction. Due to the disturbance to the soils from grazing, coupled with the scarcity of artefacts at this site, it is assessed that intact sub-surface deposits are unlikely.

5.3.23 “Toongi Valley” Aboriginal Site 2 with PAD (TV-AS2 with PAD)

Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 650740E / 6410316N.

Location of site: Site is located on the east bank of Wambangalang Creek, north of the “Toongi Valley” house complex, which itself is located on Toongi Rd (Site is located on the edge of TV-1 Survey Unit and the Macquarie Water Pipeline, but is not inside the impact footprint for either; **Figure 13**).

Description of site: Site is a sparse lithic scatter in a dirt track on the banks of Wambangalang Creek (**Figure 29; Plates 44 to 45**). Vegetation along the creek consists of eucalypt woodland and has been cleared for grazing and cropping. Six artefacts were recorded of quartz, mudstone, and chert. The most notable artefact is a scraper described as follows.

- Grey mudstone secondary flake with edge modification, measuring 21 x 24 x 10mm.

Figure 29: TV-AS2 with PAD plan view map



Ground surface visibility on the track exposure is 40% and off the exposure is almost nil. Impacts to the site consist of clearing the land of native vegetation and grazing. It is not known whether the area has been ploughed. The PAD at this site is likely to extend to the west of the site, as the eastern side has certainly been impacted by ploughing.

5.3.24 “Toongi Valley” Aboriginal Site 3 with PAD (TV-AS3 with PAD)

Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 651625E / 6408100N.

Location of site: Site is located on the banks of an unnamed drainage which flows westerly into Wambangalang Creek. Dowd Hill is located 1km southeast of the site (site extends into northern portion of the TV-4 Survey Unit; **Figure 10**).

Description of site: Site is an extensive open lithic artefact scatter on the southern bank of a second order waterway at an elevation of 340m AHD (**Figure 30, 31, and 44; Plates 46 to 47**). At the time of recording water was present in the creek despite the overall dry conditions, which indicates that it is likely the site of a reliable spring. Several first order waterways dissect the site as well. Soils are red and silty. Vegetation consists of grasses and remnant woodland. Artefacts consist of lithic debitage, modified flakes, and ground stone. Lithic materials include silcrete, chert, quartz, quartzite, sandstone, fine-grained silica (FGS), and mudstone. Maximum artefact density is four per square metre.

A sample of artefacts present was recorded:

- Green FGS: 3 secondary flakes, 2 tertiary flakes, 1 flake shatter;
- Beige chert multidirectional core: 47 x 37 x 23mm;

- Beige chert: 2 flake shatter;
- Mudstone modified flake;
- Quartz: several quartz fragments are present in the area, some with flake anatomy but only one (tertiary flake) that is undeniably cultural in origin;
- Quartzite: 1 tertiary flake with edge wear;
- Sandstone grinding stone: a flat cobble with a couple of flakes removed, ground unifacially, measuring 105 x 78 x 22mm; and
- Silcrete: 1 secondary flake, 4 tertiary flakes and 3 flake shatter.
 - Located on the east side of a barbed wire fence are:
- Green FGS: 1 secondary flake;
- Mottled reddish FGS: 1 tertiary flake with possible edge wear; and
- Silcrete: 1 tertiary flake and 1 flake shatter.

Soils are loose along the banks of the creek but highly compacted elsewhere onsite. Visibility on the exposures is approximately 50%, with 10% visibility off the exposures. Impacts to the site include grazing/ cattle trampling, clearing of native vegetation, dirt access tracks, and erosion.

Despite impacts to the land it is likely that undisturbed deposits are present as well. This PAD encompasses two other previously recorded sites (#36-1-0361 and #36-1-0357, a grinding groove site and artefact scatter – refer to **Section 5.4** and **Figure 47**), and is considered a Sensitive Archaeological Landform (SAL). The SAL encompasses all artefacts recorded and extends onto the northern side of the creek, though no artefacts were identified on the northern side. The SAL extends to the southeast for 670m.

Figure 30: TV-AS3 with PAD plan view sketch map (not to scale)

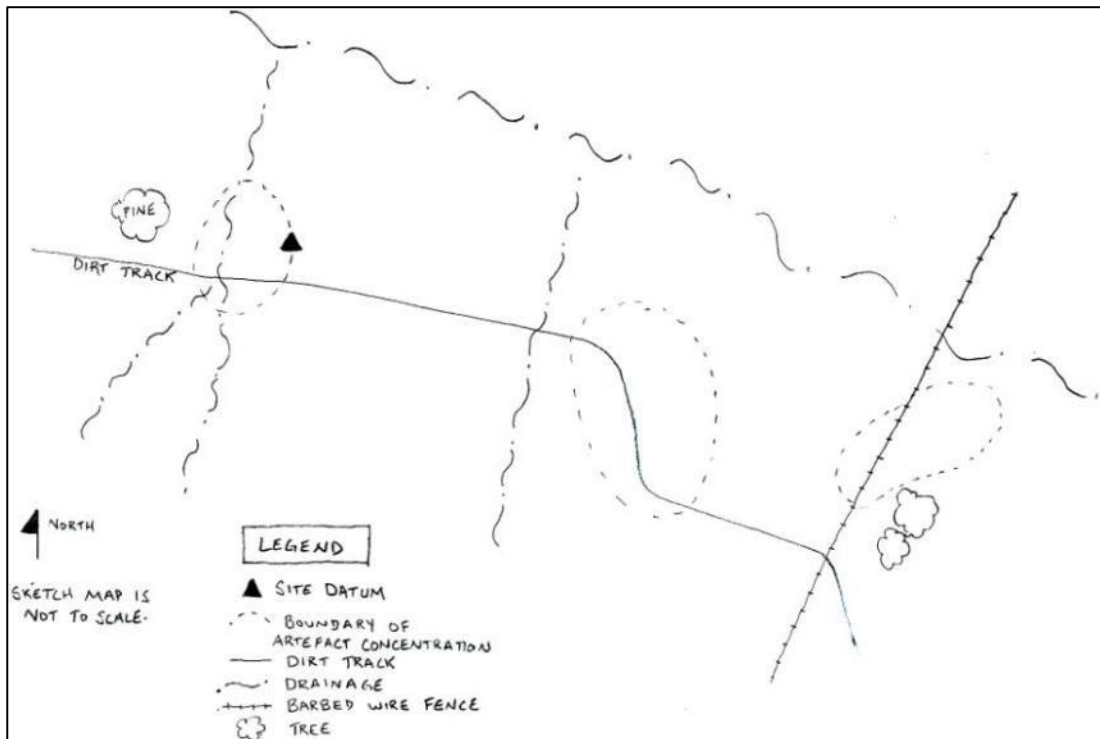


Figure 31: TV-AS3 with PAD plan view map



5.3.25 “Toongi Valley” Isolated Find 1 (TV-IF1)

Site type: isolated find.

GPS Coordinates: (GDA94 Zone 55) 652253E / 6408305N.

Location of site: Located in the eastern portion of the “Toongi Valley” property, north approximately 300m of an unnamed but sizable tributary of Wambangalang Creek (TV-3 Survey Unit; **Figure 10**).

Description of site: The site consists of a single large flake on a low hill, at 380m AHD (**Figure 28; Plates 48 to 49**). Native vegetation has largely been cleared from the paddock, but several isolated eucalypts dot the landscape, as well as stinging nettle. The artefact was found at the base of a eucalypt. Soils are dark brown and silty. A rock pile associated with land clearing lies nearby.

- Grey FGS tertiary flake measuring 87 x 74 x 20mm, with 4 flakes removed from ventral side of the artefact and a portion of the bottom edge exhibiting use wear.

Ground surface visibility in the area is approximately 15%, with patchy exposures. Impacts to the site consist of grazing and ploughing. Due to the disturbance to the soils from ploughing at this site it is assessed that intact sub-surface deposits are unlikely.

5.3.26 “Grandale” Artefact Scatter 1 (G-AS1)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 653841E / 6410946N

Location of site: To access the site go 1.5km south from Benolong Rd on the access road for “Grandale”. From the earth dam located north of the road, travel 200m south-southwest to the site (G-5 Survey Unit; **Figure 10**).

Description of site: The site consists of a two artefacts located on a low slope at an elevation of 328m elevation (**Figure 32; Plates 50 to 51**). Artefacts have been identified across a 9m by 1m area. Soils are red-brown sandy clay with sandstone. Native vegetation has largely been cleared, with patchy low and high grasses and some new growth pines and mature box trees. The nearest water source is a 1st order waterway approximately 20m from the site.

Artefacts consist of a cobble with flakes removed along one edge and an angular rock with flakes removed along one edge.

The artefacts are located in an area of moderate erosion, with 10-20% ground surface visibility on the exposure and 5% ground surface visibility off the exposure. Background noise is low across the area. The exposure measures 20m by 10m. Impacts to the site from agriculture make it unlikely that intact sub-surface deposits are present.

5.3.27 “Grandale” Isolated Find 1 (G-IF1)

Site type: isolated find.

GPS Coordinates: (GDA94 Zone 55) 654630E / 6412306N.

Location of site: Site is located on the south side of Benolong Road, approximately 3m south of the barbed wire fence which separates the survey unit from the road corridor (UG-4 Survey Unit; **Figure 10**).

Figure 32: G-AS1 plan view map (sketch map is not to scale)



Description of site: The site consists of a single quartz flake on a low slope at 308m elevation, in a dirt vehicle track (Figure 33; Plates 52 to 53). Vegetation consists of grasses and remnant mature trees on cleared land. The nearest water source is located 100m away in an ephemeral drainage.

Figure 33: G-IF1 plan view map



Soils are a red-brown sandy clay with sandstone outcrops in the vicinity. Visibility on the exposure is 80% and off the exposure is 20%. Impacts to the site include vehicle movement and agricultural activities such as land clearing and grazing. It is unlikely that there are intact sub-surface deposits at this site, given that the exposure is extensive and has good visibility and that more artefacts would have been revealed if they were present.

5.3.28 “Mia Mia” Aboriginal Site 1 (MM-AS1)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 653239E / 6413941N.

Location of site: Located northwest of the dirt track heading north from Benolong Road onto the “Mia Mia” property. The site is approximately 40m east of Wambangalang Creek and southwest of the house complex (MM-3 Survey Unit; **Figure 11**).

Description of site: The site is a moderate density lithic scatter located in a fallow, previously ploughed paddock at 300m AHD (**Figure 34**; **Plates 54 to 55**). Soils are light brown and silty. Eleven (11) artefacts were recorded representing four material types:

- Grey mudstone: 1 secondary flake and 2 pieces of flake shatter; Mottled chert: 1 tertiary flake and 1 piece of flake shatter; Grey FGS: 1 piece flake shatter; and Quartz: 3 tertiary flakes and 2 pieces of flake shatter.

Ground surface visibility is 90%. The most significant impact to the site is ploughing, though wind deflation of the soils is also likely as the fallow paddock has little vegetation to stabilise the soils.

Figure 34: MM-AS1 plan view map



5.3.29 “Mia Mia” Aboriginal Site 2 (MM-AS2)

Site type: Open artefact scatter.

GPS Coordinates: (GDA94 Zone 55) 651663E / 6411405N.

Location of site: Located on the banks of Wambangalang Creek, on the east side of a fence line that separates a paddock from the creek, on the “Mia Mia” property south of Benolong Road (MM-7 Survey Unit; **Figure 10**).

Description of site: The site is comprised of four artefacts on the edge of a ploughed paddock, 20m from a creek, at 306m AHD (**Figure 35; Plates 56 to 57**). The artefacts are approximately 40m distance from each other.

- Grey chert tertiary flake found in animal track 1m inside fence; Grey FGS core: 65 x 70 x 45mm, multidirectional with some weathered surfaces and cortex; Grey-blue FGS secondary flake; Indurated mudstone core: 35 x 39 x 22, multidirectional with cortex.

Soils are light brown silty sand. Ground surface visibility is 10%. Impacts to the site consist of fence construction, ploughing, and animal trails. Due to these impacts to the soil it is assessed that intact sub-surface deposits are unlikely.

Figure 35: MM-AS2 plan view map



5.3.30 “Mia Mia” Isolated Find 1 (MM-IF1)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 651266E / 6410925N.

Location of site: Located on the banks of Wambangalang Creek, on the east side of a fence line that separates a paddock from the creek, on the “Mia Mia” property south of Benolong Road (MM-7 Survey Unit; **Figure 10**).

Description of site: This site is comprised of an isolated artefact located in a ploughed paddock at an elevation of 308m AHD (**Figure 36; Plates 58 to 59**). It lies approximately 20m from the creek and 10m from the fence line.

- Grey-green FGS test cobble or lightly used core with approximately 50% of cortex remaining. Flakes are removed multi-directionally. The artefact measures: 70 x 55 x 50mm.

Ground surface visibility is less than 10% due to grass cover. Impacts to the area consist of ploughing. Due to disturbances to the soil as a result of ploughing it is assessed that intact sub-surface deposits are unlikely.

Figure 36: MM-IF1 and MM-IF2 plan view map



5.3.31 “Mia Mia” Isolated Find 2 (MM-IF2)

Site type: Isolated find.

GPS Coordinates: (GDA94 Zone 55) 651012E / 6410597N.

Location of site: Located on the banks of Wambangalang Creek, on the east side of a fence line that separates a paddock from the creek, on the “Mia Mia” property south of Benolong Road (MM-8 Survey Unit; **Figure 10**).

Description of site: This site is comprised of an isolated artefact located in a ploughed paddock at 304m AHD, on a terrace 20m from a creek (**Figure 36; Plates 60 to 61**). Soils are brown silt.

- Grey FGS core: 45 x 55 x 33mm, with flakes removed in one direction from only one side of the artefact.

Ground surface visibility is approximately 10% on site. Impacts to the area consist of ploughing. Due to disturbances to the soil as a result of ploughing it is assessed that intact sub-surface deposits are unlikely.

5.3.32 Obley Road Aboriginal Site 1 with PAD (OR-AS1 with PAD)

Site type: Open artefact scatter with PAD.

GPS Coordinates: (GDA94 Zone 55) 647874E / 6415464N.

Location of site: Located approximately 15m east of Obley Road, north of Hyandra Creek 40m to 50m, in a dirt road exposure (OR-7 Survey Unit; **Figure 11**).

Description of site: Site is a sparse lithic scatter comprised of three artefacts within one metre of each other (**Figure 37**; **Plates 62 to 63**). Adjacent to the dirt road exposure is an open grassy area with eucalypts nearby. The site is situated on a flat terrace above Hyandra Creek. Soil is light brown silt.

Artefacts include:

- Brown mudstone multidirectional core with some cortex: 40 x 25 x 27mm; Grey chert utilised secondary flake: 60 x 45 x 20mm; Grey FGS tertiary flake.
- There is also quartz in the area that exhibits some flake anatomy, but not to an extent to positively identify the items as cultural in origin.

Figure 37: OR-AS1 with PAD and 36-1-120 with PAD plan view map



Ground surface visibility is 70% on the exposure and 5% off the exposure due to vegetation and imported gravels. Impacts to the site include clearing of native vegetation, and most significantly, a dirt access road with imported gravels.

The PAD at this site is likely to extend out of the exposure, and more intact deposits may be present in those undisturbed areas. The exposed areas, including those covered with imported road gravels, are less likely to have intact deposits as the A-horizons have been disturbed. Additionally, the construction of Obley Road would have impacted PAD adjacent to it.

5.3.33 Obley Road Scarred Tree 1 (OR-ST1)

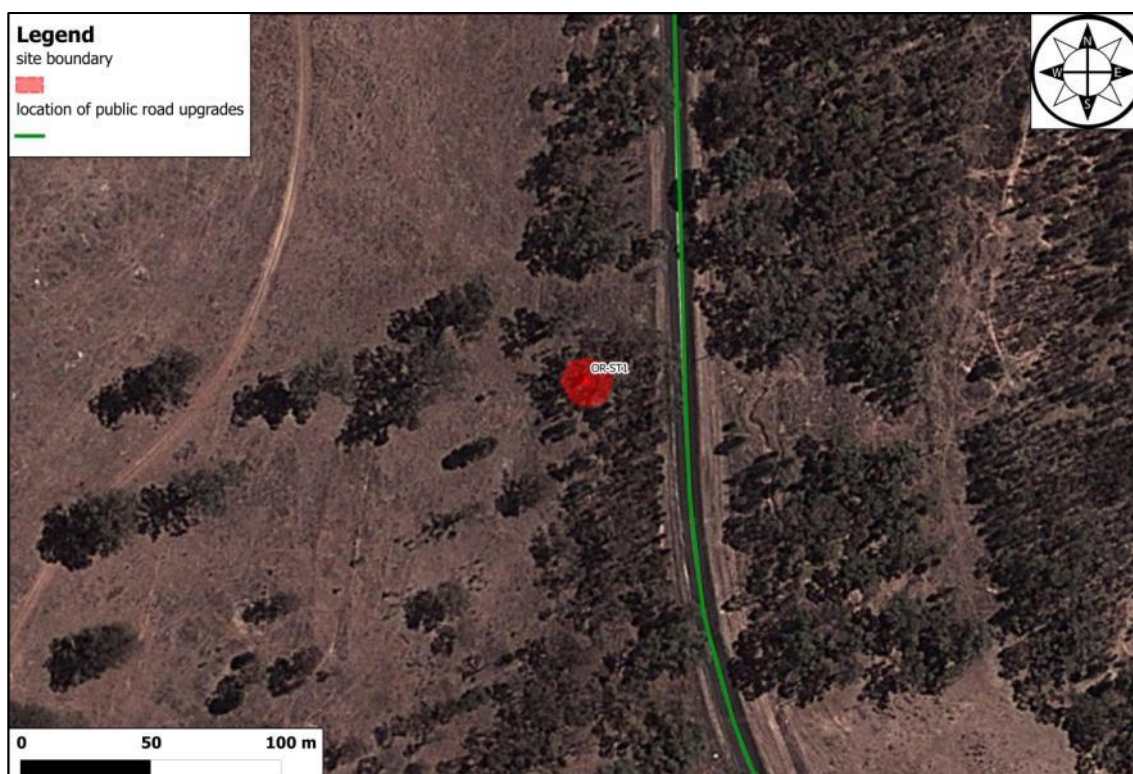
Site type: Scarred tree.

GPS Coordinates: (GDA94 Zone 55) 649529E / 6423523N.

Location of site: Located approximately 12m west of Obley Road and approximately 0.7km north of Belmont Road (**Figure 11**).

Description of site: The site consists of a single scarred tree in an Inland Grey Box (*Eucalypt macrocarpa*) community at 301m AHD (**Figure 38; Plates 64 to 65**). The scar is very large and may have been created for canoe construction. There are no associated artefacts. Soils are a dark brown silty loam. Nearest water is an unnamed second order watercourse 120m east.

Figure 38: OR-ST1 plan view map



The tree.

- Inland Grey Box (*Eucalypt macrocarpa*), alive.
- Approximately 13m height, 1.4m width of trunk.

The scar.

- Oriented to the south-southeast.
- Height of base above ground: 34cm.
- Scar length is 172cm, width is 70cm.
- Maximum depth of regrowth is 20cm.

It is unlikely that the site has PAD as no artefacts were located in the vicinity.

5.4 ABORIGINAL SITES RELOCATED (FROM AHIMS RECORDS)

5.4.1 Sites within the Application Area

Nineteen (19) previously recorded Aboriginal sites are within the Study Area (**Table 9**). Fourteen (14) are located within the DZP Site, two (2) are located in the Macquarie River Water Pipeline Corridor, and three (3) are located in the Obley Road Alignment (**Figures 39 and 40**). No sites have been previously recorded in the impact footprint of the Toongi - Dubbo Rail Line and Gas Pipeline Corridor.

Table 9: Previously Recorded Aboriginal Sites

Site Number	Feature(s)	Survey Unit	Landform
DZP Site			
#36-1-0373 (TS-ST-03)	Aboriginal scarred tree	W-4	gently undulating
#36-1-0365 (TS-ST-04)	Aboriginal scarred tree	W-4	gently undulating
#36-1-0366 (TS-ST-05)	Aboriginal scarred tree	W-5	gently undulating
#36-1-0367 (TS-ST-06)	Aboriginal scarred tree	W-5	gently undulating
#36-1-0368 (TS-ST-07)	Aboriginal scarred tree	N/A	gently undulating
#36-1-0313 (TS-IF-01)	Isolated artefact	GI	gently undulating
#36-1-0314 (TS-GG-01)	Grinding grooves	NA	Creek
#36-1-0374 (TS-ST-01)	Aboriginal scarred tree	TV-2	gently undulating
#36-1-0372 (TS-ST-02)	Aboriginal scarred tree	TV-2	gently undulating
#36-1-0357 (TS-OS-01 with PAD)	Artefact scatter	NA	floodplain
#36-1-0361 (TS-GG-02 with PAD)	Grinding grooves	NA	creek/ floodplain
#36-1-0360 (TS-GG-03)	Grinding grooves	NA	floodplain
#36-1-0358 (TS-OS-02)	Artefact scatter	TV-1	gently undulating
#36-1-0362 (TS-IF-02)	Isolated artefact	TV-1	gently undulating
Toongi - Dubbo Rail Line and Gas Pipeline Corridor			
No Aboriginal sites have been recorded in the impact zone for the Toongi - Dubbo Rail Line in the areas assessed.			
Macquarie River Water Pipeline			
#36-1-0356 (TS-OS-03 with PAD)	Artefact scatter	MM-6	floodplain
#36-1-0364 (TS-OS-05 with PAD)	Artefact scatter	MM-2	floodplain
Obley Road Alignment			
#36-1-0432 (ORWM-ST1)	Aboriginal scarred tree	N/A	gently undulating
#36-1-0433 (ORWM-ST2)	Aboriginal scarred tree	N/A	gently undulating
#36-1-0120 (H2 with PAD)	Aboriginal scarred tree and artefact scatter	OR-7	floodplain

Figure 39: AHIMS-listed sites in and adjacent to the DZP Site

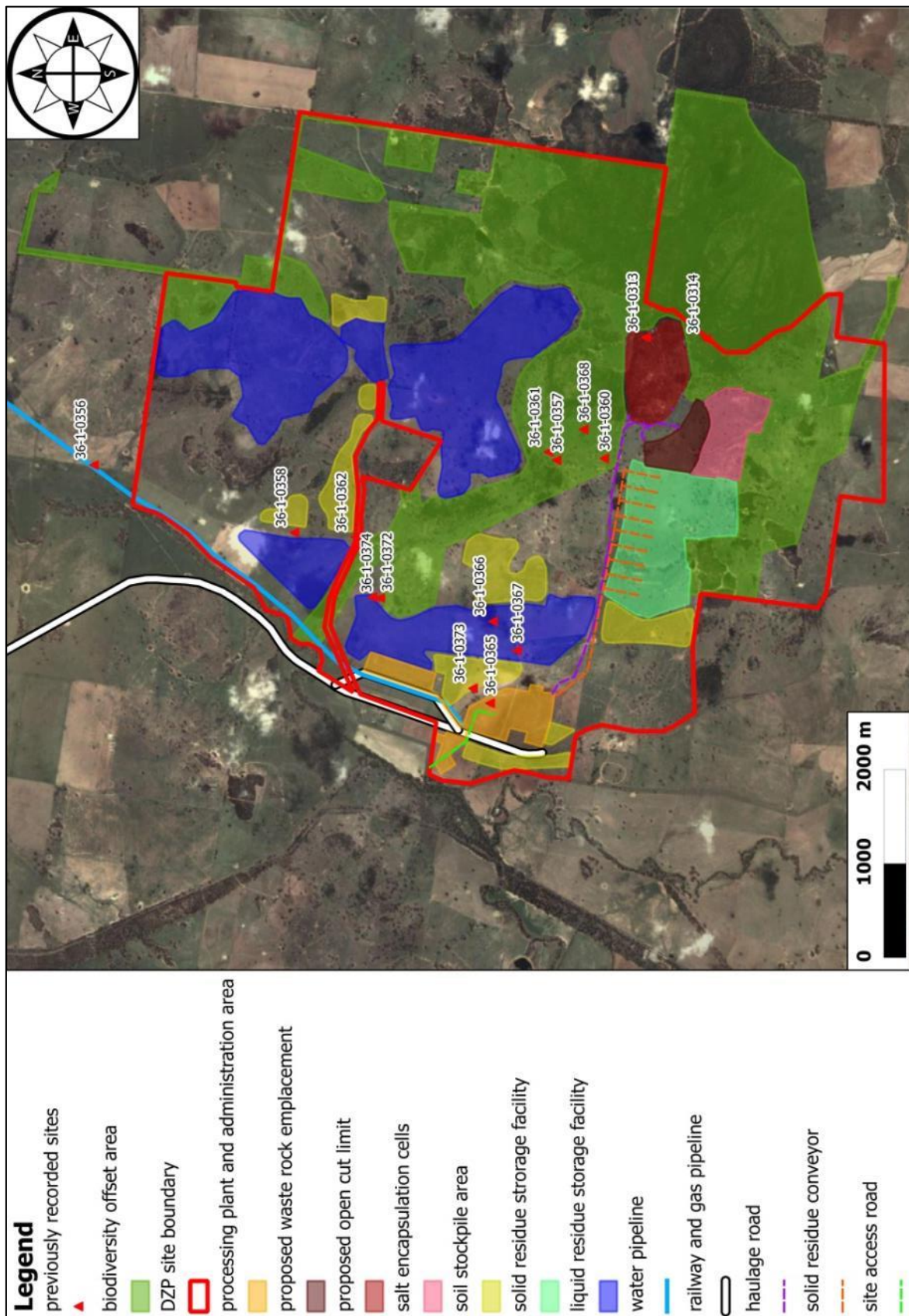
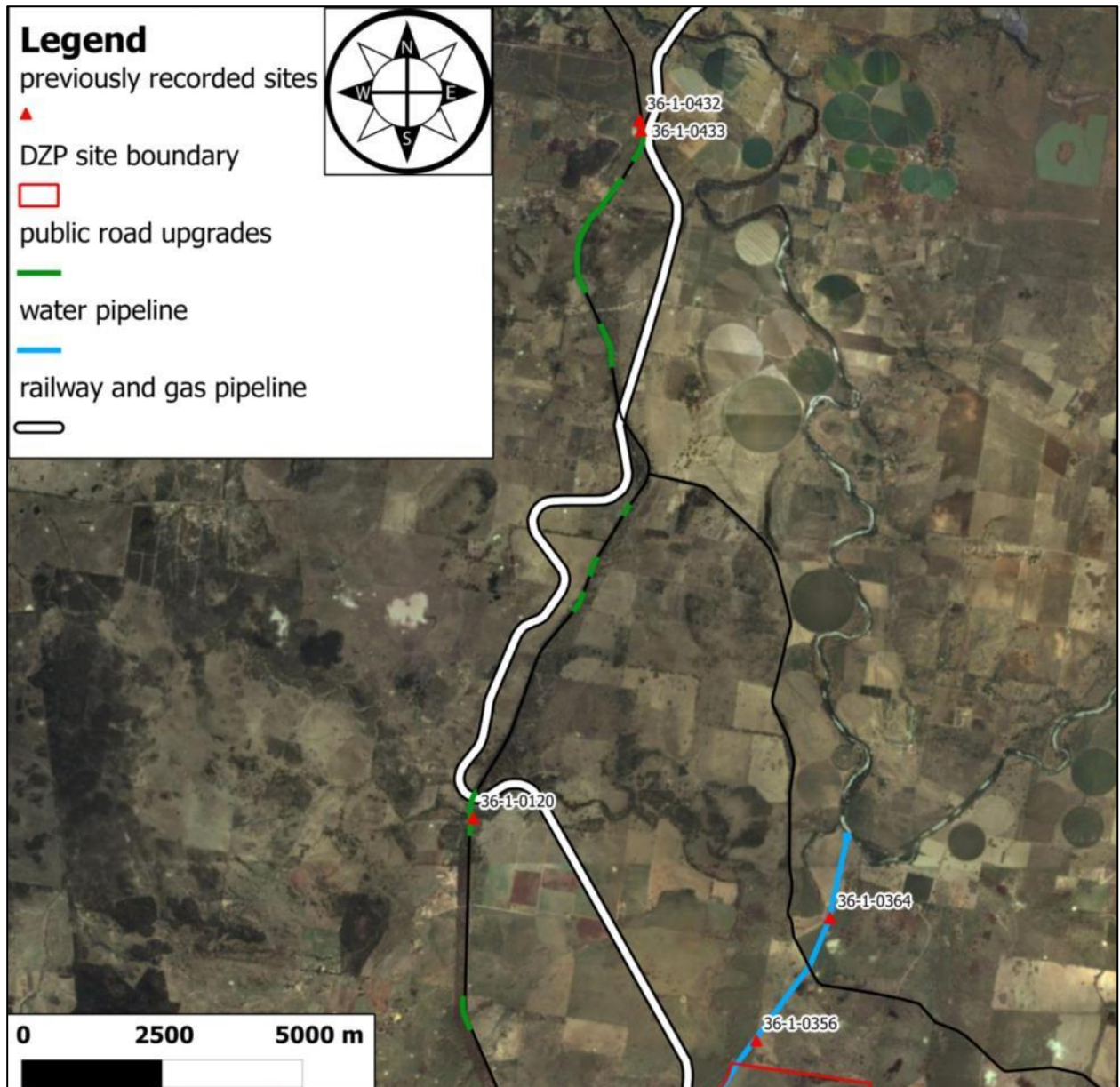


Figure 40: AHIMS-listed Sites to the north of the DZP Site Boundary



5.4.2 AHIMS Sites of the DZP Site

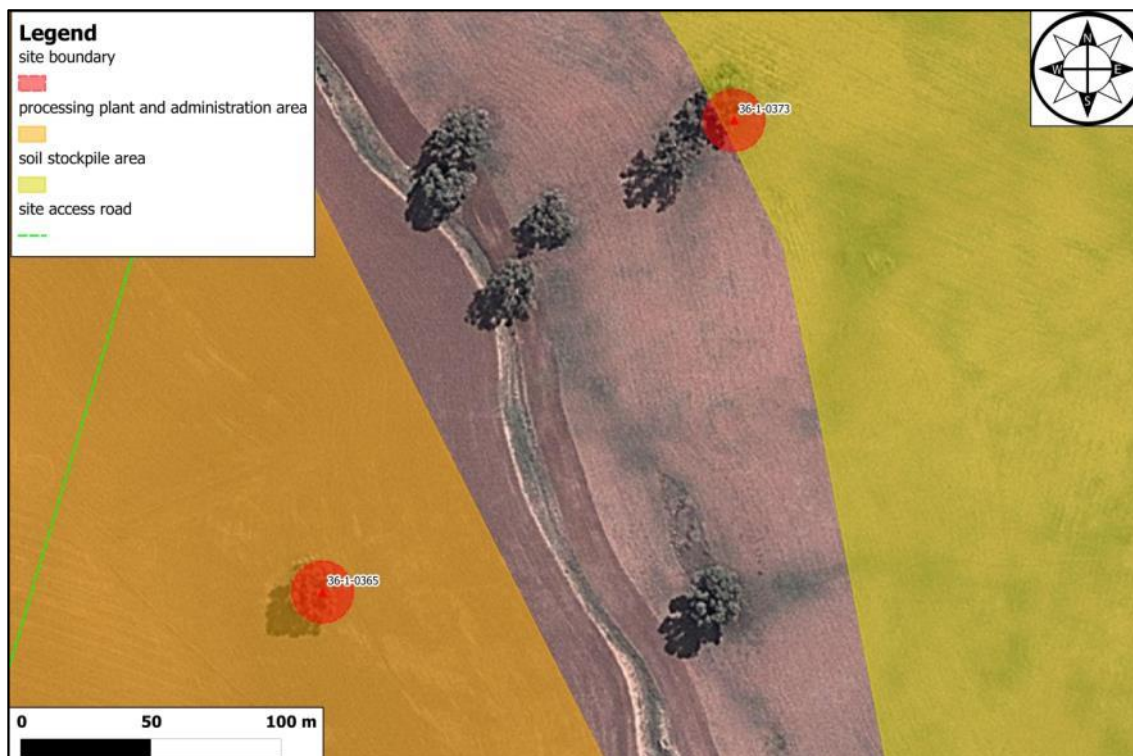
5.4.2.1 36-1-0373 (TS-ST-03)

This site is located at: (GDA94 Zone 55) 650019E / 6408565N (**Figure 39** and **41**). This is a possible Aboriginal scarred tree with no associated artefacts, located in Survey Unit W-4. The scar on this tree has closed up since its initial recording by Nolan in 2002.

5.4.2.2 36-1-0365 (TS-ST-04)

This site is located at: (GDA94 Zone 55) 649883E / 6408413N (**Figures 39** and **41**). This is an Aboriginal scarred tree with no associated artefacts, located in Survey Unit W-4.

Figure 41: 36-1-0365 and 36-1-0373 plan view map



5.4.2.3 36-1-0366 (TS-ST-05)

This site is located at: (GDA94 Zone 55) 650619E / 6408376N (**Figures 39 and 42**). This is an Aboriginal scarred tree with no associated artefacts, located in Survey Unit W-5. The scar on this tree has closed slightly since its original recording by Nolan in 2002. The tree is alive but rotting.

5.4.2.4 36-1-0367 (TS-ST-06)

The site is located at: (GDA94 Zone 55) 650355E / 6408167N (**Figures 39 and 42**). This is an Aboriginal scarred tree with no associated artefacts, located on the border of Survey Units W-5 and W-6.

5.4.2.5 36-1-0368 (TS-ST-07)

The site is located at: (GDA94 Zone 55) 652331E / 6407540N (**Figures 39 and 43**). This is an Aboriginal scarred tree with no associated artefacts, located outside the impact footprint for the Proposal, approximately 200m west of the base of Dowds Hill. The tree was found in the same condition as described originally by Nolan in 2002.

Figure 42: 36-1-0366 and 36-1-0367 plan view map

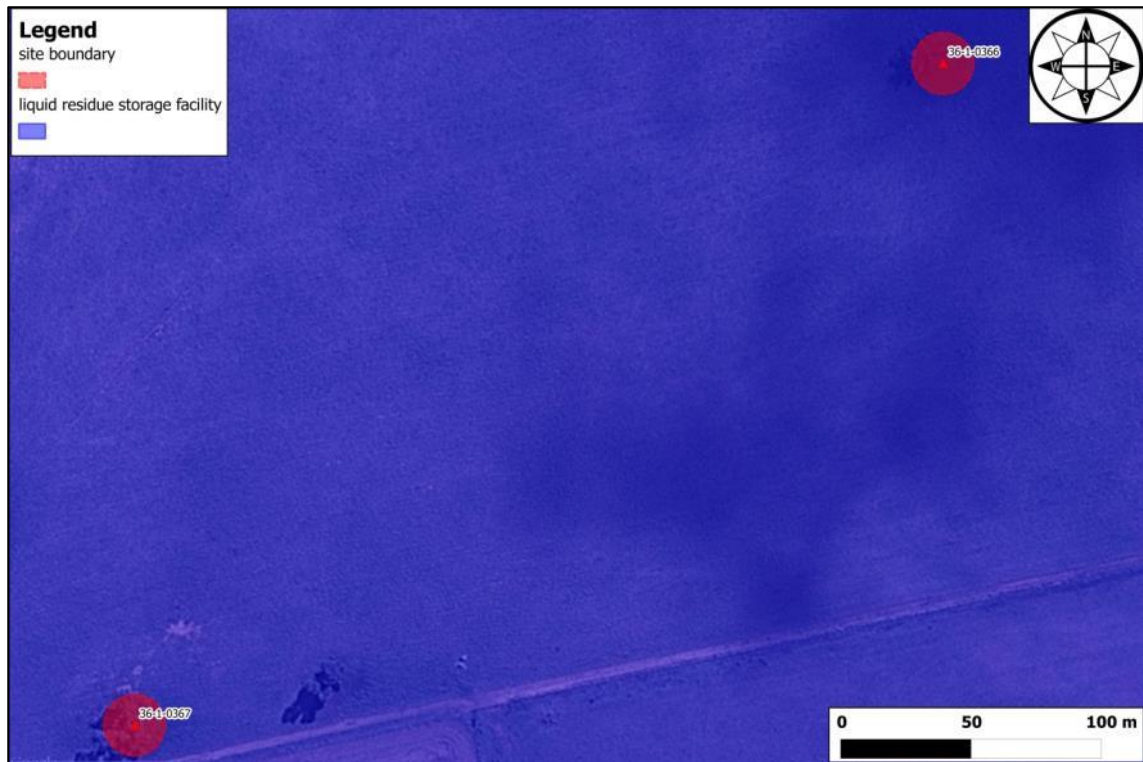
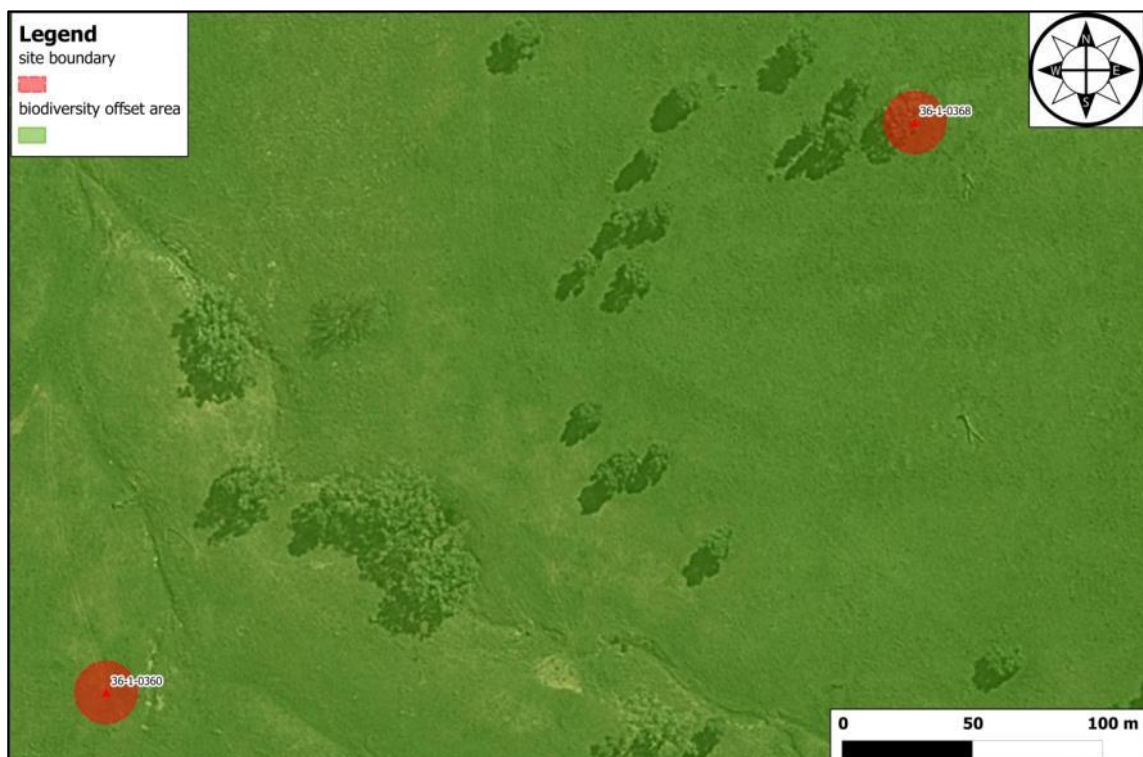


Figure 43: 36-1-0360 and 36-1-0368 plan view map



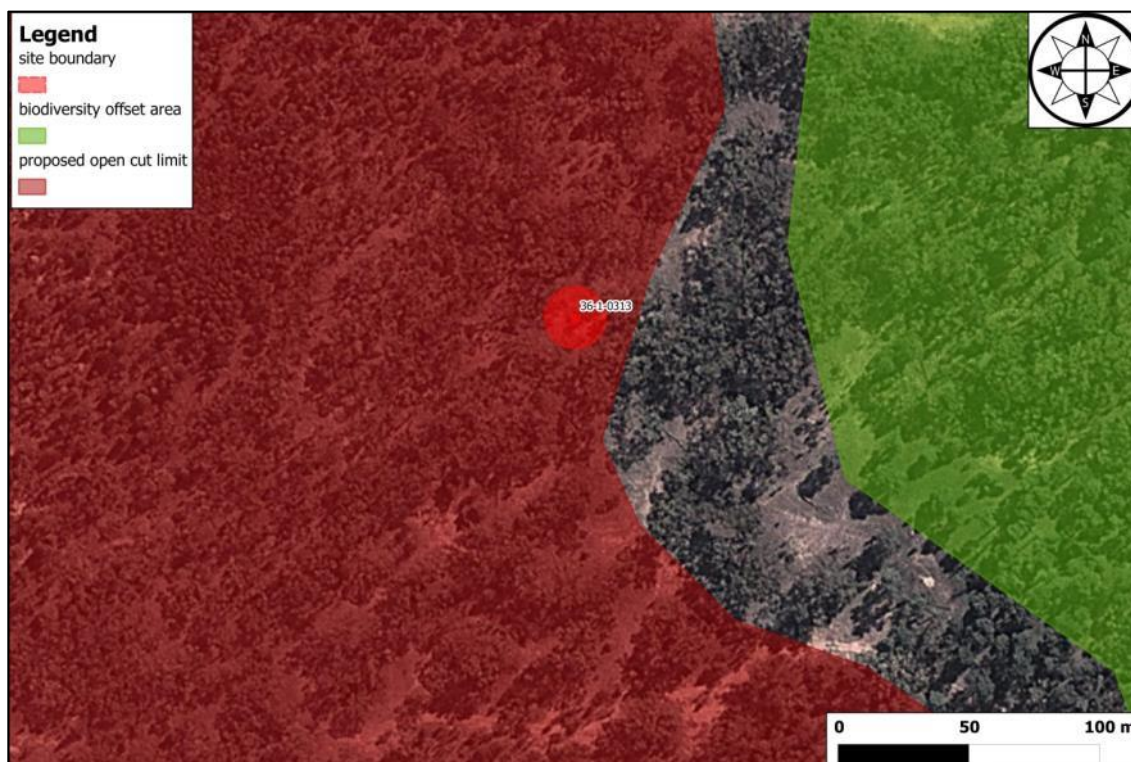
5.4.2.6 36-1-0313 (TS-IF-01)

The isolated artefact originally recorded at this site could not be located, though the general vicinity was located by GPS and description. A newly identified artefact was noted, however. The newly recorded artefact is located at (GDA94 Zone 55) 653149E / 6406967N (GI Survey Unit; **Figure 39**). The original artefact recorded was a tan chert 'flake tool.' The new artefact recorded is a pinkish chert piece of flake shatter. Impacts to the site consist of erosion, clearing of vegetation, and a borehole. It is not believed that this site has PAD as the site is very sparse despite the ground surface visibility being high, and is impacted by erosion to an extent that it is unlikely to have an intact A-horizon. Nolan (2000) believes the artefact he identified was likely to be the result of a drop/discard.

5.4.2.7 36-1-0314 (TS-GG-01)

The site is located at: (GDA94 Zone 55) 653127E / 6406427N (**Figures 39** and **44**). It has a number of grinding grooves, with five originally recorded (by Nolan) and six more identified during this assessment, bringing the total to 11 (**Plate 68**). The site plots next to the impact footprint for the proposed open cut, but was found to be outside the impact footprint by several hundred metres. Nolan (2000) indicates that the site may be at risk from incidental impacts from the mine.

Figure 44: 36-1-0313 plan view map



5.4.2.8 36-1-0374 (TS-ST-01)

Site is located at: (GDA94 Zone 55) 650844E / 6409385N, 324m AHD (TV-2 Survey Unit; **Figures 39** and **45**). This scarred tree was recorded by Nolan (2002). Since then the scar has almost completely grown together, and the survey crew thought it unlikely that the scar is Aboriginal in origin as it is very low to the ground. A metal wire encircles the tree.

Figure 45: 36-1-0372 and 36-1-0374 plan view map



5.4.2.9 36-1-0372 (TS-ST-02)

Site is located at: (GDA94 Zone 55) 650739E / 6409277N (TV-2 Survey Unit; **Figures 39 and 45**). This scarred tree was recorded by Nolan (2002). Since then the scar has almost completely grown together, and the survey crew thought it unlikely that the scar is Aboriginal in origin, as it is teardrop-shaped (not uniform in shape) and is very low to the ground.

5.4.2.10 36-1-0357 (TS-OS-01 with PAD)

Site is located at: (GDA94 Zone 55) 652057E / 6407786N (south of TV-3 Survey Unit; **Figure 39**). This artefact scatter was relocated and found in similar condition as originally described. More artefacts than originally described were noted, and the boundaries of the site were extended slightly (**Figures 39, 46 and 47**). A set of possible grinding grooves were noted on the east bank of the creek on which the site is located. This site is encompassed by the PAD shared with 36-1-0361 and TV-AS3.

5.4.2.11 36-1-0358 (TS-OS-02)

The artefacts at this site could not be located, though the location at which they were recorded was identified by the original photos at: 651443E / 6410142N (TV-1 Survey Unit; **Figure 39**). The site may have been destroyed by vehicle movement. In 2002 Nolan indicates that the land uses have almost completely destroyed the fabric of the site'.

Figure 46: 36-1-0357 and 36-1-0361 plan view map

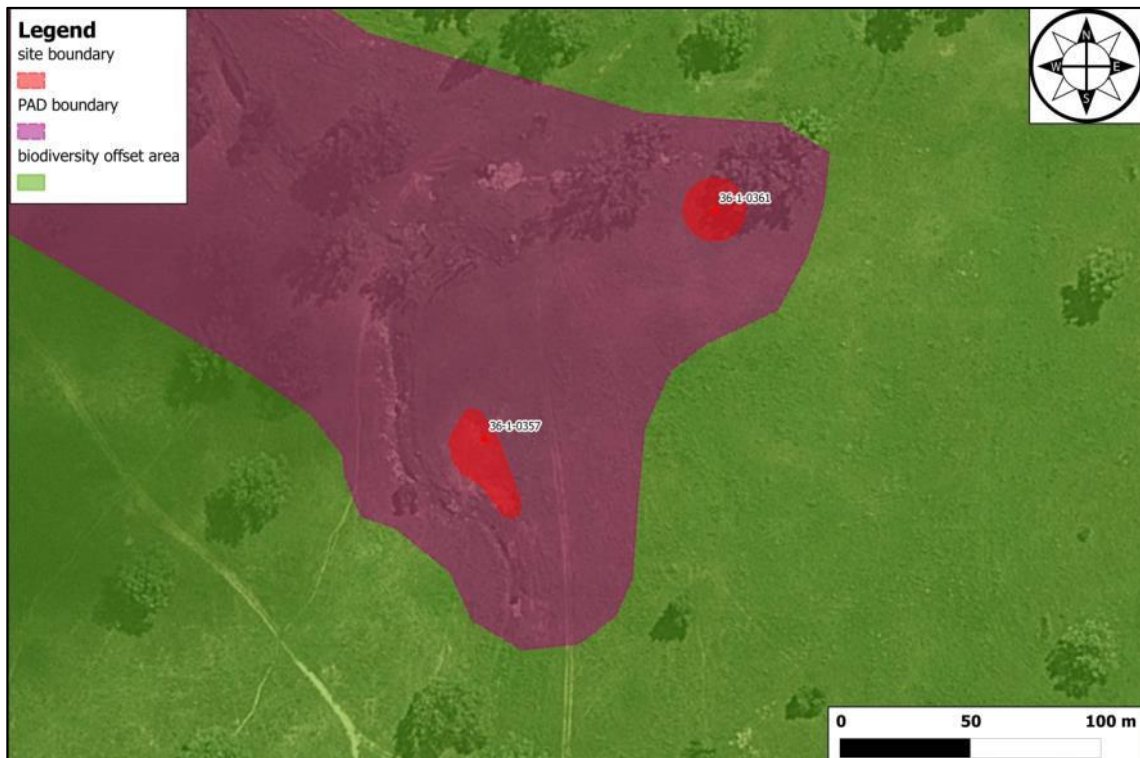
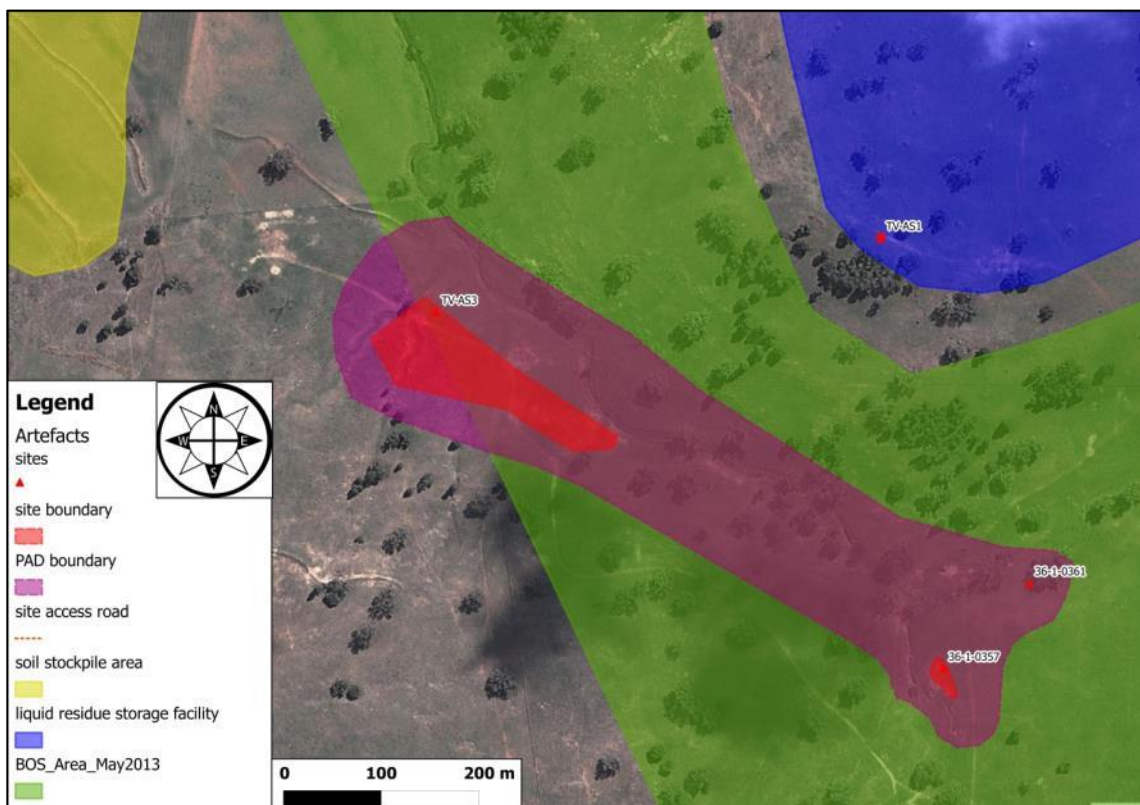


Figure 47: New Boundary of PAD Associated with 36-1-0357 Adjoining the PAD of TV-AS3



5.4.2.12 36-1-0361 (TS-GG-02 with PAD)

This site is located at: (GDA94 Zone 55) 652133E / 6407859N (south of TV-3 Survey Unit; **Figures 39, 46 and 47**). All previously recorded grinding grooves were identified, as well as several new slabs with grinding grooves (**Plates 69 to 71**). Two faint grooves were found on a rock between TS-OS-01 and this site. The rock had to be upturned to identify the grooves, and was returned to its resting position. The new grooves are:

- Six vertical grooves on a partially buried rock measuring: 60 x 50 x 14cm (exposed).
- Two straight vertical grooves, two distinctive bent grooves, and a possible squiggly horizontal groove on a broken rock overlooking the drainage. The two halves were measured separately: 75 x 50 x 40cm and 50 x 50 x 17cm. An orange chalcedony flake fragment is located nearby.

5.4.2.13 36-1-0360 (TS-GG-03)

This site is located at: (GDA94 Zone 55) 652066E / 6407360N (south of TV-3 Survey Unit; **Figures 39 and 43**). This portable slab with grinding grooves was found as originally described.

5.4.2.14 36-1-0362 (TS-IF-02)

The original artefact described as this isolated find could not be relocated, however, a newly identified artefact, an orange chalcedony flake, was found in the vicinity of the original, at: 651393E / 6409601N (just east of TV-1 Survey Unit; **Figures 39 and 48**). This site is located in the same track as site #36-1-0358 (TS-OS-02), which is deemed as being destroyed by vehicle movement in addition to agricultural land uses.

Figure 48: 36-1-0362 plan view map



5.4.3 Macquarie River Water Pipeline

5.4.3.1 36-1-0356 (TS-OS-03 with PAD)

The site is located at: (GDA94 Zone 55) 652078E / 6411926N (MM-6 Survey Unit; **Figure 49**). This is a medium-sized artefact scatter with a relatively high artefact density, of a diversity of flakes and cores. The site is located in an eroded gully and dirt track. A cropped paddock (which the survey crew was asked to remain out of) is located to the east of the site. The Wambangalang Creek is located well over 100m to the west. There is nil ground surface visibility off the exposures.

Figure 49: 36-1-0356 with PAD plan view map



The PAD was investigated through test excavation within the pipeline corridor (OzArk 2013). Eleven pits were excavated along the pipeline alignment, generally at 10m intervals and concentrated around the surface artefacts. The pits were 50cm by 50cm in area and were up to 30cm deep at which point culturally sterile soils were reached.

Five artefacts were retrieved from the test excavation, a markedly low density in comparison to the surface assemblage. Soils were found to have a low level of intactness, and in the unlikely possibility that there are sub-surface concentrations of artefacts elsewhere within the PAD they would almost certainly have low integrity. No further investigation is warranted at TS-OS3 with PAD.

5.4.3.2 36-1-0364 (TS-OS-05 with PAD)

This site would be crossed by the proposed pipeline near (GDA94 Zone 55) 653217E / 6413743N (MM-2 Survey Unit; **Figure 40**). This is a large lithic scatter site, measuring well over 100m in length. The boundaries of the site were expanded in the current assessment, as more artefacts were identified to the north of the original site extent (**Figure 50**). Artefacts were identified in two dirt tracks running parallel to each other from Benolong Road up to the "Mia

Mia" house complex. South of the gate (the original extent of the site) artefacts are sparse, with the majority of them identified in the eastern road. North of the gate (the newly noted extent) artefact density is greater, with most of the artefacts concentrated on the east side of the road. The northern extent of the surface scatter was not determined as it is not in the impact footprint and therefore not in the scope of the study.

Figure 50: 36-1-0364 with PAD plan view map



The PAD was investigated through test-excavation within the pipeline corridor (OzArk 2013). Seven pits were excavated along the pipeline alignment, generally at 20m intervals. The pits were 50cm by 50cm in area and were up to 40cm deep at which point culturally sterile soils were reached.

No artefacts were retrieved from the excavation. There was some degree of intactness in the soils at depth (i.e. 25 – 40cm), but it is not anticipated that any sub-surface deposits are elsewhere within the PAD, and certainly not at this depth. No further investigation is warranted at TS-OS3 with PAD.

5.4.4 Obley Road Alignment

5.4.4.1 36-1-0432 (ORWM-ST1)

This site is located at (GDA94 Zone 55) 650552E / 6425580N (**Figures 40 and 51**). The site is in the same condition as originally described by OzArk in 2003. The tree is healthy and the scar is well defined. No stone artefacts were identified in the vicinity of the tree at the time of recording and none were noted in the relocation of the site.

Figure 51: 36-1-0432 and 36-1-0433 plan view map



5.4.4.2 36-1-0433 (ORWM-ST2)

This site is located at (GDA94 Zone 55) 650533E / 6425729N (**Figures 40 and 51**). The site is in the same condition as originally described by OzArk in 2003. The host tree is alive and the scar remains clear. No stone artefacts were identified in the vicinity of the tree at the time of recording and none were noted in the relocation of the site.

5.4.4.3 36-1-0120 (H2 with PAD)

This site is located at (GDA94 Zone 55) 647872E / 6415317N (**Figure 40**). The location of the site was confidently relocated during this assessment, though the artefacts and features recorded in 1985 could not be found. The vicinity of the artefact scatter has poor ground visibility due to vegetation growth. It is believed that the artefacts are likely to still be present subsurface. Several trees in the area in which the scarred tree was mapped meet the description and it is possible that the scar is on a fork of trunk which has died and fallen, though no scar was visible on the exposed sides. It is also possible that the scarred tree has been removed. The PAD associated with this site has been joined with that of OR-AS1 (**Figure 37**).

5.5 RESULTS OF TEST EXCAVATION

The alignment of the proposed water pipeline overlaps with Potential Archaeological Deposits (PADs) associated with sites TS-OS-03 with PAD and TS-OS-05 with PAD (**Figures 49 and 50**). A test-excavation was carried out along the pipeline alignment within these PADs. Excavations were undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OzArk 2013).

All excavation squares at TS-OS-03 with PAD and TS-OS-05 with PAD are 50cm by 50cm and all were hand excavated. At TS-OS-03 with PAD, 11 squares were excavated during the test excavation programme, and 7 squares at TS-OS-05 with PAD. All 18 squares within both archaeological areas were excavated down to culturally sterile clays.

Five artefacts were found below the surface at TS-OS-03 and no artefacts at TS-OS-05. This contrasts with the numerous surface artefacts (see **Sections 5.4.3.1** and **5.4.3.2** as well as Nolan 2002). Pits were generally dug to 30cm – 40cm. Disturbances included ploughing, flooding and stock/vehicle movements and are likely to have affected the integrity of the sites, but would not have removed sub-surface artefacts. This suggests that the landforms are degrading and therefore artefacts are not being buried by natural deposition of soils. Disturbances are likely to be the only reason why any artefacts were found at depth, and as such, the artefacts retrieved in the test excavation were almost certainly not *in situ*. It appears that the sites TS-OS-03 with PAD and TS-OS-05 with PAD are surface sites only without any associated subsurface archaeological deposits.

5.6 ABORIGINAL COMMUNITY INPUT

Consultation has been undertaken in accordance with clause 80C of the *National Parks and Wildlife Act 1974* (NPW Act). Three Registered Aboriginal Parties (RAPs) were represented during the field survey: Binjang Wellington Wiradjuri Heritage Survey, Dubbo Local Aboriginal Land Council, and Wirrimbah Direct Descendants. Details of the input received from the RAPs can be found in **Sections 2.2, 5.8.2.3** and **6.3**.

Copies of fieldwork participation sheets and a log of correspondence are in **Appendix 1**.

5.7 DISCUSSION

5.7.1 Introduction

In total 52 Aboriginal sites are located in the Study Area. Site distribution, site type, and what this can tell us about Aboriginal settlement history is discussed in the following sections.

5.7.2 Site Distribution

The archaeological sensitivity and site distribution of the Study Area can be understood when compared to the four basic landform units present (**Figure 52; Table 10**).

- Creeks/rivers are areas that are frequently inundated with water and experience erosion as a result. They may be ephemeral or permanent.
- Floodplains or alluvial flats are those areas that are adjacent to creeks and rivers and subject to infrequent flooding, relative to the creeks/rivers. This landform includes terraces.
- Gently undulating landforms are higher landforms characterised by low rises which are often more stable surfaces that are rarely or never flooded.
- Hills can be broken down into three parts, the 'toe' or lower portion of the hill, generally having a small slope angle, the mid hill slope, which is generally steeper, and the ridge crest which can be flat or pointed.

The locations and artefact/feature assemblages of the 52 identified sites are consistent with the regional and local settlement patterns previously formulated for the Dubbo area.

Sites within creek lines consist of grinding grooves and a scarred tree (on the margin of the creek). Artefacts were only identified within the bounds of the creeks in one instance (K-AS2

with PAD), as in most instances they presumably would have been washed away. The high number of features associated with the sites are individual grinding grooves, which are clustered across two of the three creek line sites in the Study Area, evidence that either a group of people were using the same area for sharpening tools and/or that an area was used repeatedly for sharpening.

Table 10: Correlation between Archaeological sensitivity and landform

Landform		Landform Area (m ²)	Site Occurrence	Number of Artefacts or Features	Impacts	Archaeological Sensitivity
Ephemeral and perennial creeks and rivers		NA	2	42	High: stream erosion	Low
Floodplains		2071000	19	120 (approximate)	High: agricultural activities and flooding	Low-Moderate
Gently Undulating		7227000	30	60	Moderate: agricultural activities	Moderate
Hills	Toe slope	6308700	0	1	Moderate: agricultural activities	Low
	mid slope		0			
	ridge crest		0			

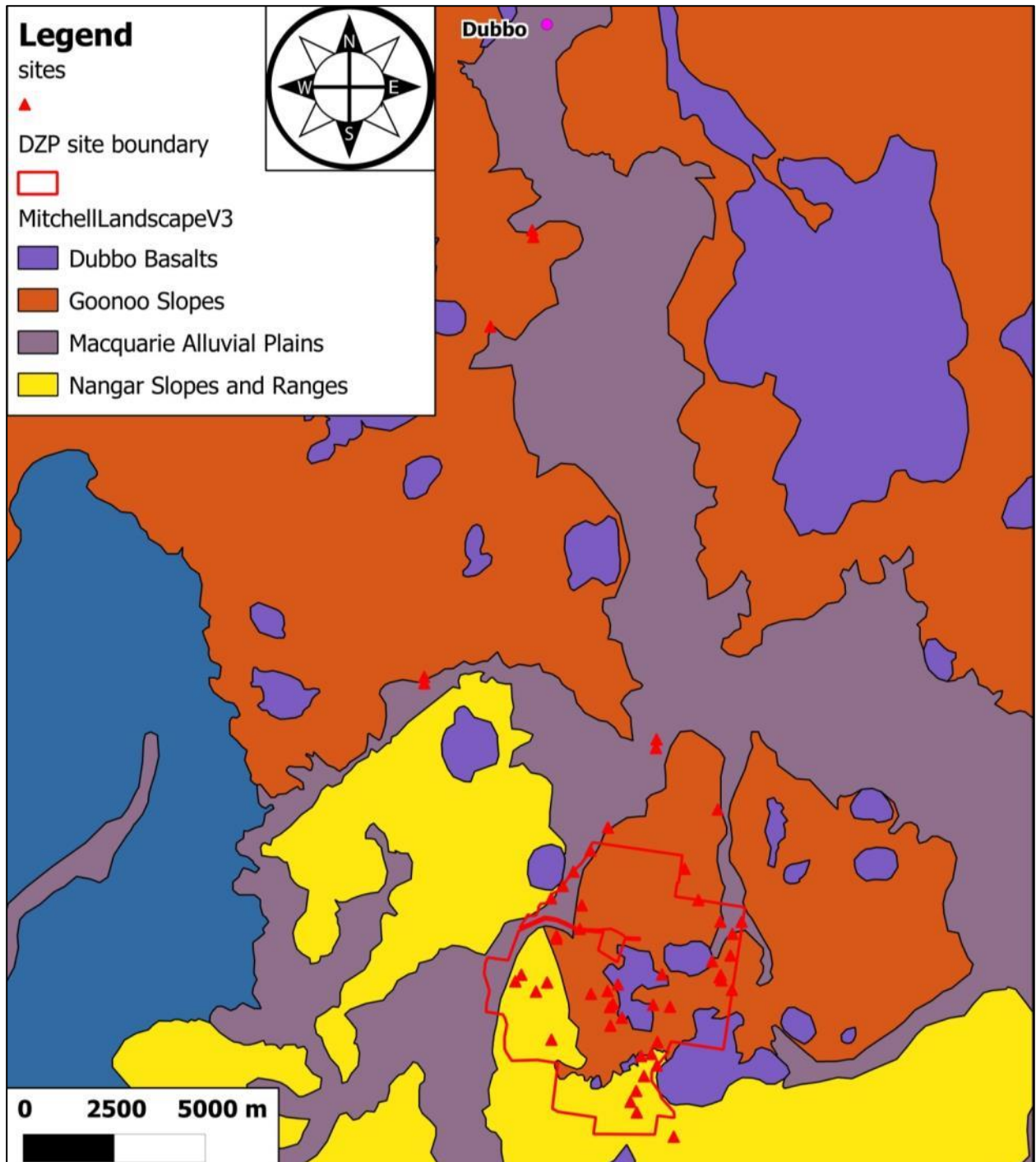
Sites within creek lines consist of grinding grooves and a scarred tree (on the margin of the creek). Artefacts were only identified within the bounds of the creeks in one instance (K-AS2 with PAD), as in most instances they presumably would have been washed away. The high number of features associated with the sites are individual grinding grooves, which are clustered across two of the three creek line sites in the Study Area, evidence that either a group of people were using the same area for sharpening tools and/or that an area was used repeatedly for sharpening.

Floodplains are a very broad landform type, and include elevated terraces, which are not to be confused with gently undulating landscapes and typically have higher archaeological sensitivity. Sites in floodplains are largely artefact scatters and isolated lithic artefacts. Scarred trees and one set of grinding grooves were also found on floodplain landforms. These landforms had the proportionally highest number of sites and artefacts, which supports the previously discussed settlement pattern of Aboriginal people camping near water (**Section 4.4**). Floodplain areas in the Study Area are generally highly disturbed by agriculture.

Gently undulating landforms comprised the majority of the Study Area. Most of the Aboriginal scarred trees are located in these areas, as well as smaller artefact scatters. The low number of artefacts/features in comparison to the number of sites recorded is accounted for by the domination of isolated artefact sites and scarred trees over open artefact scatters. It is clear from the results that Aboriginal people were using these areas which are more distant from water, but were not frequently making them the site of camps. Gently undulating landscapes in the Study Area, like floodplains, are disturbed by agriculture. However, when compared to floodplains some gently undulating areas are rocky, making them more likely to be used for grazing than growing crops.

No sites were identified in hilly landforms. Most of the hilly areas in the Study Area are distant from major waterways, with headwaters, i.e. 1st order drainages, more common hydrologic features. The lack of sites in hilly areas can be understood in terms of the predictive model for site location, which states that with increased distance from water site density decreases. Though the only site identified on a hill landform is in a paddock, hilly regions of the Application Area are frequently less disturbed than the flatter areas and may be forested.

Figure 52: Landform types and Aboriginal archaeological sites¹³



Note: Image presents the DZP Site assessed area.

¹³ Does not include sites OR-ST1, 36-1-0432, 36-1-0433 to north.

5.7.3 Artefacts

Artefacts identified in the course of this study are mostly flakes, some waste flakes from creating stone tools and others modified and/or used as tools themselves. Many cores, a stone axe, and a hand-held grinding stone were also identified in the area.

Lithic materials identified consist of cherts and other FGS, quartz, mudstone, rhyolite, and sandstone, as well as several unidentified materials.

5.7.4 Chronology

Ethnographic accounts from Aboriginal people living in the region today, in addition to early accounts of interactions between settlers and Aboriginal people clearly evidence that Aboriginal people were inhabiting the area in recent history, however, it is unknown when Aboriginal people first came to the region or how continuously the area has been occupied.

Archaeological sites may be dated by a variety of means, including relative dating via stratigraphy, laboratory analysis such as radiocarbon dating, and cross-dating of artefact types. It is difficult to cross-date artefacts identified during this project as there is currently no widely agreed upon chronology of stone tool development in Australia (Mulvaney 1999: 47). The Aboriginal scarred trees identified may be able to yield dates via dendrochronology, however, these dates may be of little use beyond reinforcing their authenticity as being culturally modified. It is already known that Aboriginal people have been in the area longer than the surviving trees. Test excavation at sites with intact subsurface deposits may yet yield relative dates, or material suitable for laboratory analysis.

5.7.5 Potential Archaeological Deposits

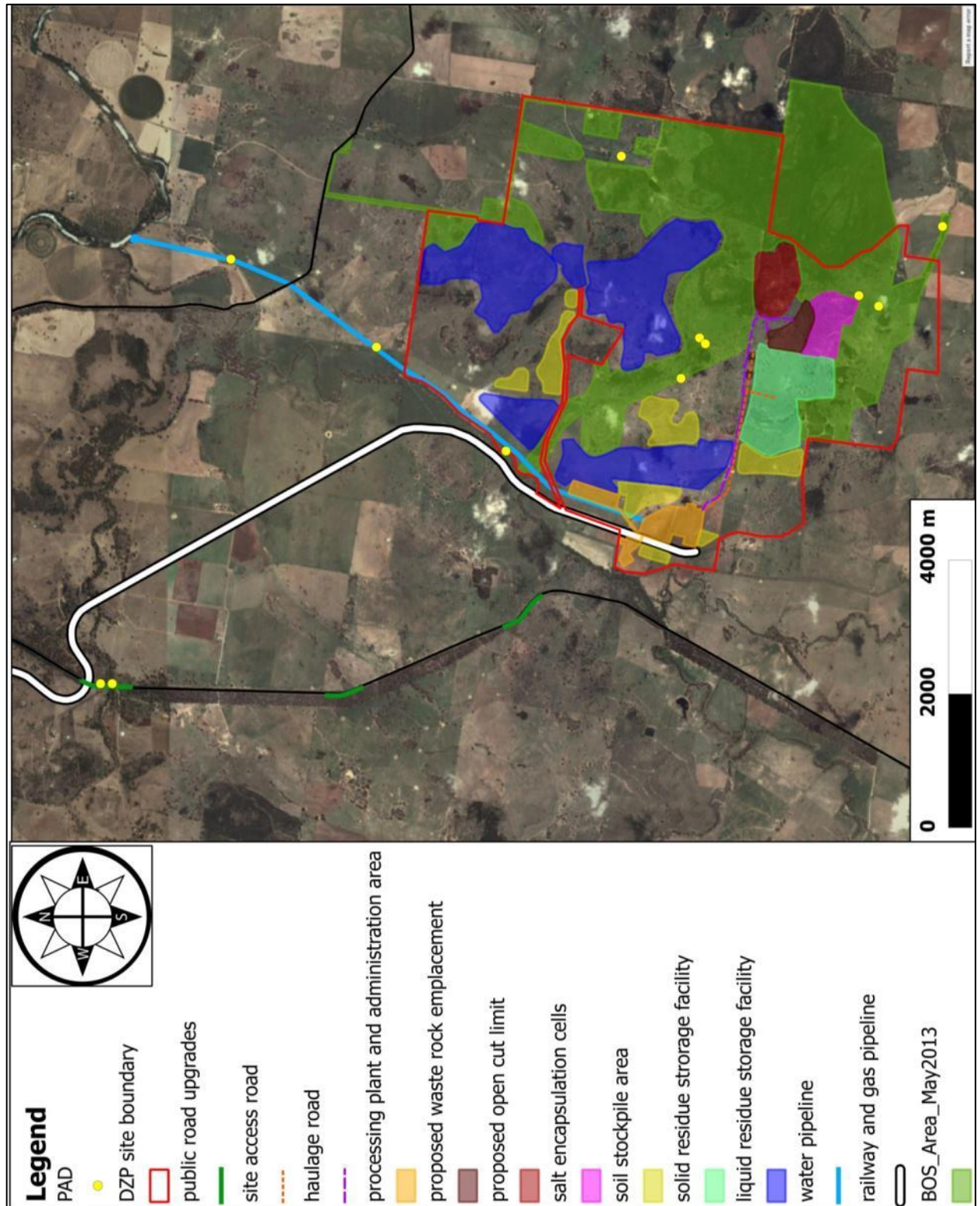
Twelve (12) of the sites have associated PADs (**Figure 53**). These are newly recorded sites UG-AS4 with PAD, K-AS1 with PAD, K-AS2 with PAD, TV-AS2 with PAD, TV-AS3 with PAD, OR-AS1 with PAD, and PAD 12, and previously recorded sites: #36-1-0357, #36-1-0361, #36-1-0356, #36-1-0364, #36-1-0120.

The site at UG-AS4 with PAD is disturbed, being situated on an eroded creek bank (**Figure 15**). The area designated as PAD to the east has been subject to agricultural impacts. It has been cleared and grazed, and likely ploughed but perhaps not regularly. Although these disturbances diminish the possibility of intact archaeological deposits, sub-surface artefacts are very likely and testing would be needed to establish the presence or absence of intact deposits. Additionally, there is likely to be an area between the edge of the creek line and the track that has escaped ploughing. Artefacts witnessed on the surface were grouped according to material types, indicating some intactness.

The PAD at K-AS1 with PAD is likely to extend out of the exposure into the grassy areas adjacent (**Figure 22**). It is bounded by the ploughed paddock to the south and the earth dam to the northeast.

K-AS2 was only partially investigated as it was identified at the end of the day and subsequently the impacts associated with the Proposal were altered, leaving KAS2 with PAD outside of the impact footprint (**Figure 23**). It was immediately apparent that a variety of activities took place along the associated creek line, with stone artefacts, a possible scarred tree, probable grinding groove, and possible ochre processing (K-OP1) all occurring within 20m of the creek. The most suitable area for occupation at K-AS2 was to the southeast of the creek line as steep ground was to the northwest. This area to the southeast was designated as a PAD, with activity most likely closer to the creek bank. The south-eastern boundary is somewhat arbitrary as there is no change in landform or disturbance levels. The area of the PAD has been subject to agricultural impacts, but these impacts may have only partially compromised integrity and archaeological deposits may exist below the plough zone.

Figure 53: Potential Archaeological Deposits (PAD)



Note: Image presents the DZP Site assessed area.

PAD 12 was assessed to have potential archaeological deposits without being associated with a particular site. As there is no associated site, the PAD's boundaries are difficult to determine. A large basis for the designation of the PAD is the landform, and it is the alluvial plains adjacent to the creek lines that effectively form the PAD (**Figure 24**). The potential for sub-surface deposits can generally be expected to diminish with distance from the creek lines. There is no prominent localised terracing that would make one particular spot within the general area more suitable for intensive activity over another. The PAD has been subject to agricultural impacts such as clearing and grazing, but has perhaps not been ploughed.

The PAD at TV-AS2 with PAD is bounded by ploughed paddocks to the east of the site and the Wambangalang creek to the west (**Figure 29**). It is unknown how far north or south the sub-surface component extends, so an area approximately 30m to the south and 60m to the north (where the creek bank juts out to the west) are recommended for testing.

The PAD at OR-AS1 with PAD (**Figure 37**) is shared with site #36-1-0120 (H2 with PAD). It is bounded by the impacted road shoulder of Obley Road to the west, and an arbitrary distance of approximately 20m distance east of site OR-AS1 with PAD. It is likely that if testing is necessary it will only be required within the impact footprint of the Proposal and so will not be undertaken to even that distance. The northern boundary of the PAD is approximately 150m from Hyandra Creek, a distance from water at which Aboriginal occupation is demonstrated to be less intensive. The southern boundary of the PAD is 100m south of Hyandra Creek, a distance which encompasses and exceeds the previously recorded extent of artefacts at site #36-1-0120.

The PAD at TV-AS3 with PAD (**Figure 47**) is shared with sites #36-1-0357 (TS-OS-01 with PAD) and #36-1-0361 (TS-GG-02 with PAD). The AHIMS sites are on the eastern side of a confluence of drainages, and site TV-AS3 with PAD is on the southern side of the main drainage, northwest of the AHIMS sites. Though the sites do not connect on the surface, the density of artefacts and features present demonstrate repeated occupation, and it is possible that artefacts are present subsurface on either side of the creek, thus the area is designated a Sensitive Archaeological Landform (SAL). Despite impacts to the land it is likely that undisturbed deposits are present. The SAL runs along the creek in a northwest-southeast direction for 670m, with a width of 120-175m, which takes into consideration landform and artefact/ feature extent.

The PAD at #36-1-0356 (TS-OS-03 with PAD; **Figure 49**) is bounded on the east by a cropped paddock mere metres from the artefacts. PAD extends to all other sides by approximately 25m, a modest arbitrary buffer as it is very possible that this area has been cropped in the past, though plough marks are no longer evident. This PAD was investigated through test excavation (see **Section 5.4.3.1**).

The PAD at #36-1-0364 (TS-OS-05 with PAD; **Figure 50**) follows the road in which the artefacts were observed. To either side of the road evidence of cropping is present, with more intensive cropping evident to the north-western side than the south-eastern. For this reason PAD is not likely to be present far from the road in either direction, but more so to the southeast. A moderate ten metre buffer to the northwest and a more generous 40m buffer to the southeast are recommended. The north-eastern and south-western extent of the PAD is dictated by the extent of artefacts observed in the exposure, approximately 40m to the south. The north-eastern extent of the site is unknown, as it extends outside the current Study Area, and the 40m buffer from the last artefact observed is thus arbitrary. This PAD was investigated through test excavation (see **Section 5.4.3.2**).

5.8 ASSESSMENT OF HERITAGE SIGNIFICANCE

5.8.1 Introduction

The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance and value, as well as the likely impacts of any proposed development.

Aesthetic, historic, scientific, and social value are baseline elements of the significance assessment, and it is through the combination of these elements that the overall heritage values of a site, place or area is determined.

The following values from the Burra Charter are outlined in the Australia ICOMOS Guidelines: Cultural Significance and is quoted verbatim below:

Aesthetic value

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.

Historic value

Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.

Scientific value

The scientific or research value of a place will depend on the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.

Social value

Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

Other approaches

The categorisation into aesthetic, historic, scientific and social values is one approach to understanding the concept of cultural significance. However, more precise categories may be developed as understanding of a particular place increases.

All values of the *Burra Charter* are considered when evaluating the significance of sites in the Study Area. Significance assessment of open sites is extremely variable and dependent upon several factors relating to:

- **Preservation:** Whether the site has the potential for the presence of intact, sub-surface deposit, or whether disturbance (human: land surface impacts, or environmental: erosion, deflation) has reduced its integrity and thus its potential;

- Representativeness: Is this the type of site one may expect in this landscape? (relates back to the predictive model), i.e. do many such sites occur nearby?;
- Artefacts: Are there artefacts present (material, types or combinations thereof) that are rare in the area or unusual for that type of site?; and
- Potential Archaeological Deposits (PAD): It is impossible to determine the scientific significance of PADs that do not have visible surface artefacts, as there is no site material or soil data to assess. Consequently, test excavation is recommended for such areas to investigate the presence, extent, nature and integrity of any possible site material such that their significance can be assessed and appropriate management recommendations devised.

5.8.2 Assessed Significance of the Recorded Sites

5.8.2.1 Aesthetic Value

None of the Aboriginal sites recorded have significant aesthetic value as the integrity of the sensory landscape has been altered in historic and modern times. Additionally, the artefacts themselves are generally not remarkable. As such, they have been preliminarily assessed as holding **low aesthetic value**.

5.8.2.2 Historic Value

None of the Aboriginal sites recorded have an apparent direct relationship to known historical Aboriginal sites (such as missions or massacre sites). It is likely that the area saw some of the earliest contact between Aboriginals and non-Aboriginal settlers, however, none of the recorded Aboriginal sites display evidence that they constitute 'Contact' or 'Post-Contact' Aboriginal sites. To that end, all are assessed as holding **low historic value**.

5.8.2.3 Social or Cultural Value

Cultural values were discussed throughout the project, including during informal on-site conversations and in official forums such as AFGMs. Most of the values presented below were captured during the AFGM held on Tuesday 13 August 2013.

The sites recorded in the DZP Project Area are reflective of the widespread use of the land by Aboriginal people over time. The sites provide a tangible, continued cultural connection with the land, and have elevated importance due to the diminishing knowledge of Aboriginal culture since white settlement. In this way, all sites have some level of cultural value.

Not only do the sites demonstrate the widespread nature of the use of the land in terms of area, but also in terms of types of use. It was noted by the RAPs that the variety of site types present reflect the range of ways the landscape was used by Aboriginal people. This range of uses can also be demonstrated within a site type. For example, scarred trees could act as markers for boundaries or burials, or could represent the use of the bark itself as a functional item such as a coolamon.

The sites have been generally assessed as holding **moderate social/cultural value**.

5.8.2.4 Archaeological/Scientific Value

16 sites have been assigned low-moderate, moderate or moderate-high scientific values. Of these, five are preliminary assessments as further test excavation would be required to fully determine their scientific values. Eleven of these sites have PADs which may yield further data about occupation of the site and prehistoric technologies should they be subject to test-

excavation. One site (K-OP1) requires further assessment to determine significance, but this is not necessary at present as it is located outside of the impact footprint.

36 sites have low scientific significance. These sites are highly disturbed and /or are unlikely to yield further data. These sites are not assessed as having PAD, but are representative of regional archaeological sites and collectively have a moderate diversity of artefacts.

Scientific value of all 52 sites is summarised in **Table 11**.

Table 11: Scientific Significance of the Recorded Sites

Site	Research potential	Representativeness	Rarity	Scientific significance
UG-AS1	low - moderate	moderate	moderate	Low - Moderate: This site has a diversity of artefacts that are somewhat unusual; however, it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
UG-AS2	low	moderate	low	Low: site is sparse and is situated on a landform with disturbed soils, making intact subsurface deposits unlikely.
UG-AS3	low	moderate	low	Low: site is sparse and is situated on a landform with disturbed soils, making intact subsurface deposits unlikely.
UG-AS4 with PAD	low - moderate	moderate	low	Low - Moderate: site is sparse and is situated on a landform with disturbed soils to an unknown depth, making intact subsurface deposits unlikely.
UG-ST1	low	moderate	low	Low: site is well preserved and is a fair representation of a scarred tree, but is unlikely to yield further data.
UG-ST2	low	moderate	low	Low: site is well preserved and is a fair representation of a scarred tree, but is unlikely to yield further data.
UG-IF1	low	low	low	Low: the site is at too low a density, given the moderate ground visibility, for a more extensive site to be likely to be present at this location, and the artefact itself can yield no further data.
UG-IF2	low	low	low	Low: the site is at too low a density, given the moderate ground visibility, for a more extensive site to be likely to be present at this location, and the artefact itself can yield no further data.
UG-IF3	low	moderate	low	Low: This sit is on a landform not conducive to settlement. Although surrounding visibility is poor, isolated finds of this type are common in the broader area.
UG-IF4	low	moderate	low	Low: this isolated find is typical of this landform in the region. Along with UG-IF6 and UG-IF5 nearby, these artefacts display specific usage but do not indicate extensive settlement or activity in the immediate vicinity. They have some scientific collectively, but this is derivable from the information already obtained in the survey.
UG-IF5	low	moderate	low	Low: this isolated find is typical of this landform in the region. Along with UG-IF4 and UG-IF6 nearby, these artefacts display specific usage but do not indicate extensive settlement or activity in the immediate vicinity. They have some scientific collectively, but this is derivable from the information already obtained in the survey.
UG-IF6	low	moderate	moderate	Low: this isolated find is typical of this landform in the region. Along with UG-IF4 and UG-IF5 nearby, these artefacts display specific usage but do not indicate extensive settlement or activity in the immediate vicinity. They have some scientific collectively, but this is derivable from the information already obtained in the survey. Of the three sites nearby, this is the most rare.
UG-IF7	low	low	low	Low: the site is at too low a density, given the moderate ground visibility, for a more extensive site to be likely to be present at this location, and the artefact itself can yield no further data.

Site	Research potential	Representativeness	Rarity	Scientific significance
K-AS1 with PAD	moderate – high	moderate	low	Moderate: This site has a diversity of stone artefacts. It is possible that there are intact subsurface deposits in the grass-covered areas adjacent, which may yield further data about Aboriginal occupation.
K-AS2 with PAD	moderate – high	moderate	moderate	Moderate: There is potentially a great diversity of artefacts at this site and PAD. While intactness is unlikely, it is possible that subsurface deposits have some integrity and if so would possibly have excellent scientific value. Even if integrity was moderate or low, some scientific value is likely.
K-IF1	low	moderate	low	Low: this isolated find is typical of this landform in the region.
K-OP1	low	moderate	moderate	Low-Moderate: If the site is an ochre processing place then this is a rare site although the landform did not have likely potential for associated intact deposits.
PAD 12	moderate	uncertain	uncertain	Moderate (preliminary): Scientific significance is particularly difficult to assess given there are no artefacts. The research potential is based on landscape features and nearby sites.
GI-AS1	low	moderate	low	Low: site is sparse and is situated on a landform with skeletal soils, making the likelihood of subsurface deposits unlikely.
GI-AS2	low	moderate	low	Low: site is sparse and is situated on a landform with skeletal soils, making the likelihood of subsurface deposits unlikely.
PH-IF1	low	low	low	Low: site is sparse and is situated on a landform with disturbed soils, making the likelihood of subsurface deposits unlikely. Exposures nearby did not contain artefacts.
TV-AS1	low	low	low	Low: site is sparse and is situated on a landform with disturbed soils, making the likelihood of subsurface deposits unlikely. An exposure nearby did not contain artefacts.
TV-AS2 with PAD	moderate-high	moderate	moderate	Moderate: This site has a diversity of stone artefacts. It is possible that there are intact subsurface deposits in the grass-covered areas adjacent, which may yield further data about Aboriginal occupation.
TV-AS3 with PAD	moderate-high	moderate	moderate	Moderate: This site has a diversity of stone artefacts. It is possible that there are intact subsurface deposits in the grass-covered areas adjacent, which may yield further data about Aboriginal occupation.
TV-IF1	low	low	moderate	Low: The artefact itself is of interest, as it is a tool, however, the site has been too modified by farming activities to have intact deposits, and therefore is not likely to yield further data about Aboriginal occupation.
G-AS1	low	low	low	Low: site is sparse and is situated on a landform with disturbed soils, making intact subsurface deposits unlikely.
G-IF1	low	low	low	Low: site is sparse and is situated on a landform with disturbed soils, making the likelihood of subsurface deposits unlikely. The large exposures in which the isolate was found did not contain artefacts.
36-1-0373 (TS-ST-03)	low	low	low	Low: site is well preserved but is a poor representation of a scarred tree, and it is unlikely to yield further data.
36-1-0365 (TS-ST-04)	low	low	low	Low: site is well preserved and is a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0366 (TS-ST-05)	low	low	low	Low: site is in fair condition and is a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0367 (TS-ST-06)	low	low	low	Low: site is well preserved and is a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0368 (TS-ST-07)	low	low	low	Low: site is well preserved and is a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0313 (TS-IF-01)	low	low	low	Low: The integrity of the site has been impacted by erosion and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.

Site	Research potential	Representativeness	Rarity	Scientific significance
36-1-0314 (TS-GG-01)	moderate	moderate	low	Moderate: site exhibits extensive use and it is possible that subsurface artefacts are present along the banks of the site, which may yield further data about Aboriginal occupation.
36-1-0374 (TS-ST-01)	low	low	low	Low: the site is a poor example of an Aboriginal scarred tree and is unlikely to yield further data.
36-1-0372 (TS-ST-02)	low	low	low	Low: the site is a poor example of an Aboriginal scarred tree and is unlikely to yield further data.
36-1-0357 (TS-OS-01 with PAD)	moderate-high (preliminary)	moderate	moderate	Moderate-high (preliminary): the site has a diversity of grinding groove types. Though there is disturbance due to grazing, the extent of grazing's impact on subsurface deposits is unknown and the site may yield further data about Aboriginal occupation.
36-1-0358 (TS-OS-02)	low	low	low	Low: this site is in poor condition and no artefacts could be located at the site. It is not likely to yield further data.
36-1-0361 (TS-GG-02 with PAD)	moderate-high	moderate	moderate	Moderate-high: the site has a diversity of artefacts and features (several grinding groove sites are nearby). Though there is disturbance due to grazing, the extent of grazing's impact on subsurface deposits is unknown, and the site may yield further data about Aboriginal occupation.
36-1-0360 (TS-GG-03)	low	moderate	moderate	Moderate: this grinding groove on a portable slab is unusual for the area in that it is not on bedrock, and in itself has some scientific value. However, further investigation is not likely in the vicinity to yield any further data about Aboriginal occupation.
36-1-0362 (TS-IF-02)	low	low	low	Low: The integrity of the site has been reduced by agricultural land uses and road use, and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
Toongi - Dubbo Rail Line and Gas Pipeline Corridor				
No Aboriginal sites have been identified within the fenced corridor of the rail line at the areas checked (the creek crossings), and no previously recorded sites fall within the rail easement.				
Macquarie River Water Pipeline				
MM-AS1	low	moderate	low	Low: The integrity of the site has been greatly reduced by ploughing and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
MM-AS2	low	moderate	low	Low: The integrity of the site has been greatly reduced by ploughing and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
MM-IF1	low	low	low	Low: The integrity of the site has been greatly reduced by ploughing and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
MM-IF2	low	low	low	Low: The integrity of the site has been greatly reduced by ploughing and it is unlikely that the site can yield further archaeological data as the soil stratigraphy has been compromised.
36-1-0356 (TS-OS-03 with PAD)	low	moderate	low	Low-moderate: This site was initially assigned a moderate level of significance, but test excavations revealed a very low possibility of yielding further data about Aboriginal occupation. It retains some scientific significance on the basis of the diversity of stone artefacts.
36-1-0364 (TS-OS-05 with PAD)	low	moderate	low	Low-moderate: This site was initially assigned a moderate level of significance, but test excavations revealed a very low possibility of yielding further data about Aboriginal occupation. It retains some scientific significance on the basis of the diversity of stone artefacts.

Site	Research potential	Representativeness	Rarity	Scientific significance
Obley Road Alignment				
OR-AS1 with PAD	moderate-high	moderate	low	Moderate: Surface manifestation of the site is sparse, but proximity to a water way makes the site likely to have been repeatedly occupied. Subsurface deposits may be present and intact, and able to yield further data about Aboriginal occupation.
OR-ST1	low	moderate	low	Low: site is well preserved and a good representation of a scarred tree, but is unlikely to yield further data.
36-1-0432 (ORWM-ST1)	low	moderate	low	Low: site is well preserved and a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0433 (ORWM-ST2)	low	moderate	low	Low: site is well preserved and a fair representation of a scarred tree, but is unlikely to yield further data.
36-1-0120 (H2 with PAD)	moderate-high (preliminary)	moderate	low	Moderate (preliminary): Surface manifestation of the site is sparse, but proximity to a water way makes the site likely to have been repeatedly occupied. Subsurface deposits may be present and intact, and able to yield further data about Aboriginal occupation.

5.9 LIKELY IMPACTS TO ABORIGINAL HERITAGE FROM THE PROPOSAL

Not all of the sites recorded in the Study Area are at risk of harm from the Proposal, and the degree of harm to sites is variable. For example, some sites only fall partially inside the impact footprint.

- 26 sites are outside the impact footprint of the Proposal.
- 12 sites are outside the impact footprint of the Proposal but are likely to suffer indirect impacts from the proposal unless managed appropriately; and
- 14 sites would be impacted to some degree by the Proposal.

Generally, sites or portions of sites within the proposed impact footprint will lose their cultural, archaeological and aesthetic values to some degree. The type, degree and consequence of harm to the sites are discussed in **Table 12**. This harm applies to the various types and levels of significance described in **Section 5.8**. In the case of cultural significance, the values supplied by the RAPs were common to all sites. As the sites offer a connection to heritage and country, their removal from their current location breaks this link and this key aspect to cultural value is lost. Some cultural and scientific value could be retained through salvage.

Table 12: Impact Assessment

Site Number	Type of Harm (Direct/Indirect/None)	Degree of Harm (Total/Partial/None)	Consequence of Harm (Total/Partial/No loss of value)
DZP Site			
UG-AS1	Direct	Partial	Total loss of value: A portion of this site remains outside of the impact area, although salvage for the entire site is recommended.
UG-AS2	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-AS3	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-AS4	None	None	No loss of value: This site is currently outside of the impact footprint.

Site Number	Type of Harm (Direct/Indirect/None)	Degree of Harm (Total/Partial/None)	Consequence of Harm (Total/Partial/No loss of value)
UG-ST1	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
UG-ST2	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF1	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF2	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF3	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF4	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF5	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF6	None	None	No loss of value: This site is currently outside of the impact footprint.
UG-IF7	None	None	No loss of value: This site is currently outside of the impact footprint.
K-AS1 with PAD	None	None	No loss of value: This site is currently outside of the impact footprint.
K-AS2 with PAD	None	None	No loss of value: This site is currently outside of the impact footprint.
K-OP1	None	None	No loss of value: This site is currently outside of the impact footprint.
K-IF1	None	None	No loss of value: This site is currently outside of the impact footprint.
PAD 12	None	None	No loss of value: This site is currently outside of the impact footprint.
GI-AS1	Direct	Total	Total loss of value: The site falls within the open cut impact footprint.
GI-AS2	Direct	Total	Total loss of value: The site falls within the open cut impact footprint.
PH-IF1	Direct	Total	Total loss of value: The site falls within the Solid Residue Storage Facility.
TV-AS1	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
TV-AS2 with PAD	None	None	No loss of value: This site is currently outside of the impact footprint.
TV-AS3 with PAD	None	None	No loss of value: This site is currently outside of the impact footprint.
TV-IF1	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
G-AS1	None	None	No loss of value: This site is currently outside of the impact footprint.
G-IF1	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0373 (TS-ST-03)	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm. It is just 30m from the soil stockpile impact footprint and will require marking and protection to avoid incidental felling.
36-1-0365 (TS-ST-04)	Direct	Total	Total loss of value: The site falls within the processing plant and Administration Area impact footprint.

Site Number	Type of Harm (Direct/Indirect/None)	Degree of Harm (Total/Partial/None)	Consequence of Harm (Total/Partial/No loss of value)
36-1-0366 (TS-ST-05)	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
36-1-0367 (TS-ST-06)	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
36-1-0368 (TS-ST-07)	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0313 (TS-IF-01)	Direct	Total	Total loss of value: The site falls within the open cut impact footprint.
36-1-0314 (TS-GG-01)	None	None (with monitoring)	No loss of value: This site is currently outside of the impact footprint. Specific management recommendations are applied to this site to ensure that no harm arises from the Proposal.
36-1-0374 (TS-ST-01)	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0372 (TS-ST-02)	Direct	Total	Total loss of value: The site falls within the LRSF impact footprint.
36-1-0357 (TS-OS-01 with PAD)	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0358 (TS-OS-02)	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Specific management recommendations are applied to this site to ensure that no harm arises from the Proposal.
36-1-0361 (TS-GG-02 with PAD)	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0360 (TS-GG-03)	None	None	No loss of value: This site is currently outside of the impact footprint.
36-1-0362 (TS-IF-02)	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
Toongi-Dubbo Rail Line			
No Aboriginal sites have been identified within the fenced corridor of the rail line at the areas checked (the creek crossings), and no previously recorded sites fall within the rail easement.			
Macquarie Water Pipeline			
MM-AS1	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
MM-AS2	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
MM-IF1	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
MM-IF2	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.

Site Number	Type of Harm (Direct/Indirect/None)	Degree of Harm (Total/Partial/None)	Consequence of Harm (Total/Partial/No loss of value)
36-1-0356 (TS-OS-03 with PAD)	Direct	Partial	Partial loss of value: The Macquarie Water pipeline goes through the site.
36-1-0364 (TS-OS-05 with PAD)	Direct	Partial	Partial loss of value: The Macquarie Water pipeline goes through the site.
Obley Road Alignment			
OR-AS1 with PAD	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
OR-ST1	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
36-1-0432 (ORWM-ST1)	None	None	No loss of value: The site is more than 100m from the impact footprint of the Obley Road Alignment and no impacts are expected.
36-1-0433 (ORWM-ST2)	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.
36-1-0120 (H2 with PAD)	Indirect	None (with management)	No loss of value: This site is currently outside of the impact footprint. Potential for indirect impact arising from the Proposal due to the site's close proximity to the proposed works. Specific management recommendations will avoid harm.

6 MANAGEMENT AND MITIGATION: ABORIGINAL HERITAGE

6.1 GENERAL PRINCIPLES FOR THE MANAGEMENT OF ABORIGINAL SITES

Appropriate management of cultural heritage items is primarily determined on the basis of their assessed significance, as well as the likely impacts of the proposed development. **Section 5.7** provides a definition of significance of sites from a cultural, scientific and public-interest perspective, all of which are taken into account in assessing significance. **Section 5.8** provides a description of the assessed significance of each of these aspects for the recorded sites. **Section 5.9** provides a summary of the sites that would be impacted by the Proposal. The following management options are based on general principles, in terms of best practice and desired outcomes. Specific management options for the identified Aboriginal sites based on known site impacts are presented in **Section 6.2**.

The following management options are general principles, in terms of best practice and desired outcomes, rather than measures to mitigate individual site disturbance.

1. Avoid impact by altering the development proposal. A suitable buffer around a site should be established to ensure the site's protection both during the short term construction phase of development and in the long term use of the area. If plans are altered, care must be taken to ensure that sites previously assessed as not impacted, remain so.
2. If impact is unavoidable: An Aboriginal Heritage Impact Permit (AHIP) that are normally required for impacts to Aboriginal heritage under the NPW Act are not necessary as the Proposal is being assessed under Part 4 Division 4.1 of the EP&A Act (State Significant Development). This notwithstanding, the spirit of site protection and management in the face of impacts remains the same. In place of a permit under the NPW Act, a Statement of Commitments (SoC) in terms of heritage management is prepared. This SoC forms the basis for the Minister's approval which would usually contain one or more conditions, including a requirement for the preparation of an *Aboriginal Cultural Heritage Management Plan* (ACHMP), with which the Applicant would be required to operate in accordance with.

The ACHMP will include measures for site conservation, as well as detailing methods for the management of sites to be impacted. The management will depend on many factors including the assessed significance of the sites. Sites of moderate to high significance in any of the categories (cultural, scientific and public-interest) may require salvage excavation, or more detailed recording, as part of the ACHMP. In certain instances, a site may have low archaeological, aesthetic, and historic values but moderate or high cultural value. In these cases, management can be applied that takes this into account.

Sites of low significance may be removed / destroyed with no further archaeological assessment being required, or with an approved salvage / monitoring programme. The local Aboriginal communities may wish to collect or relocate artefacts, whether temporarily or permanently, and such issues are also required to be covered in the ACHMP. The ACHMP is to be developed in consultation between the Applicant and the RAPs.

The recommended management specific to each site is detailed in **Section 6.3**.

6.2 GENERAL PRINCIPLES (AVOID, MINIMISE, MITIGATE)

Recognising the relatively large impact footprint of the Proposal, the Applicant has followed the principles of 'avoid, minimise, mitigate' to reduce the impact of the Proposal on local heritage values. The following provides a summary of the approach taken. A biodiversity offset area of 1021ha will also be set up as a mitigation strategy through a *Conservation Property Vegetation Plan* registered on title under the Native Vegetation Act 2003.

Avoid Impact

The site of the proposed processing operations and related infrastructure has been located over land which has been regularly cultivated over many years. The areas targeted for the positioning of disturbance associated with the management of waste materials and residues generated by the mining and processing operations considered local environmental considerations and heritage values with efforts made to exclude the following areas.

- The remnant vegetation of Dowds Hill.
- Larger and intact remnants of native woodland vegetation.
- Major drainage lines.
- Higher quality agricultural land.

In developing the initial impact footprint, the Applicant noted the locations of previously-identified Aboriginal sites and attempted to avoid these where practical. Nine sites including 36-1-0358, 36-1-0362, 36-1-0374, 36-1-0372, 36-1-0360, 36-1-0357, 36-1-0357, 36-1-0361 and 36-1-0314 were specifically identified and the relevant impact area modified as required to avoid.

The survey of the initially-designed impact footprint yielded a number of new sites, including those of historic heritage. Following considerations of these sites and environmental factors, sixteen of the newly-recorded sites were excluded in the re-design of the impact footprint including UG-AS2, UG-AS3, UG-AS4, UG-ST2, UG-IF2, UG-IF3, UG-IF4, UG-IF5, UG-IF6, UG-IF7, K-OP1, K-IF1, PAD 12, MM-AS1, MM-AS2, and OR-AS1. Furthermore, the re-design also avoided previously-recorded sites 36-1-0120 and 36-1-0433.

The following efforts to minimise and mitigate the impacts are largely pertinent to environmental considerations. However, the commitments made to offsetting environmental impacts guarantee the long-term conservation of those heritage sites that fall within the biodiversity offset area. Furthermore, in designing environmental impact minimisation and mitigation, the locations of Aboriginal heritage sites were taken into account.

It should also be recognised that Aboriginal heritage values are strongly linked to the natural environment. Not only does a largely-unmodified landscape provide a setting that enhances the value of a site, but it has value in itself to Aboriginal heritage.

Minimise Impact

Noting the largest area of impact would be associated with the Liquid Residue Storage Facility (LRSF), the Applicant has, at significant cost, continued to modify the processing operations to improve water efficiency. Through this process optimisation, the water required has been reduced by approximately 20%, in turn reducing the area required for the LRSF.

When determining which of the LRSF Areas to exclude from the disturbance footprint, the occurrence of heritage sites was considered. The density of Aboriginal sites on the "Ugothery" property where LRSF Area 7 was originally located is far higher than on those sections of the "Grandale", "Ugothery" and "Toongi Valley" properties on which LRSF Areas 4 and 5 are located. As such, greater heritage benefit was derived from excluding LRSF Area 7.

Mitigate Impacts

Noting that some impact on heritage sites is unavoidable should the Proposal be approved in its present form, the Applicant aims to mitigate this impact by:

- undertaking appropriate archival recording of Aboriginal cultural heritage sites prior to disturbance; and

- updating OEH AHIMS with the results of this assessment and any subsequent changes to sites within the Study Area.
- Sites within the Biodiversity Offset Area will generally have better protection than they currently have. Not only will they no longer be subject to agricultural impacts, land management practises will attempt to limit the erosion which currently affects sites.
- The DZP mine will generate employment opportunities in the Dubbo area. The Applicant has a history of high employment rates from local areas in nearby mines, for example the Peak Hill Gold Mine and Tomingley Gold Operations.

6.3 MANAGEMENT AND MITIGATION OF RECORDED ABORIGINAL SITES

Within the parameters of the proposed works, complete avoidance of all sites recorded within the Study Area is unlikely given that the sites lie within the limits of the proposed impact zones. However, it is generally recommended that changes be made to the proposed works as far as possible so as to avoid archaeological sites. It is acknowledged that the design of the impact footprint has been altered substantially since the inception of the project, and this has resulted in the exclusion of many sites from the proposed impact footprint.

Where recommendations for the management of these sites indicate that salvage or monitoring is necessary, these mitigations need to be expressed in the SoC, which should be prepared in consultation with the RAPs. This must be completed prior to the commencement of any archaeological monitoring or salvage activity and before there can be any impact by the proposed works.

As documented in **Section 5.9**, 14 sites are completely or partially within the proposed impact footprint. Impacts associated with the Proposal must be considered as permanent. The recommendation for management of these sites falls under three management recommendation groups (**Table 13**).

Group 1: Avoidance.

26 sites are outside the current impact footprint and are at no direct risk of harm from the Proposal.

Sites to be avoided should be clearly marked on mine plans and the areas avoided by all activities associated with the construction and operation of the mine and related infrastructure. These sites are to be taken into consideration in further land use/management practises such as agriculture and biodiversity offset.

Group 2: Sites requiring management

This category includes sites directly within or adjacent to the impact footprint where cultural material was identified but where sub-surface archaeological deposits are considered unlikely.

Group 2a: Surface collection of artefacts

Detailed recording and collection of surface artefacts would be the primary management approach for sites in this category. All but one site in this group (UG-AS1) have been assigned a low scientific value and only limited further investigation is considered necessary. Nine sites fall into this group: UG-AS1, GI-AS1, GI-AS2, PH-IF1, TV-AS1, TV-IF1, and 36-1-0313. The former Group 3 sites, 36-1-0356 and 36-1-0364, will now be managed as Group 2a sites as the test excavation program demonstrated that these sites are surface manifestations only and that further sub-surface salvage is not warranted.

In the cases where sites partially overlap with the impact footprint, surface collection should be confined to the impact footprint with a five metre buffer. The remainder of the site should be fenced off during construction to avoid incidental impacts. UG-AS1 is the exception to this, as it

is almost entirely within the impact footprint and the section of the site not directly in the impact area will be nearby to the impacts for the life of the proposal. There would be little value in fencing off and conserving the small section of the site outside of the impact footprint and so total salvage is recommended.

RAP Consultation

Following discussions with the RAPs in an AFGM, it was determined that the collected surface artefacts be transferred to the custody of the RAPs via a Care Agreement. This agreement is to be drafted and included in a forthcoming ACHMP. Potential management options were discussed such as reburial, holding the artefacts in a keeping place for educational purposes, reserving some artefacts for public display, or a combination of any of these options. The formalisation of this management is an ongoing requirement of the project.

Group 2b: Relocation of cultural heritage items

As the proposed works will impact five Aboriginal scarred trees (UG-ST1, TS-ST-04 [36-1-0365], TS-ST-05 [36-1-0366], TS-ST-06 [36-1-0367] and TS-ST-02 [36-1-0372]), the Applicant has commenced consultation with the RAPs to determine the best management and fate of these the scarred portions of these trees. All scars are deemed to be of low scientific significance and the preservation of the scarred trunk portions is not an archaeological recommendation. This is due to the low level of archaeological/scientific significance of these scarred trees on the basis that they are not outstanding examples of this site type and in many cases are doubtful in origin.

RAP Consultation

It is the desire of the RAPs that the scar-bearing portions of the scarred trees to be impacted be removed and transferred to their custody via a Care Agreement. Further management is to be formalised and included in a forthcoming ACHMP. Potential management options discussed include storing the scars in a keeping place such as in a shelter in the Biodiversity Offset Area and/or public display of selected scars, perhaps involving plaster casting.

Should the Applicant wish to agree to this path of management, the details are to be formalised in conjunction with the RAPs through the ACHMP development. In the case of only select scars being salvaged and / or displayed, it is recommended that site 36-1-0366 (TS-ST-05) be utilised as the best example from an archaeological perspective. It should also be noted that 36-1-0372 (TS-ST-02) was deemed unlikely to be cultural in origin by the team of archaeologists and RAP representatives during OzArk's reassessment of this previously recorded scarred tree.

Group 3: Avoidance with management

Eleven sites are located adjacent to component disturbance areas and face possible indirect impacts. These specific sites (TS-ST-03 [36-1-0373], TS-IF2 [36-1-0362], TSA-OS-02 [36-1-0358], MM-AS1, MM-AS2, MM-IF1, MM-IF2, OR AS1 with PAD, OR-ST1, ORWM-ST2 [36-1-0433] and H2 with PAD [36-1-0120]) should be managed separately by:

- Sites should be revisited by a suitably qualified archaeologist before construction and the sites located so that their extent can be temporarily fenced
- DZP personnel should be alerted to their location and the location of the sites should be shown on mine plans;
- Work crews in the vicinity of any of these sites should be informed by way of an induction as to the site's location and its legislative protection under the NPW Act. All work crews should be informed that the fenced area remains a no-go area for the duration of the works; and

- If at the time of construction it becomes obvious that a site in this category will be harmed by the proposed works, the site should be managed as a Group 3 site (in all likelihood, given their low scientific significance, as Group 3a sites). Specific management recommendations for the site could be formulated following the site visit by a suitably qualified archaeologist (point 'a' above).

Group 2d: Avoidance with monitoring

One site (TS-GG-01; 36-1-0314) could suffer over time from modification of the drainage coming from the proposed Open Cut. Once the eastern half of the Open Cut has begun, a condition assessment schedule is recommended to ensure that the site is not being harmed.

Group 3: Sites requiring further investigation

Two sites once fell into this group: 36-1-0356 with PAD and 36-1-0364 with PAD. These sites have been moved to Group 2a following the results of the test excavation that took place at each site. These sites are mentioned here to indicate their previous management category.

No sites are now assigned to Group 3 as this group is now redundant following the completion of test excavation.

Table 13 provides an overview of the appropriate management for each site. **Section 7** details recommendations for next steps, based on these management options.

Table 13: Aboriginal Site Management Recommendations

AHIMS Site ID	Site Name	PAD	Management Group	Recommended Management
DZP Site				
	UG-AS1	No	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefacts is recommended.
	UG-AS2	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-AS3	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-AS4	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-ST1	No	2b	Salvage: This site is to be harmed by the Proposal. Detailed recording and consultation with Aboriginal community about possible relocation and storage of the tree is recommended.
	UG-ST2	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF2	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF3	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF4	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF5	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.

AHIMS Site ID	Site Name	PAD	Management Group	Recommended Management
				from mine-related works.
	UG-IF6	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	UG-IF7	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	K-AS1 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	K-AS2 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	K-IF1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	K-OP1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	PAD 12	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	GI-AS1	No	2a	Salvage: This site is within the impact footprint of the open cut by 50m. Detailed recording and collection of artefacts is recommended.
	GI-AS2	No	2a	Salvage: This site is within the impact footprint of the open cut by over 50m. Detailed recording and collection of artefacts is recommended.
	PH-IF1	No	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefact is recommended.
	TV-AS1	No	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefacts is recommended.
	TV-AS2 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	TV-AS3 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	TV-IF1	No	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefact is recommended.
	G-AS1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
	G-IF1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0373	TS-ST-03	No	2c	Avoidance/Management:: This site is 25m outside the impact footprint. However, the site should be marked to avoid inadvertent impacts.
36-1-0365	TS-ST-04	No	2b	Salvage: This site is to be harmed by the Proposal. Detailed recording and consultation with Aboriginal community about possible relocation and storage of the tree is recommended.
36-1-0366	TS-ST-05	No	2b	Salvage: This site is to be harmed by the Proposal. Detailed recording and consultation with Aboriginal community about possible relocation and storage of the tree is recommended.
36-1-0367	TS-ST-06	No	2b	Salvage: This site is to be harmed by the Proposal. Detailed recording and consultation with Aboriginal community about possible relocation and storage of the tree is recommended.

AHIMS Site ID	Site Name	PAD	Management Group	Recommended Management
36-1-0368	TS-ST-07	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0313	TS-IF-01	No	2a	Salvage: This site is within the impact footprint of the open cut by 15m. Detailed recording and collection of the artefact is recommended.
36-1-0314	TS-GG-01	PAD	2d	Avoidance/Inspect: This site is outside the impact footprint, but could suffer over time from modification of the drainage coming from the proposed Open Cut. Once the eastern half of the Open Cut has begun a condition assessment schedule is recommended to ensure that the site is not being harmed.
36-1-0374	TS-ST-01	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0372	TS-ST-02	No	2b	Salvage: This site is to be harmed by the Proposal. Detailed recording and consultation with Aboriginal community about possible relocation and storage of the tree is recommended.
36-1-0357	TS-OS-01 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0358	TS-OS-02	No	2c	Avoidance/Management: This site is outside the impact footprint of the open cut by only 15m. It is recommended that the location be marked to avoid inadvertent impacts to the site. If avoidance is not possible then salvage is recommended (Management Group 2a).
36-1-0361	TS-GG-02 with PAD	PAD	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0360	TS-GG-03	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0362	TS-IF-02	No	2c	Avoidance/Management: This site is outside the impact footprint of the open cut by only 30m. It is recommended that the location be marked to avoid inadvertent impacts to the site. If avoidance is not possible then salvage is recommended (Management Group 2a).
Toongi - Dubbo Rail Line and Gas Pipeline Corridor				
No Aboriginal sites have been identified within the fenced corridor of the rail line at the areas checked (the creek crossings), and no previously recorded sites fall within the rail easement.				
Macquarie River Water Pipeline				
	MM-AS1	No	2c	Avoidance/Management: this site is located nearby to the Macquarie Water Pipeline, but will not be impacted by the pipeline. However, the site should be marked to avoid inadvertent impacts.
	MM-AS2	No	2c	Avoidance/Management: this site is located within 20m of the Macquarie Water Pipeline, but will not be impacted by the pipeline. However, the site should be marked to avoid inadvertent impacts.
	MM-IF1	No	2c	Avoidance/Management: this site is located within 20m of the Macquarie Water Pipeline, but will not be impacted by the pipeline. However, the site should be marked to avoid inadvertent impacts.
	MM-IF2	No	2c	Avoidance/Management: this site is located within 30m of the Macquarie Water Pipeline, but will not be impacted by the pipeline. However, the site should be marked to avoid inadvertent impacts.
36-1-0356	TS-OS-03 with PAD	PAD	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefacts within the pipeline corridor is recommended. Fencing along pipeline corridor where it intersects with the site is recommended.
36-1-0364	TS-OS-05 with PAD	PAD	2a	Salvage: This site is to be harmed by the Proposal. Detailed recording and collection of artefacts within the pipeline corridor is recommended. Fencing along pipeline corridor where it intersects with the site is recommended.

AHIMS Site ID	Site Name	PAD	Management Group	Recommended Management
Obley Road Alignment				
	OR-AS1 with PAD	PAD	2c	Avoidance/Management: This site falls near the proposed Obley Road Alignment, but may be avoidable, in which case it should be marked off to avoid inadvertent impacts. If it is not avoidable limited test excavation (management option 3) within the impact footprint is recommended to determine the significance of the site.
	OR-ST1	No	2c	Avoidance/Management: The site should be marked off to avoid inadvertent impacts as it falls close to the impact footprint for the Obley Road Alignment.
36-1-0432	ORWM-ST1	No	1	Avoidance: This site is outside the impact footprints for the Proposal. Site should be marked on mine plans to prevent accidental impact from mine-related works.
36-1-0433	ORWM-ST2	No	2c	Avoidance/Management: The site should be marked off to avoid inadvertent impacts as it falls close to the impact footprint for the Obley Road Alignment.
36-1-0120	H2 with PAD	PAD	2c	Avoidance/Management: This site falls near the proposed Obley Road Alignment, but may be avoidable, in which case it should be marked off to avoid inadvertent impacts. If it is not avoidable limited test excavation (management Group 3) within the impact footprint is recommended to determine the significance of the site.

6.3.1 Management Discussion

There has been general accordance between the management proposed by OzArk and the views of RAPs on management. However, it should be noted that the desired management measures expressed by the RAPs for the scarred trees to be impacted is perhaps beyond what would be expected given the sites' archaeological significance as assessed in this report.

There has been some level of doubt applied to the origin of the scars by Nolan (2002) and/or OzArk (this report). Of the scars, 36-1-0366 is most likely to have a cultural origin. Should the Applicant and RAPs agree to salvage an example of the site type, 36-1-0366 would be the preferred scar to salvage. However, it is recognised that the RAPs have assigned value to all scars and that it is their wish to salvage all five sites.

While not an archaeological requirement, the Applicant should discuss management options with the RAPs prior to the removal of the scars. In order to justify such an action, RAPs would need to be able to ensure the long-term curation and preservation of the scar-bearing portion of the tree. Alternatively, should no suitable permanent site be available, the Applicant and RAPs could discuss a suitable place within the Project Area for the scar-bearing portions of the trees to be placed so that they are preserved, at least in the short-term. If this option were followed, a simple shelter and supports to keep the tree off the ground away from termites and under shelter would aid the preservation of the scar-bearing portion of the trees.

6.4 RELEVANT LEGISLATION

Cultural heritage is managed by a number of NSW and Commonwealth Acts. Baseline principles for the conservation of heritage places and relics can be found in the Burra Charter¹⁴, which recognises that there are places worth keeping because they can enrich our

¹⁴ The Burra Charter defines the basic principles and procedures to be followed in the conservation of all kinds of places such as monuments, buildings, Aboriginal sites, roads, archaeological sites, whole districts or even regions. It was first adopted in 1979, based on the Australian ICOMOS (International Council on Monuments and Sites) review (1977) of the 1966 Venice Charter (Australian ICOMOS Inc. 1998).

lives on many levels. The significance of such places may be embodied in fabric (physical material), environmental setting, contents, use or meaning to people, and should be assessed through methodical data collection. Since its adoption in 1979, The Burra Charter has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The Burra Charter generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a State level.

A number of Acts of parliament provide for the protection of Aboriginal heritage at various levels of government¹⁵. The three most important statutes in New South Wales are the:

- *Environmental Planning and Assessment Act 1979* (EP&A Act), amended by the *Environmental Planning and Assessment Amendment (Infrastructure and Other Planning Reform) Act 2005* (EP&AA Act).
- *National Parks and Wildlife Act 1974* (NPW Act).
- *Heritage Act 1977* (Heritage Act)

While at Commonwealth level, the following statute is relevant:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) amended by the *Environment and Heritage Legislation Amendment Act (no. 1) 2003*.

6.4.1 NSW legislation

6.4.1.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act established requirements relating to land use and planning. The main areas controlled by the Act pertaining to heritage are:

- Part 4: local government development assessments, including heritage. May include schedules of heritage items.
 - Division 4.1: approvals process for State Significant Development (not infrastructure related).
- Part 5: environmental impact assessment requirements (for those developments not requiring consent under Part 4). State owned heritage items listed on LEPs are governed by Part 5.
 - Division 5.1: approvals process for State Significant Development (infrastructure related).

6.4.1.2 National Parks and Wildlife Act 1974 (NPW Act)

Amended during 2010, the NPW Act provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the Act (S.5), an Aboriginal object is defined as: any deposit, object or material evidence (not being a handicraft for sale) relating to Aboriginal and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

¹⁵ NSW Heritage Office 1998: *Living with Aboriginal Culture*, p. 3.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

As of 1 October 2010, it is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the Act provides a series of defences against the offences listed in Section 86:

- The harm was authorised by and conducted in accordance with the requirements of an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the Act.
- The defendant exercised 'due diligence' to determine whether the action would harm an Aboriginal object.
- The harm to the Aboriginal object occurred during the undertaking of a 'low impact activity' (as defined in the regulations).

Under Section 89A of the Act, it is a requirement to notify the OEH Director-General of the location of an Aboriginal object. Identified Aboriginal items and sites are registered with the OEH on AHIMS.

6.4.2 Commonwealth Legislation

6.4.2.1 Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Amendments in 2003 established the National Heritage List and the Commonwealth Heritage List, both administered by Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC). Ministerial approval is required for proposals involving significant impacts to National/Commonwealth heritage places.

6.4.3 Applicability to the Application Area

The following provides a summary of the applicability of the legislation identified in the preceding sections.

- There are no Aboriginal items listed on the National or Commonwealth heritage registers (see **Table 1**) within the Study Area. Therefore the EPBC Act is not applicable.
- The Proposal is being assessed under Part 4.1 of the EP&A Act.
- The Aboriginal sites recorded here have legislative protection under the NPW Act.

7 RECOMMENDATIONS

The following recommendations are made on the basis of:

- NPW Act whereby it is illegal to harm or desecrate an Aboriginal object or place without the prior written consent of the Director of the OEH;
- The findings of the current investigations undertaken within the Application Area; and
- The interests of the RAPs identified for this Proposal.
- EP&A Act Part 4 Division 4.1, for assessment of State Significant Development.

Details of the management measures recommended for each site are given in **Section 6.3** and **Table 13**. In general, on the basis of the findings of the current assessment it is concluded that management of the identified sites should be as follows.

- Management Group 1: 26 sites (including one PAD) are currently located outside of the impact footprint. For these sites and for any additional sites where avoidance of harm be the chosen management, the following is recommended:
 - Inductions should be provided to workers as to the location and legislative protection of these sites. These inductions should be documented.
 - Appropriate measures should be in place to protect the site such as marking sure that all future activities avoid impacts to a site's location.
- Management Group 2a: Nine sites are currently under threat of harm from the proposed impacts that were assessed as being unlikely to yield further significant data about Aboriginal heritage. As these sites were determined to hold low scientific/archaeological values, the management recommendations are as follows.
 - An *Aboriginal Cultural Heritage Management Plan* (ACHMP), including a Statement of Commitments (SoC), documenting how each site is to be managed should be prepared following consultation undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs).
 - The ACHMP and SoC should include measures for the collection / salvage of surface artefacts from sites prior to works commencing.
 - A Care Agreement covering any artefacts from the salvage would be included in the ACHMP.
- Management Group 2b: Five sites (all culturally modified trees) are currently under threat of harm from the proposed impacts. Specific management of these sites include are as follows.
 - There are no archaeological deposits associated with these sites so further archaeological investigation is not warranted.
 - The scars should be recorded to archival quality prior to removal.
 - Salvage of these sites is not an archaeological recommendation, however it is the desire of the RAPs to retain the scar-bearing portions of the trunks. Should the Applicant and RAPs agree to salvage one or more of the scar-bearing portions of the trees, the methodology and Care Agreement would form part of the ACHMP.
- Management Group 2c: Eleven (11) sites are located closely adjacent to the proposed impact footprint and specific recommendations are applied to them to ensure that these sites are not impacted by the proposed works (**Section 6.2**).

- Management Group 2d: One site is located outside the proposed impact footprint but there remains the potential that the site could be indirectly impacted. Specific recommendations are applied to this site to ensure that these sites are not impacted by the proposed works (**Section 6.2**).
- Management Group 3: This group is now redundant (as test excavation is now complete) and no further sites are subject to Group 3 management.
- Proposed works should remain limited to the Application Area as assessed in the current report so as to eliminate the chance of encountering Aboriginal objects in unassessed areas.
- Should any other objects or Aboriginal sites be identified during the course of construction *The Unanticipated Finds Protocol* in **Appendix 5** should be followed.
- As this Proposal falls under Part 4 Division 4.1 of the EP&A Act, an AHIP is not required for the salvage of heritage sites if development consent is issued. Rather, approval for the undertakings should be sought through a Statement of Commitments and eventually incorporated into an *Aboriginal Cultural Heritage Management Plan*.
- One copy of this report should be sent to:
 - Binjang Wellington Wiradjuri Heritage Survey
 - Dubbo Local Aboriginal Land Council
 - Diane Stewart
 - Wirrimbah Direct Descendants
- Two copies of this report should be sent to:
 - Office of Environment and Heritage, AHIMS Registrar, Attention: Cheryl Brown, PO Box 1967, Hurstville, NSW, 1481.

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PLATES

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Plate 1: Typical view of survey unit UG-2 from a hill crest.



Plate 2: K-7 Survey Unit overview



Plate 3: W-2 Survey Unit overview



Plate 4: GI Survey Unit overview



Plate 5: PH-5 Survey Unit overview



Plate 6: TV-1 Survey Unit overview



Plate 7: Southeast-facing view of survey unit G-8 along a strip of ploughing



Plate 8: Dundullimal RB Survey Unit overview, west side of Macquarie River



Plate 9: Hyandra RB Survey Unit overview, north side of creek



Plate 10: MM-2 Survey Unit overview



Plate 11: TV-H2O Survey Unit overview



Plate 12: OR-1 Survey Unit overview

