

Sydney Zoo Bungarribee Precinct

Aboriginal Archaeological Survey
Report

Report to Sydney Zoo

December 2015



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EXECUTIVE SUMMARY

Sydney Zoo is seeking approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction of a zoo (Sydney Zoo) within the Bungarribee Precinct in the Western Sydney Parklands.

The project was declared to be State Significant Development (SSD). Assessment and approval is being pursued in accordance with the EP&A Act. The Secretary's Environmental Assessment Requirements (SEARs) for the project have been issued and set out the environmental assessment requirements for the project.

In accordance with the SEARs Artefact Heritage has conducted an Aboriginal heritage assessment in order to document and assess Aboriginal cultural heritage and any impacts within the study area. This assessment was conducted in accordance with the Office of Environment and Heritage (OEH) 'Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales' (2010), the Department of Environment and Conservation (now OEH) *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005) and *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).

Overview of findings

- Three previously recorded Aboriginal sites are located within the study area (AHIMS sites # 45-5-0455, #45-5-0465 and # 45-5-4433). These sites were assessed as demonstrating low archaeological significance.
- Two areas of Potential Archaeological Deposit (PAD) were identified during the study (SZ PAD1 and SZ PAD2).
- Disturbance was generally assessed to be low with the exception of the modified drainage channel and pipeline located in eastern and western portion of the study area respectively.

Recommendations

It is therefore recommended that:

- No further archaeological investigation of AHIMS sites 45-5-0455, 45-5-0465 and 45-5-4433 is recommended.
- As the likely archaeological significance of SZ PAD1 has been determined based on archaeological salvage excavation in a comparable landform at Bungarribee North, archaeological test excavation in that portion of SZ PAD1 that will be impacted is not required.
- Archaeological test excavation in accordance with the OEH code of practice as best practice is recommended at SZ PAD2 to determine the extent and archaeological significance of PAD in that area.
- Following completion of archaeological test excavation at SZ PAD2, a report would be prepared that outlines the findings of the investigation and assesses the archaeological significance of the PAD.

- Following the completion of archaeological test excavation and reporting at SZ PAD2, an Aboriginal Cultural Heritage Assessment Report (ACHAR) would be prepared for the study area that includes the results of consultation with registered Aboriginal stakeholders, an assessment of cultural significance, a final impact assessment and management measures for the proposal.
- The ACHAR would include an outline of what mitigation and management measures would be required within that portion of SZ PAD1 impacted by the extension of the car park into that area.
- If changes are made to the proposed works which may impact any area not investigated in this ASR, further archaeological investigation may be required.

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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

Sydney Zoo is seeking approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction of a zoo (Sydney Zoo) within the Bungarribee Precinct in the Western Sydney Parklands.

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In accordance with the SEARs Artefact Heritage has conducted an Aboriginal heritage assessment in order to document and assess Aboriginal cultural heritage and any impacts within the study area. This assessment was conducted in accordance with the Office of Environment and Heritage (OEH) 'Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales' (2010), the Department of Environment and Conservation (now OEH) 'Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation' (2005) and 'Aboriginal Cultural Heritage Consultation Requirements for Proponents' (2010).

1.2 The Study Area

The study area is located in the southern portion of Lot 101/ DP1195067 within the Blacktown City Local Government Area (LGA). It is bounded by Eastern Creek to the west, Doonside Road to the east and the Great Western Highway to the south (Figure 1). The study area is 16.5 hectares.

1.3 The proposal

The proposal includes the development of the land within the study area into a world class zoo exhibiting a wide range of popular animal species. The facility will provide an immersive safari-like experience including open grassland areas, elevated walkways and boardwalks, reptile and nocturnal animal houses, aquarium and infrastructure to service 30+ exhibits. Education and conservation programs planned for the Zoo are intended to provide a focus on local heritage values including natural and Aboriginal heritage.

The proposed development of Sydney Zoo will include.

- Animal exhibits across several enclosures of varying design for a range of native and exotic animals.
- Back-of-house buildings for exhibits.
- Main entrance building comprising entry/exit, and gift shop.
- Restaurant and café.
- Kiosks and amenities.
- Show arena.
- Picnic areas and gardens.
- Wetlands and waterways.
- Service building containing:
 - Administration areas;
 - Curatorial and food preparation areas; and
 - Veterinarian space.

- Service yard with maintenance shelter.
- Main formal carpark on asphalt 387 vehicles, overflow on asphalt road 88 vehicles (total on asphalt 475 vehicles), overflow on gravel 800 vehicles, disabled spots 9 vehicles, total parking 1284 vehicles. Access via an internal road connecting to the Great Western Highway.
- Bus parking.

Construction of the project is expected to take approximately 8 – 12 months to complete.

Figure 1: Location of the study area

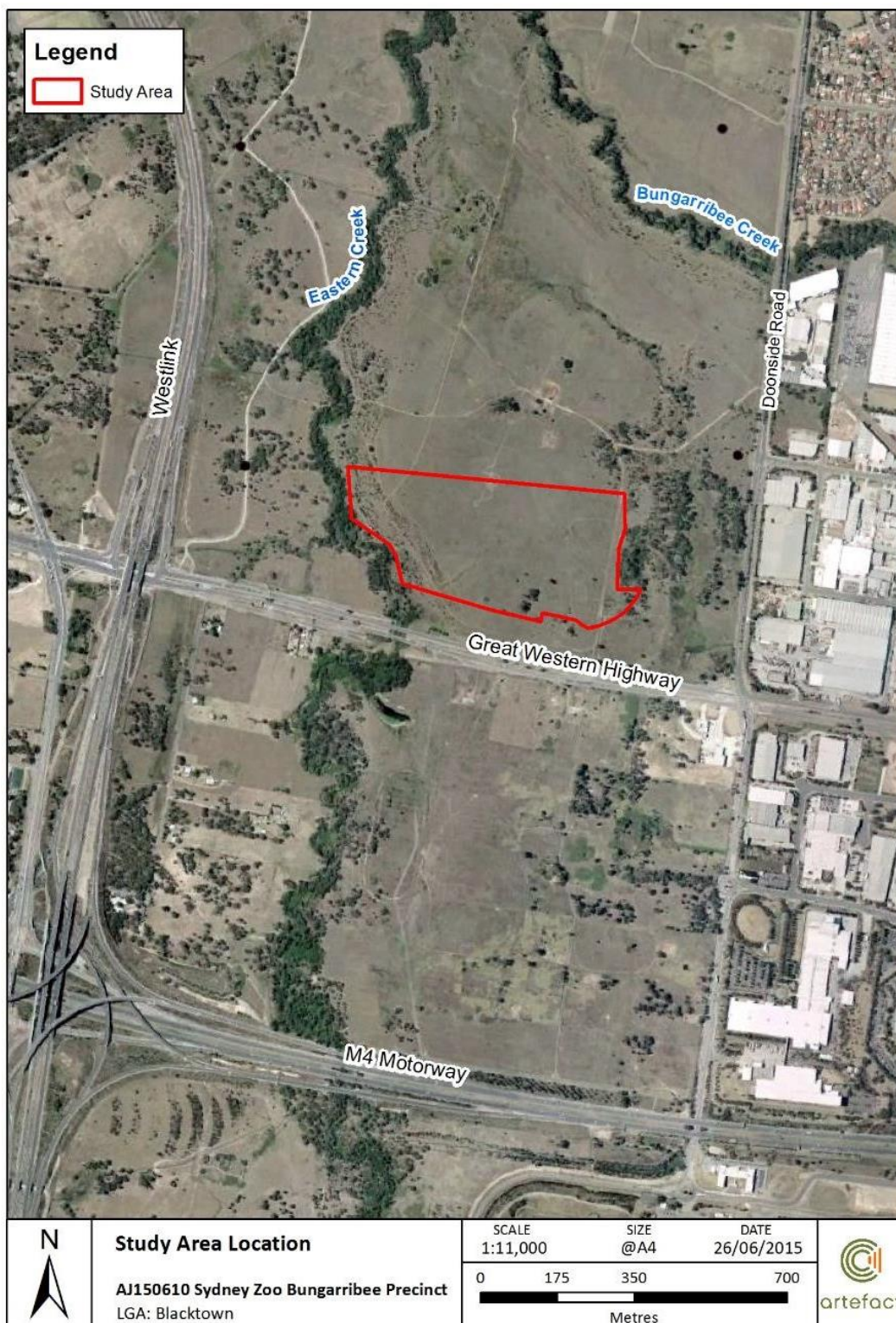


Figure 2: Proposed Sydney Zoo layout



1.4 Objectives of Assessment

The objective of the assessment is to meet the requirements of the Secretary's Environmental Assessment Requirements (SEARs). In accordance with the SEARs Artefact Heritage has conducted an Aboriginal Cultural Assessment in order to document and assess both Aboriginal cultural heritage and any impacts within the study area. This assessment was conducted in accordance with the Office of Environment and Heritage (OEH) 'Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales' (2010), the Department of Environment and Conservation (now OEH) 'Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation' (2005) and 'Aboriginal Cultural Heritage Consultation Requirements for Proponents' (2010). The main objectives of this study include providing:

- A description of the proposal and the extent of the study area.
- Discussion of the environmental context of the study area.
- Discussion of the Aboriginal and historical context of the study area.
- A summary of the archaeological context of the study area including a discussion of previous archaeological work in the area.
- Development of an archaeological predictive model.
- Registration of Aboriginal stakeholders.
- Results of the archaeological survey.
- Description and analysis of the identified Aboriginal sites within the study area.
- Development of a significance and impact assessment of the identified Aboriginal site, addressing archaeological values.
- Development of management and mitigation measures.
- Recommendations relating to the further mitigation of potential impacts to the identified site.

1.5 Investigator and Contributions

Artefact Heritage archaeologists Josh Symons and Claire Rayner conducted this assessment. Claire Rayner and Alyce Haast prepared this report with management input from Doctor Sandra Wallace, Principal Archaeologist at Artefact Heritage.

2.0 ABORIGINAL COMMUNITY INVOLVEMENT

Comprehensive Aboriginal stakeholder consultation for the proposal has been conducted by Artefact Heritage on behalf of Sydney Zoo (the proponent). As a SSD project under Part 4 Division 4.1 of the EPA Act, consultation has been conducted in accordance with the Department of Environment and Conservation (now OEH) *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005). The OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) have been used as best practice guidelines for the stakeholder registration process.

In accordance with Step 4.1.2 of the consultation requirements Artefact contacted the following organisations to request the names of Aboriginal people who may hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places within the Bungarribee Precinct:

- Aboriginal heritage department of the Metropolitan OEH
- Deerubbin Local Aboriginal Land Council (DLALC)
- The Registrar, *Aboriginal Land Rights Act 1983*
- National Native Title Tribunal
- NTSCORP
- Blacktown City Council
- Greater Sydney Catchment Management Authority

In accordance with Step 4.1.3 of the consultation requirements, an advertisement was placed in the Blacktown Sun on 30 June 2015. The advertisement invited all Aboriginal persons and organisations who hold cultural knowledge relevant to determining the significance of Aboriginal objects and places in the subject land to register their interest by 5 August 2015.

In accordance with Step 4.1.3 of the consultation requirements, letters were sent to all Aboriginal persons or organisations identified through responses from agencies contacted as part of Step 4.1.2. The letters provided details about the location and nature of the proposal, as well as an invitation to register as an Aboriginal stakeholder.

Following the completion of steps 4.1.2 and 4.1.3 forty-five Aboriginal stakeholders registered as persons or organisations that may hold cultural knowledge relevant to determining the Aboriginal cultural values of the study area. The registered Aboriginal stakeholders included:

- Darug Land Observations (DLO)
- Darug Consultants and Archaeological Assessments (DCAA)
- Walbunja
- Badu CHTS
- Dharug
- Eora
- Gangangarra
- Ngarigo
- Nundagurri
- Walgalu
- Wandandian

- Yerramurra
- Murrin
- Djiringanji
- Thauaira
- Ngunawal
- Kuringgai
- Bidawal
- Tharawal
- Elouera
- Darug Custodian Aboriginal Corporation (DCAC)
- Goobah Developments
- Wullung
- Murramarang
- Biamanga
- Gulaga
- Murrumbul
- Cullendulla
- Munyanga
- HSB Consultants
- AAS/ Rane Consultants
- Wingikara CHTS
- Bilinga CHTS
- Gunjeewong Cultural Heritage Aboriginal Corporation
- Daraug Aboriginal Cultural Heritage Assessments (DACHA)
- Murri Bidgee Mullangari Aboriginal Corporation
- Gulla Gunar Elders
- Golangaya Elders
- Cuwur Murre
- Bulling Gang
- Walbunja Elders
- Merrigarn Indigenous Corporation
- Corroboree Aboriginal Corporation
- Wurrumay Consultants
- Kawal Cultural Services

An archaeological survey of the Sydney Zoo - Bungarribee Precinct was conducted on the 3rd of August 2015. Steve Randall, a Representative of Deerubbin Local Aboriginal Land Council (DLALC) participated in the survey. Comments received from DLALC following the survey indicated that although no Aboriginal objects were identified during the survey, that DLALC recommends further investigation due to the fact that previous archaeological investigation in the surrounding area led to several Aboriginal sites being identified. The DLALC report is attached with this report as Appendix A.

3.0 ENVIRONMENTAL CONTEXT

3.1 Geology

The underlying geology of the study area consists of late Triassic period shale deposits across the gently sloping raised terrain bordering Quaternary period alluvial deposits associated with Eastern Creek. The underlying Bringelly Shale deposit across the raised land in the eastern portion of the study area generally consists of shale, claystone, laminate, lithic sandstone, rare coal and tuff (Clark and Jones 1991). The Quaternary alluvium associated with the lower terrain bordering Eastern Creek generally consists of fine-grained sand, silt and clay (Clark and Jones 1991).

3.2 Soils

Overlying soils consist of residual soils developed in situ across the raised portions of the study area associated with the underlying Bringelly Shale. The residual soils, called the Blacktown soil landscape, generally consist of shallow duplex soils over a clay base. Overlying fluvial soils were associated with the alluvium across the low-lying terrain bordering Eastern Creek. The fluvial soils, called the South Creek soil landscape, are likely to be subject to frequent flood events.

A significant feature of the regional geological landscape includes a significant source of silcrete at Plumpton Ridge, approximately six kilometres northwest of the study area. Silcrete, a raw material used by Aboriginal people across Sydney Basin, was extracted from underlying Tertiary period geology called the St Marys formation. The silcrete raw material source at Plumpton Ridge was an important and extensively used quarry where extraction and tool manufacture activities took place (JMcd CHM 2006a).

3.3 Hydrology

The study area is located across slope and flat landforms bordering Eastern Creek. The southern half of the study area is located across slopes associated with undulating terrain in the southeastern corner of Bungaribee Precinct.

Eastern Creek is a major watercourse across the Cumberland Plain that flows north into South Creek in the Marsden Park area. Bungaribee Creek, to the north of the study area, is a second order watercourse that flows northwest from the Prospect area into Eastern Creek.

3.4 Natural Resources

The study area would once have been covered by open Cumberland Plain Woodland, which is typical of the Wianamatta Group shale geology. Tree species would have included Forest Red Gum (*E. tereticornis*), and Grey Box (*E. moluccana*) (Benson and Howell 1990).

Aboriginal people were highly mobile hunter-gatherers utilising different landform units and resource zones. Different resources may have been available seasonally, necessitating movement or trade (Attenbrow 2010: 78). Aboriginal people hunted kangaroo and wallaby and snared possums for food and skins. In marine or estuarine environments Aboriginal people caught fish and collected shellfish. There are many accounts by Europeans of Aboriginal people in canoes on rivers and the ocean, fishing and cooking the fish on small fires within the vessels (e.g. Collins 1798).

Plants were an important source of nutrition, common edible species being *Macrozamia*, a cycad palm with poisonous seeds that were detoxified and ground into a paste and *Xanthorrhoea*, or grass tree. The grass tree nectar was a high-energy food, the resin strong hafting glue, and the flower

spikes used for spear barbs. From observations by early European colonists, only about twenty species of plant are identified as being used for food or manufacture by Aboriginal people of the Sydney region (Attenbrow 2010:41). It is likely this is only a fraction of what was actually used.

3.5 Land Use History

From 1802 the Bungarribee area formed part of the Rooty Hill Government Farm. While the focus of farm activities was north of the Bungarribee Precinct on Rooty Hill, the area had begun to be cleared to provide pasture for government herds. From 1822 the north eastern portion of the Precinct comprised a single grant to Colonel John Campbell who built a homestead and several outbuildings to the north of the Bungarribee Precinct. The Bungarribee Estate passed through a number of hands and was used as a horse stud (1828 to 1945) and as a remount depot for the East India Company for horses to be shipped to India for use by the British cavalry (1845 to 1846).

The north western portion of the Precinct was subdivided from the 1840s. These subdivisions fronted Belmore Street, east of the Bungarribee Precinct. The area within the Precinct comprised the back half of each subdivision and has been subject to a low level of disturbance, aside from the construction of outbuildings. In the 1900s a dairy farm existed within the north western portion of the Precinct. The south western portion of the Precinct developed as part of the Eastern Creek village. From the 1880s a commercial strip fronted the Great Western Road and included a post office and a blacksmiths shop.

During World War II (WWII) the whole Bungarribee Precinct was resumed for use as a RAAF dispersal area. The dispersal area comprised a sealed landing strip, taxiways and hides (aircraft dispersal pads). Jo McDonald Cultural Heritage Management (JMcDCHM) (2007) suggests that the gravels used in the construction of the landing strip were sourced from Plumpton Ridge, about five kilometres northwest of the Precinct.

In the 1949 the Overseas Telecommunications Commission (OTC) resumed the Bungarribee precinct for use as a transmission station. A transmission station was built in the central portion of the Precinct and a series of transmission towers or aials were erected across the OTC land holding. The OTC station was closed in the 1990s, telecommunication technologies having surpassed the need for radio transmission. The transmission towers were removed and the station demolished in 2001.

Previous land use has caused a moderate level of disturbance to the Precinct. The clearing of native vegetation between 1802 and circa 1840 has caused a moderate level of disturbance across the Precinct. There are also a number of isolated incidences of high disturbance, for example in the south and west where roads have been constructed and in the central portion of the Precinct where the RAAF landing strip, taxiways and hides and OTC transmission station were built.

4.0 ABORIGINAL HISTORICAL AND ARCHAEOLOGICAL CONTEXT

4.1 Aboriginal Material Culture

Aboriginal people have lived in the Sydney area for more than 20,000 years. The oldest securely dated site in the greater Sydney region is 17,800 years before present (yBP), which was recorded in a rock shelter at Shaw's Creek (Nanson et al 1987). Evidence of Aboriginal occupation has been found dated to 50-60,000 yBP at Lake Mungo in NSW, so it is likely that Aboriginal people have lived in the Sydney region for even longer than indicated by the oldest recorded dates we have at present. The archaeological material record provides evidence of this long occupation, but also provides evidence of a dynamic culture that has changed through time.

The existing archaeological record is limited to certain materials and objects that were able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Archaeological analyses of these artefacts in their contexts have provided the basis for the interpretation of change in material culture over time. Technologies used for making tools changed, along with preference of raw material. Different types of tools appeared at certain times, for example ground stone hatchets are first observed in the archaeological record around 4,000yBP in the Sydney region (Attenbrow 2010:102). It is argued that these changes in material culture were an indication of changes in social organisation and behaviour.

The Eastern Regional Sequence was first developed by McCarthy in 1948 to explain the typological differences he was seeing in stone tool technology in different stratigraphic levels during excavations such as Lapstone Creek near the foot of the Blue Mountains (McCarthy 1948). The sequence had three phases that corresponded to different technologies and tool types (the Capertian, Bondaian and Eloueran). The categories have been refined through the interpretation of further excavation data and radiocarbon dates (Hiscock & Attenbrow 2005, JMcDCHM 2005). It is now thought that prior to 8,500 yBP tool technology remained fairly static with a preference for silicified tuff, quartz and some unheated silcrete. Bipolar flaking was rare with unifacial flaking predominant. No backed artefacts have been found of this antiquity.

After 8,500 yBP silcrete was more dominant as a raw material, and bifacial flaking became the most common technique for tool manufacture. From about 4,000yBP to 1,000yBP backed artefacts appear more frequently. Tool manufacture techniques become more varied and bipolar flaking increases (JMcD CHM 2006a). It has been argued that from 1,400 to 1,000 years before contact there is evidence of a decline in tool manufacture. This reduction may be the result of decreased tool making, an increase in the use of organic materials, changes in the way tools were made, or changes in what types of tools were preferred (Attenbrow 2010:102). The reduction in evidence coincides with the reduction in frequency of backed blades as a percentage of the assemblage.

After European colonisation Aboriginal people of the Cumberland Plain often continued to manufacture tools, sometimes with new materials such as bottle glass or ceramics. There are several sites in Western Sydney where flaked glass has been recorded, for example at Prospect (Ngara Consulting 2003) and Oran Park (JMcD CHM 2007a).

4.2 Aboriginal Ethno-historic Context

Prior to the appropriation of their land by Europeans, Aboriginal people lived in small family or clan groups that were associated with particular territories or places. It seems that territorial boundaries were fairly fluid, although details are not known. The language group spoken on the Cumberland Plain is known as Darug (Dharruk – alternative spelling). This term was used for the first time in 1900 (Matthews & Everitt) as before the late 1800s language groups or dialects were not discussed in the literature (Attenbrow 2010:31). The Darug language group is thought to have extended from Appin in the south to the Hawkesbury River, west of the Georges River, Parramatta, the Lane Cove River and to Berowra Creek (Attenbrow 2010:34). This area was home to a number of different clan groups throughout the Cumberland Plain.

British colonisation had a profound and devastating effect on the Aboriginal population of the Sydney region, including Darug speakers. In the early days of the colony Aboriginal people were disenfranchised from their land as the British claimed areas for settlement and agriculture. The colonists, often at the expense of the local Aboriginal groups, also claimed resources such as pasture, timber, fishing grounds and water sources. Overall the devastation of the Aboriginal culture did not come about through war with the British, but instead through disease and forced removal from traditional lands. It is thought that during the 1789 smallpox epidemic over half of the Aboriginal people of the Sydney region died. The disease spread west to the Darug of the Cumberland Plain and north to the Hawkesbury. It may have in fact spread much further afield, over the Blue Mountains (Butlin 1983). This loss of life meant that some of the Aboriginal groups who lived away from the coastal settlement of Sydney may have disappeared entirely before Europeans could observe them, or record their clan names (Karskens 2010:452).

The British initially thought that Aboriginal people did not live inland, but were confined to the coast taking advantage of the abundant marine resources available. The first major expeditions into the interior did not witness any Aboriginal people, but evidence of their existence was noted. In April 1788 Governor Philip led an expedition west to Prospect Hill. It was noted, ‘...that these parts are frequented by the natives was undeniably proved by the temporary huts which were seen in several places. Near one of these huts, the bones of kangaroo were found, and several trees where seen on fire’ (Stockdale 1789).

In 1789 Captain Watkin Tench led an expedition to the Nepean River. He noted that:

Traces of the natives appeared at every step, sometimes in their hunting huts which consist of nothing more than a large piece of bark bent in the middle and opened at both ends, exactly resembling two cards set up to form an acute angle; sometimes in marks on trees which they had climbed; or in squirrel-traps....We also met with two old damaged canoes hauled up on the beach. (Tench 1789)

It wasn't until rural settlement began in the western Cumberland Plain, around 1791 that the colonists and Aboriginal peoples came face to face. Relations quickly disintegrated, and tensions over land and resources spilled over. Governor King sanctioned the shooting of Aboriginal peoples in a General Order made in 1801 (Kohen 1986:24). Intermittent killings on both sides continued for over 15 years, including the Appin massacre and attacks at South Creek in 1816 (Karskens 2010: 225, Kohen 1986:23).

Although tensions existed between Aboriginal people and Europeans on the Cumberland Plain, a number of Aboriginal families continued to live semi-traditional lives in the area. The first parcels of land granted to an Aboriginal person were to the north-west of the study area between Richmond Road and Plumpton Ridge along Bells Creek. Governor Macquarie granted this land to Colebee and

Nurragingy in 1819. Colebee did not stay long but Nurragingy lived on the land and it remained in the family until 1920 when it was resumed by the Aboriginal Protection Board (Kohen 1986:27).

The government policy of removal of Aboriginal children from their parents in order to assimilate them into white society began fairly early on in the colony's history, and was epitomized by the development of the Native Institution at Parramatta in 1814. This facility was moved to the Black Town settlement in 1823 approximately six kilometres north-west of the current study area. It was closed in 1829 and the land was used for farming, but the site remains significant for its historical, archaeological and social values (GML 2010:36).

Into the nineteen and twentieth centuries descendants of Darug language speakers continued to live in Western Sydney along with Aboriginal people from other areas of NSW. The Aboriginal groups in their comments on this study will address the contemporary cultural, social and spiritual meanings of the locality.

4.3 OEHS AHIMS site register search

An extensive search of the Aboriginal Heritage Information System (AHIMS) was undertaken on 26 June 2015 (# 179265) to determine whether Aboriginal sites had been recorded within Bungarribee Precinct. The search covered an area approximately one kilometre around the study area. A total of 25 recorded Aboriginal sites are listed on the AHIMS site register within the following coordinates:

GDA 94	MGA 56	301538 E	303203 E
		6258505 N	6259876 N
AHIMS Search ID		179265	

The distribution of recorded sites within the AHIMS search area is shown in Figure 3. All 25 recorded sites listed on the AHIMS site register search are open artefact sites, comprising both isolated artefacts and artefact scatters. The search identified that three recorded Aboriginal sites are located within the study area.

The three recorded Aboriginal sites within the study area are described below.

4.3.1 Bungarribee 10 Blacktown (AHIMS # 45-5-0455)

Bungarribee 10 is an artefact scatter located about 200 m along a road leading from the former OTC transmission station entrance to the station itself. In 1984 Kohen recorded and collected a chert point, a chert flake and a silcrete flake.

4.3.2 Bungarribee 18 Blacktown (AHIMS # 45-5-0465)

Bungarribee 18 is an artefact scatter located in an artificial drainage ditch midway between Eastern Creek and the road leading into the Precinct from the OTC transmission station entrance. Kohen recorded and collected three silcrete artefacts and a utilised slab of local igneous rock adjacent to the artificial drainage ditch, and noted that the site was located in a highly disturbed context.

4.3.3 BP-AS-6 (AHIMS # 45-5-4433)

BP-AS-6 is an artefact scatter located in the mid slope in an area of rolling hills/ grasslands. Artefact recorded the site as part of efforts to relocate AHIMS # 45-5-3526 which had previously been recorded with inaccurate coordinates.

Figure 3: Results of OEH AHIMS site register search



4.4 Overview of Previous Archaeological Investigations

4.4.1 Regional archaeological context

The study area is located in a region that has been subject to frequent archaeological investigations. Early investigations within the Blacktown area included research conducted by Jim Kohen as part of PhD research and an investigation of Aboriginal sites for Blacktown City Council (Kohen 1986). Kohen's (1986) investigation for Blacktown City Council included a sample survey of four areas within the LGA, including an area around Prospect Reservoir, Erskine Park, Marsden Park and along Ropes Creek. Using data gathered from the four sample survey areas, and previously recorded Aboriginal sites within the LGA, Kohen (1986: 67) determined that there were 25 identified major archaeological sites within the Blacktown LGA, with a major site defined as containing more than 50 recorded artefacts.

Silcrete raw material was identified at all 25 of the major archaeological sites, with other raw materials present in varying frequencies including chert, quartz, silicified wood, basalt and quartzite. All of the major archaeological sites were located either adjacent to a watercourse or on a ridge landform. Kohen (1986: 75) noted that the majority of identified major archaeological sites were located within 50 metres of a reliable watercourse, and that 'where a ridge or hill is situated close to a major creek, the high ground would generally be selected for the campsite'.

Although surface visibility tended to be very low, limiting the potential to identify surface artefacts, previous archaeological investigations further downstream along the Eastern Creek corridor have identified the area bordering the watercourse as generally demonstrating a high level of archaeological potential. Brown (2008) conducted an archaeological investigation for the replacement of a 132kV line through the Western Sydney Parklands from the northern boundary of Bungarribee Precinct for approximately five kilometres. Based on the results of previous archaeological investigations in the area and models of site distribution (such as Kohen 1986), Brown (2008: 18-20) considered that the entire area within 150 m of Eastern Creek associated with his study area was a PAD (EC132kVPAD).

Archaeological investigation of Plumpton Ridge, bordering the western side of Eastern Creek approximately six kilometres northwest of the study area, identified a significant silcrete extraction site and tool manufacturing area (JMCD CHM 2006a). The comprehensive archaeological investigation on the eastern side of Plumpton Ridge involved the excavation of 687 square metres across seven locations. These locations were representative of different landscape units within the study area and included floodplain, upper and mid slope and one site on a terrace/bank of Eastern Creek. The later site produced the highest density of artefacts, up to 1,289 per square metre. The excavation results indicated that the Plumpton Ridge quarry site was used extensively by Aboriginal people, though probably with greatest intensity over the last few thousand years (JMCD CHM 2006a: 136).

4.4.2 Previous archaeological investigations within Bungarribee Precinct

A number of archaeological investigations have been conducted within Bungarribee Precinct, including surveys by Jim Kohen as part of his PhD research in 1984 and as part of an investigation for Blacktown City Council in 1986, and more recent investigations by JMCD CHM (2006b; 2007; 2011). Several smaller investigations have also been undertaken within the Precinct and wider Parklands area as impact assessment studies and archaeological management studies (Haglund 1987; 2000; Navin Officer 1993; AMBS 2005; Artefact 2012).

Kohen’s research within the Sydney Zoo Precinct

As part of his PhD research Kohen recorded a number of surface artefact scatters over the undulating land in the south eastern corner of the Bungarrabee Precinct. Of these, two fall within boundary of the Sydney Zoo project, AHIMS sites 45-5-0455 and 45-5-0465.

JMcD CHM archaeological investigations within the Sydney Zoo Precinct

JMcD CHM’s archaeological investigations into the Bungarrabee Precinct included an initial survey and archaeological assessment (2006b), an Indigenous Heritage Impact Statement (2007), and archaeological excavation of a portion of potential archaeological deposit (PAD) identified in the earlier assessment (2011).

The initial survey and impact statement (2006b and 2007) identified that 52 recorded Aboriginal sites and five PADs were located across the Bungarrabee Precinct. During that investigation the Precinct covered a much larger area than the current boundaries of Bungarrabee Precinct, and included both the Bunya residential area (previously referred to as the Doonside residential parcel) to the northeast, and the Bungarrabee industrial estate area to the south of the Great Western Highway (previously referred to as the Huntingwood West Employment Lands).

Figure 4: Location of PAD WSP1 within Bungarrabee Precinct, yellow indicates good potential, with areas assessed as demonstrating greatest potential marked by white stars (JMcD CHM 2006b: 9)



JMcD CHM (2007) developed a Strategic Management Model (SMM) for the Precinct, which identified sites and sensitive landscapes within the Precinct. A significant portion of the Precinct was designated Zone 1 (good archaeological potential) and delineated as PAD WSP1 (see Figure 4). JMcD CHM recommends that Zone 1 areas are avoided and that a possible Aboriginal heritage conservation area is declared. Other areas within the Precinct were assessed as Zone 3 (low archaeological potential). JMcD CHM recommended there are no constraints to development in those areas and no further archaeological works would be required. It is noted however, that Aboriginal stakeholders may want to monitor development within these areas, particularly along the creek lines.

Salvage excavation was recommended for portions of identified good and moderate archaeological potential that would be impacted by proposed development within Bungarribee Precinct (JMcD CHM 2007: 39).

Artefact Heritage Bungarribee Precinct Masterplan investigations

In 2014 Artefact prepared an ASR for the entirety of the Bungarribee Precinct as part of Aboriginal heritage investigations for the Bungarribee Precinct Masterplan. As part of that investigation a number of previously recorded Aboriginal sites were revisited and several previously unrecorded sites recorded.

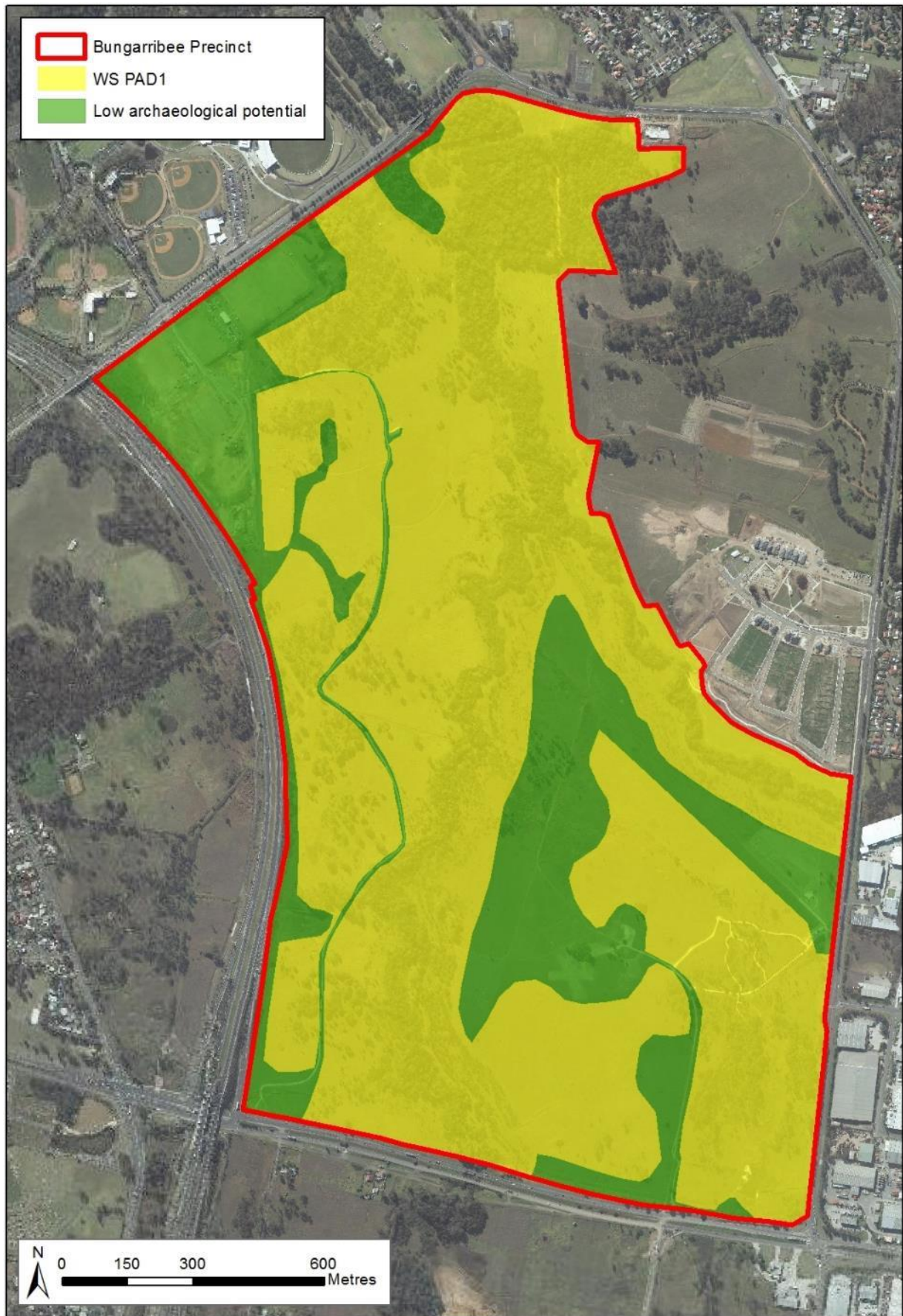
The ASR discussed previously recorded Aboriginal sites within the Precinct, as well as additional sites identified during the preparation of that ASR. The outcome of the ASR was the refinement, based on background research and sample archaeological survey, of the boundaries of PAD WSP1 (JMcD CHM 2006b). The refined extent of PAD WSP1, which was renamed "WS PAD1" for the purposes of that ASR, is shown in Figure 5.

Artefact (2014) noted that no areas of high archaeological potential were identified within the Precinct. This was based on the results of sub-surface investigation within the local area, including excavation at AHIMS site 45-5-2719 and 45-5-3255 within Bungarribee Precinct, and at 45-5-3883 adjacent to the eastern margin of the Precinct (a further description of archaeological excavation at these three sites is included in Section 4.4.3).

The landform context of AHIMS site 45-5-3883, which included a slope context in close proximity to Bungarribee Creek and the confluence of that creek with Eastern Creek, demonstrated a very high-density artefact scatter. In contrast, excavation at AHIMS site 45-5-3255 and 45-5-2719 further from Eastern Creek demonstrated much lower density artefact scatters. With localised exceptions the remainder of the Precinct was characterised by low-lying and gently undulating landform contexts bordering Eastern Creek and Bungarribee Creek.

Artefact (2015) identified the broad central portion of Bungarribee Precinct associated with Eastern Creek and Bungarribee Creek as demonstrating moderate archaeological potential (see Figure 5). It is likely that the density of potential sub-surface archaeological deposit in this zone would vary, with large areas of low density archaeological deposit interspersed with areas of higher density deposits.

Figure 5: Extent of WS PAD1 as delineated by Artefact (2014)



4.4.3 Previous archaeological excavations within Bungarribee Precinct (see Figure 6)

JMcD CHM 2011

A portion of WSPAD1 within the Bunya residential area, north of Bungarribee Creek, was excavated as part of impact mitigation prior to development of that area (JMcD CHM 2011). The portion of excavated PAD is recorded on the AHIMS sites register with the site name WSP PAD AHIMS #45-5-3883. A total of 41 one metre square pits and 82 square metres of open area was excavated within AHIMS #45-5-3883. The excavation retrieved a total of 5,535 artefacts, 1,083 pieces of silcrete and silicified tuff crenate affected by heat shatter, and 11,751 pieces of silcrete gravel.

No report for the excavation at AHIMS site 45-5-3883 was available at the time this document was prepared. A summary of excavation results is available on the site card for site 45-5-3883.

Artefact 2014b - Pipeline Salvage Excavation

In 2012, Artefact Heritage conducted a survey of a proposed wastewater trunk pipeline through the Bungarribee Precinct. Artefacts associated with three previously recorded Aboriginal sites (AHIMS #45-5-3253, #45-5-3255 and #45-5-3256) were identified on the pipeline. AHIMS #45-5-3255 and #45-5-3256 were assessed as demonstrating moderate archaeological significance with potential to provide information about Aboriginal occupation of the area. It was also determined that further investigation of these sites would enable comparisons to be made between past Aboriginal occupation within the Bungarribee Precinct and the local area. The salvage excavation covered the lower slope and terrace landform bordering the eastern side of the Eastern Creek floodplain.

AHIMS #45-5-3253 was assessed as demonstrating low archaeological significance due to the site being situated within a disturbed context. To mitigate impacts to Aboriginal cultural heritage by the proposed works, surface collection of visible artefacts at AHIMS #45-5-3255 and #45-5-3256 was recommended. Salvage excavation was also recommended for AHIMS #45-5-3255.

A total of 73 artefacts were retrieved from 35 salvage excavation squares across AHIMS #45-5-3255, and 17 artefacts were retrieved from surface collection across AHIMS #45-5-3256. No artefacts were retrieved from surface collection across AHIMS #45-5-3253.

Artefact 2015 – Bungarribee Precinct Masterplan Salvage Excavation

Following archaeological survey and assessment of the Bungarribee Masterplan completed by Artefact in 2014, it was determined that 11 sites would be impacted as part of proposed works. Based on recommendations from Artefact, Archaeological salvage was included within the Operational Conditions of the AHIP. A total of fifty-five one x one metre excavation units were excavated within the study area in two locations named 'Bungarribee North' and 'Bungarribee South'.

The Bungarribee North salvage area was situated within the South Creek soil landscape which was associated with floodplains, valley flats and drainage depressions. A total of 287 stone artefacts, weighing a maximum total of 148.35 grams, were recovered from the Bungarribee North area as a result of the salvage excavations. The salvage excavations undertaken at Bungarribee North uncovered a moderate density stone artefact assemblage which exhibits some distinctive types of stone reduction activities. The stone artefact analysis has shown that knapping events have been undertaken in this location, particularly within the area of the Stage II excavations (this is where the majority of the formal tools were identified). The formal tool types are associated with the ASTT and are typical of a Bondaian assemblage (likely dating anywhere from 8,000 BP up until the contact period). Preference of raw material use for the production of formal tools is indicated as all of the tools were composed of mudstone. No silcrete tools were identified.

The Bungarribee South salvage area was situated within the Blacktown soil landscape which is associated with gently undulating rises on Wianamatta Group Shales. All of the units excavated within this area were located on slightly raised terrain associated with a first order watercourse flowing onto the Bungarribee and Eastern Creek floodplains. A total of 346 stone artefacts, weighing a maximum total of 935.76 grams, were recovered from the Bungarribee South area as a result of the salvage excavations.

The salvage excavations undertaken at Bungarribee South uncovered a low density stone artefact assemblage of small to medium size flakes, angular fragments and cores. One artefact was identified as having some scalar retouch with evidence of usewear and defined as an utilised flake. The raw materials utilised at the site are common in the region. No evidence of intensive occupation of the site or the manufacture of stone tools was discovered. The assemblage was interpreted as opportunistic general stone reduction and discard rather than intensive occupation or site use reflective of transient campsites related to the movement of Aboriginal people across the landscape.

The salvage excavations revealed that the landform contexts are associated with two different types of archaeological sites which exhibit different types of stone artefact reduction techniques or behaviours.

Figure 6: Location of previous archaeological excavations discussed in Section 4.4.3



5.0 PREDICTIONS

5.1 Previous Predictive Models for the Study Area

Data including landscape context and artefact density from previous archaeological excavations on the Cumberland Plain has been synthesised to develop a model of site distribution (White and McDonald 2010). The model demonstrated a strong correlation between proximity to permanent water sources and site location, and also highlighted the relationship between topographical unit and Aboriginal occupation in the region.

The major findings of the study were that artefact densities were most likely to be greatest on terraces and lower slopes within 100 m of water. The stream order model was used to differentiate between artefact densities associated with intermittent streams as opposed to permanent water. It was found that artefacts were most likely within 50 to 100 m of higher (4th) order streams, within 50 m of second order streams, and that artefact distribution around first order streams was not significantly affected by distance from the watercourse (White and McDonald 2010: 33).

Overall, landscapes associated with higher order streams (2nd order or greater) were found to have higher artefact densities, higher maximum densities, and more continuous distribution than lower order intermittent streams. The analysis also concluded that while there were statistically viable correlations that demonstrated a relationship between stream order, land form unit and artefact distribution across the RHDA, the entire area should be recognised as a cultural landscape with varied levels of artefact distribution (White and McDonald 2010: 37).

JMcD CHM (2006b: 13) developed a predictive model specific to the Western Sydney Parklands (including the Bungarribee Precinct). JMcD CHM predicted:

- Based on the results of previous archaeological investigations within the Parklands, open stone artefacts would be the most common Aboriginal site identified within the Parklands. JMcD CHM (2006b: 13) predicted that stone artefact sites would be of varied size and densities with the largest being located near permanent water sources.
- Scarred trees would be a less common Aboriginal site type to be identified within the Parklands. JMcD CHM (2006b: 13) noted scarred trees may be identified in areas where there was old growth native vegetation.

5.2 Predictive Model for the Study Area

Archaeological data gathered in the locality has demonstrated the widespread and varying use of the area by Aboriginal people. This predictive model comprises a series of statements about the nature and distribution of evidence of Aboriginal land use that is expected in the study area. These statements are based on the information gathered regarding:

- Landscape context and landform units.
- Ethno-historical evidence of Aboriginal land use.
- Distribution of natural resources.
- Results of previous archaeological work in area.
- Predictive modelling proposed in previous archaeological investigations.

Predictive statements are as follows:

- Stone artefact scatters are the most likely Aboriginal site type to be identified within the study area. This has been demonstrated in previous archaeological investigations which have identified a series of sites across Bungarribee Precinct.
- There is potential for intact sub surface archaeological deposits with high densities of stone artefacts. This has been demonstrated through the archaeological excavation of WSP PAD1, north of Bungarribee Creek (JMcD CHM 2011).
- Based on the location of recorded Aboriginal sites within Bungarribee Precinct and on predictive models developed for the Cumberland Plain (White and McDonald 2010) the highest numbers of sites and sites with the highest densities of artefacts are likely to be located along Eastern Creek.
- In situ stone artefacts are likely to be located where there is least ground disturbance.
- Based on the natural resources available and the results of previous archaeological investigations, silcrete will be the dominant raw material of stone artefact assemblages.
- Where old growth native vegetation remains there is potential for scarred trees to be located. As there are few areas of remnant native vegetation there are few areas where this is possible.
- Visibility is likely to be low, obstructed by dense grass cover. Sites on the ground surface will be most obvious in exposed areas where vegetation has recently been cleared and/or on tracks.

6.0 FIELD METHODS

6.1 Site Definition

An Aboriginal site is generally defined as an Aboriginal object or place. An Aboriginal object is the material evidence of Aboriginal land use, such as stone tools, scarred trees or rock art. Some sites, or Aboriginal places can also be intangible and although they might not be visible, these places have cultural significance to Aboriginal people.

OEH guidelines state in regard to site definition that one or more of the following criteria must be used when recording material traces of Aboriginal land use:

- The spatial extent of the visible objects, or direct evidence of their location.
- Obvious physical boundaries where present, e.g. mound site and middens (if visibility is good), a ceremonial ground.
- Identification by the Aboriginal community on the basis of cultural information.

For the purposes of this study an Aboriginal site was defined by the recording the spatial extent of visible traces or the direct evidence of their location.

PADs are areas where sub-surface stone artefacts and/or other cultural materials are likely to occur (DECCW 2010:38). These areas may be associated with recorded sites but are often greater in extent taking in areas around the visible artefacts where there is a potential for further buried artefacts to exist. PADs may also be present where no visible artefacts are located. This may be the case when there is no ground surface visibility, but the area is seen to have a high likelihood of containing artefacts.

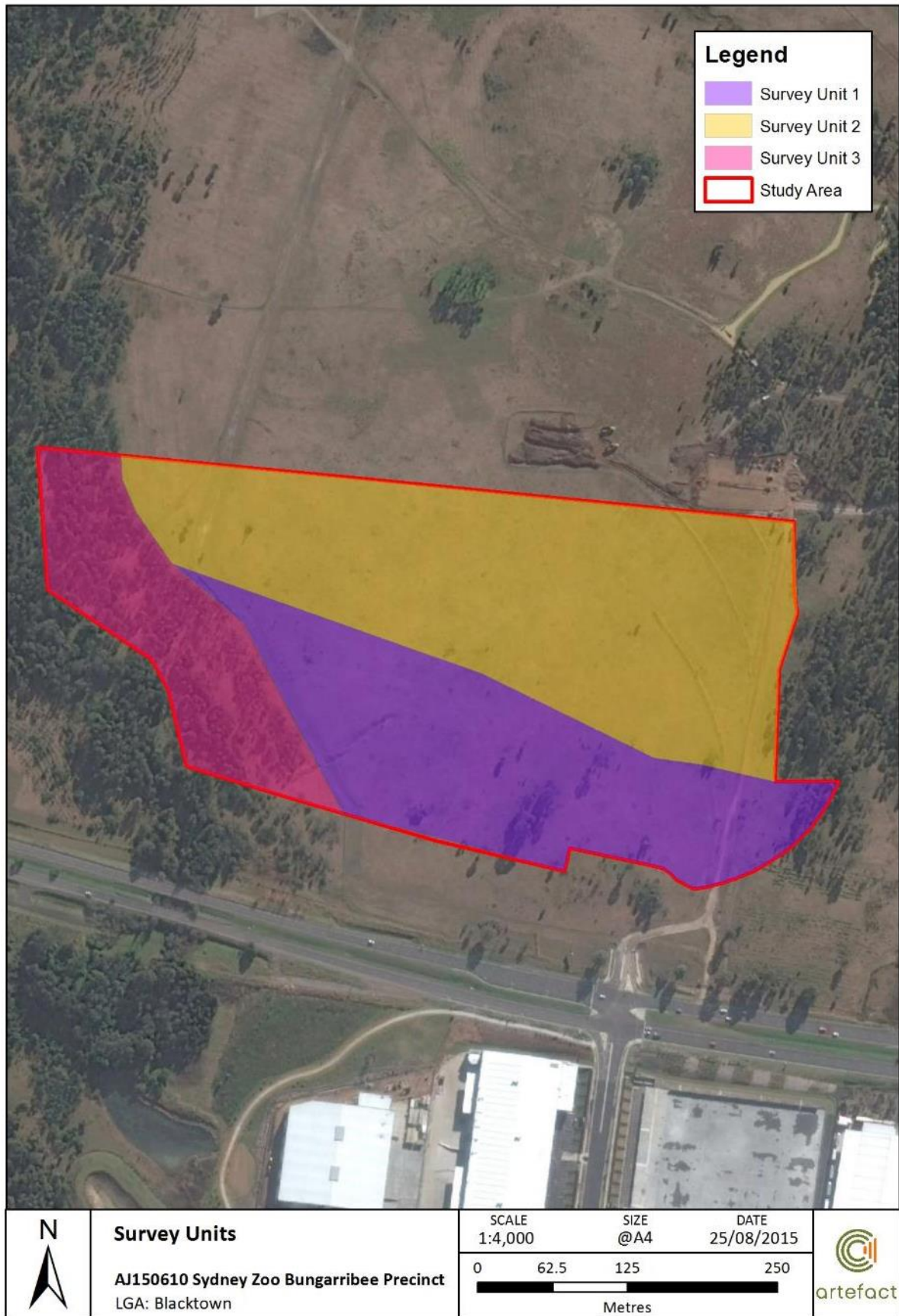
6.2 Survey Methodology and Limitations

A sample survey of the study area was undertaken on the 3 August 2015. The survey was undertaken in accordance with the OEH code of practice.

Survey units were delineated by the landforms within the study area (Figure 7). Given the poor visibility of the study area, the survey targeted areas of exposure. This was generally limited to tracks, tree bases and areas near the creek line.

All survey units were covered on foot and examined for stone artefacts or other traces of Aboriginal occupation. Aerial photographs and topographic maps of the study area were carried by all members of the survey team. A non-differential GPS was also used to track the path of the survey team and to record the geographical coordinates of Aboriginal sites and landscape features. A photographic record was also kept of the study area.

Figure 7: Delineation of survey units



7.0 SURVEY RESULTS

7.1 Effective Survey Coverage

The survey covered all three landform units identified within the study area, including slope, crest, and flat landform contexts. Effective survey coverage is outlined in Table 1 and landform survey coverage is outlined in Table 2.

Table 1: Effective survey coverage

Survey unit	Landform	Survey unit area (sq m)	Visibility (%)	Exposure (%)	Effective coverage Area (sq m)	Effective coverage (%)
Survey unit 1	Slope	54,510	5%	10%	272	0.5%
Survey unit 2	Crest	82,561	5%	10%	412	0.5%
Survey unit 3	Flat	27,881	5%	10%	139	0.5%

Table 2: Landform survey coverage

Landform	Landform Area (sq m)	Area effectively surveyed (sq m)	% of landform effectively surveyed	Number of sites
Slope	54,510	272	0.5%	2
Crest	82,561	412	0.5%	1
Flat	27,881	139	0.5%	0

8.0 SURVEY OBSERVATIONS

8.1 Survey Unit One

Survey unit one encompasses the slope landform that forms the southern half of the study area. The landform slopes south west towards Eastern Creek. Visibility within the survey unit was generally low and restricted to access tracks running along the eastern and western boundaries of the survey unit (Plate 1). Visibility was restricted due to dense grasses (Plate 2). Exposures were inspected for the presence of Aboriginal objects however none were identified. Two AHIMS sites (#45-5-0455 and #45-5-0465) are located within survey unit one. Disturbance was noted in the form of modified drainage channels cut into the lower slopes of the survey units near Eastern Creek (Plate 3).

Plate 1: Access track running along eastern boundary, survey unit 1



Plate 2: Poor visibility due to dense grass, survey unit 1



Plate 3: Artificial drainage channel, survey unit 1



8.2 Survey Unit Two

Survey unit two includes the northern crest landform overlooking Eastern Creek (Plate 4). The crest landform is relatively flat with a slight slope descending to the north. Visibility is generally nil within the study area with no areas of exposure identified (Plate 5). Visibility was inhibited by dense grass throughout the survey unit. Disturbance was noted in the form of furrows located in the north eastern region of the survey unit (Plate 6). There is one previously recorded AHIMS site located within the survey unit (#45-5-4433), there were no new sites identified within the survey unit. There was one area of PAD identified within the survey unit.

Plate 4: View west towards Eastern Creek, survey unit 2



Plate 5: Low visibility due to dense grass, survey unit 2



Plate 6: View north along furrow, survey unit 2



8.3 Survey Unit Three

Survey unit three encompasses the flat landform adjacent to Eastern Creek. Visibility in the area was nil with no exposures. Thick grass and trees inhibited visibility within the survey unit. Eastern Creek is a deeply incised creek line with raised terraces along its banks. Disturbance within the survey unit was generally found to be low and the landform was assessed to be in an intact and good condition. There is evidence of recent tree plantings occurring along the waterline. There were no newly identified sites located within the survey unit. The entirety of survey unit three was assessed to have the potential to contain intact archaeological deposits

Plate 7: Thick vegetation inhibited visibility within survey unit 3



Plate 8: Evidence of recent plantings, survey unit 3



9.0 SUMMARY OF RESULTS

The current survey delineated two specified areas of PAD contained within the wider WS PAD1 area originally defined by Jo McDonald (2006).

The coordinates of three registered AHIMS sites were inspected during the survey. The artefacts recorded at these sites were not relocated. Visibility was generally nil across the study area due to dense grass. Disturbance was limited to parts of the crest and slope landforms whilst the flat landform adjacent to Eastern Creek appears to be relatively intact.

9.1 Previously Recorded Archaeological Sites

9.1.1 AHIMS site 45-5-0455 Bungarribee 10 Blacktown

AHIMS site 45-5-0455 was originally recorded by Jim Kohen in 1984 as comprising a chert point, a chert flake and a silcrete flake.

AHIMS site 45-5-0455 is located on a formed vehicle track that leads north of the Great Western Highway into the Precinct. The track appears to have been repeatedly graded and formed with introduced materials.

No artefacts were identified at AHIMS site 45-5-0455 during the current field survey.

Plate 9: South west view of AHIMS 45-5-0455



Plate 10: West view of AHIMS 45-5-0455



9.1.2 AHIMS site 45-5-0465 Bungarribee 18 Blacktown

AHIMS site 45-5-0465 was originally surveyed by Jim Kohen in 1984 in which he recorded three silcrete artefacts and an utilised slab of local igneous rock over a 1m x 2m area adjacent to an artificial drainage ditch. It was noted in the original report that the site was located in a highly disturbed context.

AHIMS site 45-5-0465 was located across a gently sloping landform context. Surface visibility across the site area was limited due to dense grass cover. No Aboriginal objects were identified at AHIMS site 45-5-0465 during the current survey.

Plate 11: South view of AHIMS 45-5-0465



9.1.3 AHIMS site 45-5-4433 BP AS 6

AHIMS site 45-5-4433 was identified by Artefact in 2014 at the site coordinates originally attributed to AHIMS site # 45-5-3526 (WSP/10) described by JMcD CHM. The original recording of site WSP/10 described a total of 16 artefacts across an area of 80 m x 100 m, west of the former OTC site.

Whilst the actual location of WSP/10 based on the site description was likely to have been approximately 250 m further to the north, artefacts were identified by Artefact Heritage at the incorrectly listed AHIMS coordinates for site WSP/10 (302267E 6259337N). Two silcrete artefacts and numerous natural silcrete gravels were observed at this location and recorded as site BP AS 6.

No artefacts were identified at AHIMS site 45-5-0455 during the current field survey.

Plate 12: South west view of AHIMS 45-5-0465



Plate 13: North west view of AHIMS 45-5-0465



9.2 Potential Archaeological Deposits

Areas of Archaeological potential were located in the western portion of the study area adjacent to the creek as well as on the crest landform located to the east (Figure 5). The areas of archaeological potential have been designated as Sydney Zoo PAD1 (SZ PAD1) and Sydney Zoo PAD2 (SZ PAD2) respectively. Both areas of archaeological potential are described below.

9.2.1 SZ PAD1

PAD1 is located within survey unit three, the flat area adjacent to Eastern creek.

Previous investigations have highlighted the archaeological potential of Eastern Creek and bordering areas of higher elevation. The high archaeological potential of the Eastern Creek corridor was highlighted by Brown (2008), who labelled the entire area within 150 m of Eastern Creek as PAD. The Eastern Creek corridor is also closely associated with the significant silcrete raw material extraction site at Plumpton Ridge. Excavation identified staged silcrete extraction and tool manufacture activities across the eastern slope of Plumpton Ridge, culminating in extremely dense sub-surface archaeological deposit bordering Eastern Creek (JMCD CHM 2006a).

Salvage excavation of the northern side of Bungarribee Creek in 2011 by JMCD CHM recovered an very high density site with 5535 artefacts recovered from 41 one x one metre excavation units. Subsequent excavation in the areas surrounding Eastern Creek has included salvage excavation of AHIMS site # 45-5-3255 by Artefact in 2012 and test excavation of the area designated Bungarribee North by Artefact in 2015. Of particular interest is the variation seen between the JMCD CHM (2011) excavation and Bungarribee North. While the JMCD CHM (2011) excavation contained a significant proportion of silcrete tools within its artefact assemblage the Bungarribee North assemblage was composed completely of mudstone artefacts. The difference seen between the two sites despite similar landscape contexts hints at the high level of complexity of Bungarribee occupation patterns. Additional testing within the landform will enable further understanding of the variety of land use within the region

9.2.2 SZ PAD2

PAD2 is located on the crested area approximately 275 m east of the creek line. The crest represents a unique landform within the Bungarribee district that has not been previously investigated.

Previous archaeological salvage in the area has focused on the area surrounding both Eastern Creek and Bungarribee Creek. Landscapes investigated have been limited to flood plains, valley flats and lower slope terrain surrounding the creeks. The salvage excavation completed by Artefact in 2015 focused on two different landscape contexts, the valley flat and lower slope areas of the precinct. Excavation revealed that the landform contexts were associated with two distinct types of archaeological sites which exhibit different types of stone artefact reduction techniques and subsequently are representative of varied behaviour patterns. This study highlighted the value in considering varied landform types when developing an understanding of regional land use patterns

Sensitivity mapping completed by both JMCD CHM (2006b) and later modified by Artefact (2014a) indicate that the crest area represents an area of moderate archaeological potential. Given this and the untested nature of the crest landform this PAD contains significant research potential.

Figure 8: Location of SZ PAD1 and SZ PAD2

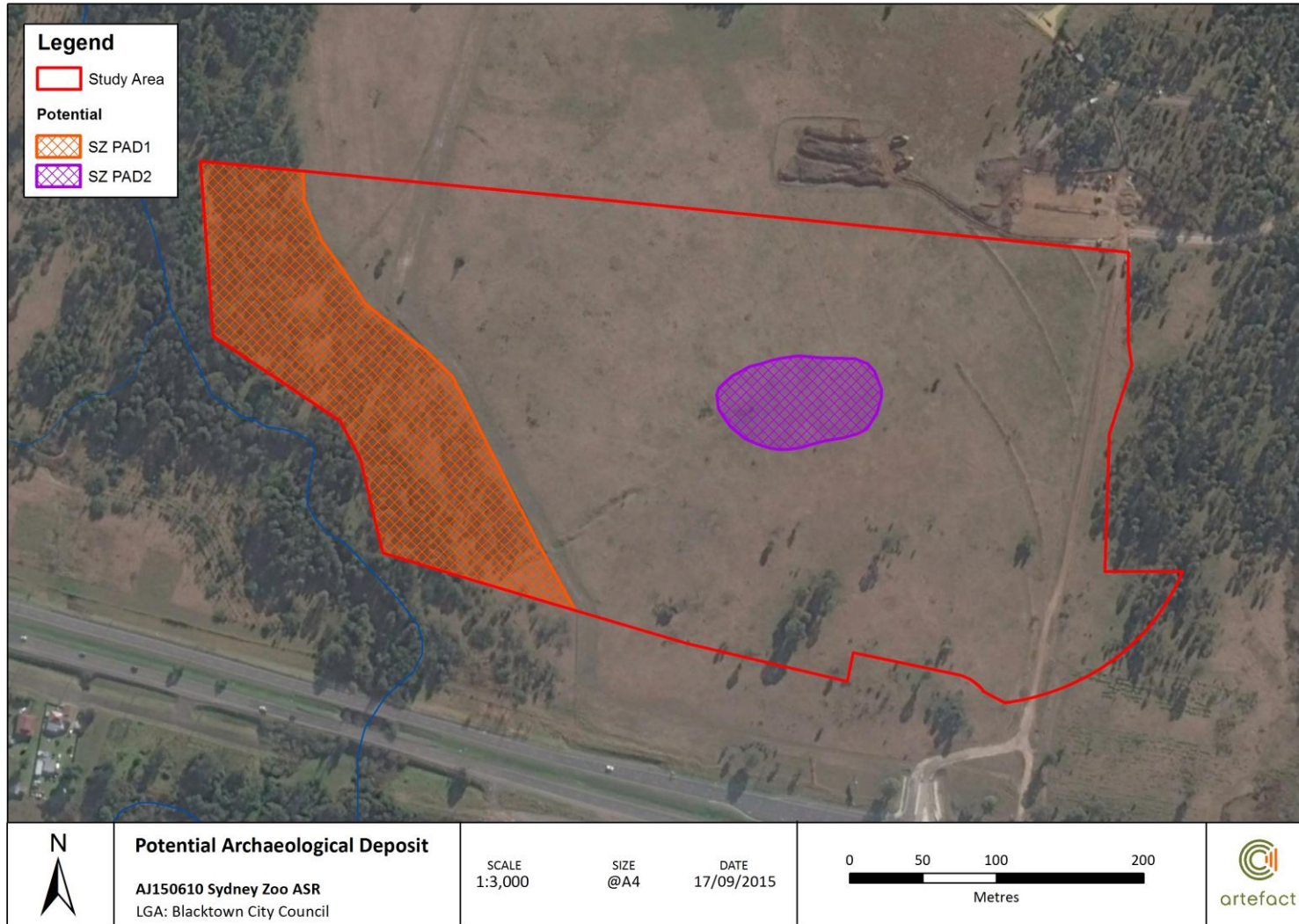
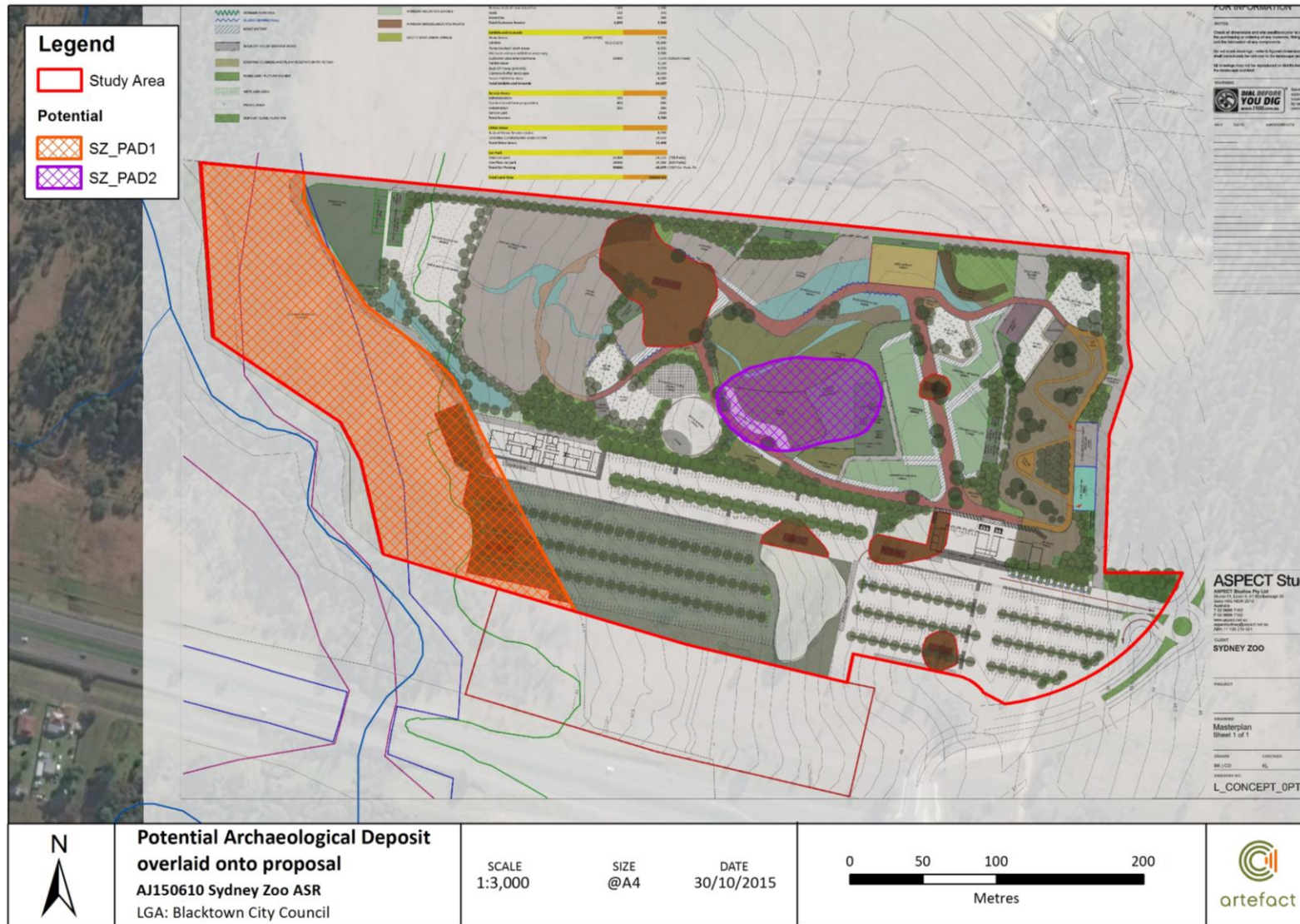


Figure 9: Location of SZ PAD1 and SZ PAD2 overlaid onto the propose layout of Sydney Zoo



10.0 ANALYSIS AND DISCUSSION

10.1 Results Discussion

No new Aboriginal sites were identified during site survey.

Two areas of PAD were recorded during the survey, including SZ PAD1 and SZ PAD2.

Three previously recorded Aboriginal sites within the study area were revisited during the survey. However, Aboriginal objects were not observed at each location primarily due to dense grass cover (AHIMS sites 45-5-4433 and 45-5-0465) and frequent grading and introduction of materials across the access road (AHIMS site 45-5-0455).

Vegetation within the study area comprised largely of dense grass cover, with the exceptions being extensive revegetation along the Eastern Creek corridor (Survey Unit 3) and open woodland in the northeastern portion of the study area.

Recent disturbance within the study area was generally isolated to specific areas of the site in particular disturbance related to the installation of the underground pipeline through the western portion of the study area, vehicle tracks and modified drainage channels. Large contour drainage banks were observed across part of the crest adjacent to the existing vehicle track. Other general surface disturbance across the study area includes original vegetation clearance following British occupation of the area, and works associated with the Overseas Transmission Centre such as concrete tower pads.

10.2 Analysis of Archaeological Potential

Previous archaeological investigations within Bungarribee Precinct have identified large areas of archaeological potential. This includes the identification of PAD WSP1 by JMcD CHM (2006b) and the refinement of that area of archaeological potential by Artefact Heritage (2015), called WS PAD1. WS PAD1 includes large portions of the current study area.

The boundaries of PAD WSP1 and subsequent recording as WS PAD1 were based on sample survey and desktop predictive modelling of Bungarribee Precinct. The boundaries of WS PAD1 were also delineated prior to recent archaeological salvage excavation adjacent to Eastern and Bungarribee Creeks by Artefact (2015). More detailed archaeological survey, such as within the Sydney Zoo portion of Bungarribee Precinct, provides more detailed and refined information on the extent of PAD in those areas.

Archaeological survey has refined the areas of PAD within the current study area to SZ PAD1 and SZ PAD2. SZ PAD1 incorporates the Eastern Creek floodplain area adjacent to a gentle slope landform. Although the Eastern Creek floodplain area is likely to be subject to occasional high intensity flooding, archaeological salvage excavation has previously identified moderate density deposits of Aboriginal artefacts demonstrating evidence of stone reduction activities (Artefact 2015).

The archaeological potential of SZ PAD1 has been extrapolated from salvage excavation at Bungarribee North by Artefact Heritage (2015) due to the fact that both are located across the same Eastern Creek floodplain landform within Bungarribee Precinct.

SZ PAD2 is situated across a prominent crest landform within the study area. The crest landform is unique within Bungarribee Precinct, and is the most prominent high point overlooking Eastern Creek in the local area. The archaeological potential of crest landforms has not been assessed through archaeological excavation within Bungarribee Precinct. Previous archaeological excavations within

Bungaribee Precinct have included a raised area overlooking Bungaribee Creek (JMcD CHM 2011), the eastern margin of the Eastern Creek floodplain (Artefact 2014b), the Eastern Creek floodplain (Artefact 2015) and a raised area and floodplain associated with a tributary of Bungaribee Creek (Artefact 2015).

11.0 STATUTORY REQUIREMENTS

This study has been undertaken in the context of several pieces of legislation that relate to Aboriginal heritage and its protection in New South Wales.

National Parks and Wildlife Act (1974) (NPW Act)

The NPW Act, administered by the OEH provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under Section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only Aboriginal Heritage Impact Permit (AHIP) available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.

As part of the administration of Part 6 of the NPW Act OEH has developed regulatory guidelines on Aboriginal consultation, which are outlined in *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010). Guidelines have also been developed for the processes of due diligence - *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (2010), and for investigation of Aboriginal objects - *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010) in accordance with the 2010 amendment to the NPW Act.

Aboriginal sites are located within the study area. An AHIP would be required prior to impacts to these sites occurring.

Environmental Planning & Assessment Act (1979)

The EP&A Act is administered by the Department of Planning and Infrastructure, and provides planning controls and requirements for environmental assessment in the development approval process. This Act has three main parts of direct relevance to Aboriginal cultural heritage. Namely, Part 3 which governs the preparation of planning instruments, Part 4 which relates to development assessment processes for local government (consent) authorities and Part 5 which relates to activity approvals by governing (determining) authorities.

The proposal will be assessed under Part 4, Division 4.1 of the EP&A Act, which establishes an assessment and approval regime for State Significant Development (SSD). Part 4, Division 4.1 applies to development that is declared to be SSD by a State Environmental Planning Policy (SEPP). Section 89J of the EP&A Act specifies that approvals or permits under section 90 of the NPW Act 1974 are not required for approved SSD projects.

Aboriginal Land Rights Act (1983)

The Aboriginal Land Rights Act 1983 is administered by the NSW Department of Human Services - Aboriginal Affairs. This Act established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the Act to; (a) take action to protect the culture and heritage

of Aboriginal persons in the council's area, subject to any other law, and (b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

Native Title Act (1994)

The Native Title Act 1994 was introduced to work in conjunction with the Commonwealth Native Title Act. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

12.0 SIGNIFICANCE ASSESSMENT

12.1 Assessment Criteria

Archaeological significance refers to the archaeological or scientific importance of a landscape or area. This is characterised by using archaeological criteria such as archaeological research potential, representativeness and rarity of the archaeological resource and potential for educational values. These are outlined below:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

The archaeological potential of each recorded Aboriginal site and the Precinct as a whole is closely related to significance values. Areas of moderate archaeological potential have research potential and the potential for Aboriginal objects that are representative of Cumberland Plain archaeology. Areas of moderate archaeological potential are less likely to contain Aboriginal objects with rarity values.

Areas of low archaeological potential have limited research potential and rarity values, and are likely to be in disturbed contexts not representative of intact areas on the Cumberland Plain. All recorded Aboriginal sites and areas of archaeological potential within the Precinct have education potential.

Areas of low archaeological potential have limited research potential and rarity values, and are likely to be in disturbed contexts not representative of intact areas on the Cumberland Plain.

The distribution and nature of Aboriginal sites and associated heritage values provide important educational values for Aboriginal land-use on the Cumberland Plain. Higher educational values are associated with more intact areas on the Cumberland Plain such as Bungarribee Precinct considering the dense residential and commercial development in the region.

12.2 Archaeological Significance Assessment

The archaeological significance of identified Aboriginal sites within the study area is summarised in Table 3 below

Table 3: Archaeological Significance Assessment

Site Name	Research Potential	Scientific/ Archaeological Value	Representative Value	Rarity Value	Overall Significance
45-5-0455	Low	Low	Moderate	Low	Low
45-5-0465	Low	Low	Moderate	Low	Low
45-5-4433	Low	Low	Moderate	Low	Low
SZ PAD1*	Moderate	Moderate	Low/moderate	Low/moderate	Moderate
SZ PAD2	Unknown	Unknown	Unknown	Unknown	Unknown

* = likely significance based on the results of salvage excavation at Bungarribee North by Artefact (2015)

12.2.1 Sites of low archaeological significance

Sites listed as demonstrating low archaeological significance have been identified as impacted or associated with disturbance. AHIMS site 45-5-0459 is located in an area which has been heavily landscaped and modified as part of drainage, vegetation and pathway works. AHIMS site 45-5-3253 and 45-5-3255 are associated with disturbance and introduced gravels from construction of airstrips, taxiways and the OTC station. These sites do not represent research potential or archaeological value, and demonstrate low rarity and representative values in the local context.

12.2.2 SZ PAD1 – likely to demonstrate moderate archaeological significance

Results of archaeological excavation on the Eastern Creek floodplain at Bungarribee North by Artefact (2015) retrieved a moderate density sub-surface stone artefact scatter across a disturbed floodplain landform. The results of that excavation and identification of SZ PAD1 as an extension of that area of archaeological potential suggests that the assessed level of moderate research potential at Bungarribee North is likely to also be relevant to SZ PAD1.

SZ PAD1 is likely to have a moderate' archaeological significance based on the results of excavation at Bungarribee North. That assessment was based on the following factors:

- Although the raw materials are common to the region, stone artefact analysis has indicated a preference for mudstone in formal tool manufacture.
- Several formal tool types were identified within the assemblage and are indicative of a Bondaian assemblage associated with the ASTT (likely dating anywhere from 8,000 BP up until the contact period)
- At least one and potentially more knapping events are present within the area
- This type of site is less common within the Bungarribee Precinct.

Based on the results of salvage excavation, Bungaribee North was assessed as demonstrating moderate archaeological significance. The archaeological salvage has confirmed the research potential of the Eastern Creek floodplain and surrounding slope landform contexts. The site demonstrates low to moderate representative, rarity and education values.

12.2.3 Unknown archaeological significance – SZ PAD2

SZ PAD2 is considered to demonstrate unknown archaeological significance. This is due to the fact that the PAD is located within an area of limited surface visibility and therefore any artefacts that may be present on the surface were not detected during the survey. The PAD has been identified within an area of moderate archaeological potential associated with a crest landform context. Therefore there is a moderate potential that intact archaeological deposits and subsurface cultural material may be identified during excavations. Crest landforms have not been previously investigated within the Bungaribee precinct therefore the archaeological significance, extent and nature of SZ PAD2 cannot be accurately assessed until further archaeological investigations have been conducted.

12.3 Cultural Significance

Any comments received from Aboriginal stakeholders on the cultural significance of the study area would be attached with the final version of this report. The cultural significance of the study area will be addressed in the Aboriginal Cultural Heritage Assessment Report (ACHAR) prepared for the project prior to impacts.

13.0 IMPACT ASSESSMENT

It is assumed that the initial impacts associated within the proposal will be land clearance and ground disturbance works associated with the development of the following park features:

- Main car park (728 spaces) – Gravel surface, vehicle control
- Overflow car park (659 spaces) – Gravel surface, vehicle control
- Entry, administrative and exhibition facilities
- Moat water feature – Varying depth between 1.8-3m
- Varied animal enclosures including nocturnal house, aquarium and aviary.
- Service access roads.
- Amenities
- Holding paddocks
- Picnic areas

The levels of surface impact within the development area will be high and will impact any identified Aboriginal objects or areas of PAD in those areas.

13.1 Summary of Impacts

Based on the current masterplan, specific impacts to each site are outlined below:

- AHIMS Site # 45-5-0465 will be impacted by car park works including associated earth works and tree planting
- AHIMS Site # 45-5-0455 will be impacted by the dingo enclosure
- AHIMS Site #45-5-4433 will be impacted by the African grassland exhibit
- Impacts to 0.4 hectares of SZ PAD1 from extension of the car park into that area as well as a portion of access road around the western perimeter of the zoo exhibits
- SZ PAD 2 will be impacted by a variety of exhibits including the Tiger, Elephant and Baboon exhibits as well as the back of house building development associated with these areas.

Table 4: Summary of impacts to identified Aboriginal objects and areas of PAD

Site Number	Type of Harm	Degree of Harm	Consequence of Harm
45-5-0455	Direct	Total	Total loss of value
45-5-0465	Direct	Total	Total loss of value
45-5-4433	Direct	Total	Total loss of value
SZ PAD1	Direct	Partial	Partial loss of value
SZ PAD2	Direct	Total	Total loss of value

14.0 MANAGEMENT AND MITIGATION MEASURES

14.1 Guiding Principles

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved. If conservation is not practical, measures should be taken to mitigate impacts to Aboriginal sites.

The nature of mitigation measures is primarily based on an assessment of archaeological significance. As the archaeological significance of Aboriginal sites within the Precinct could not be accurately determined, and the Masterplan impacts at this stage are indicative, a framework of mitigation and management measures based on archaeological potential has been established, and is outlined below.

14.2 Mitigation Measures

The mitigation measures recommended vary depending on the assessment of archaeological significance of the Aboriginal site which is based on its research potential, rarity, representativeness and educational value. In general the significance of a site would involve the following mitigation measures:

- Low archaeological significance – Conservation where possible. An AHIP would be required to impact the site before works can commence.
- Moderate archaeological significance – Conservation where possible. If conservation was not practicable further archaeological investigation would be required such as salvage excavations or surface collection under an AHIP.
- High archaeological significance – Conservation as a priority. An AHIP would be required only if other practical alternatives have been discounted. Conditions of this AHIP would depend on the nature of the site, but may include removal and preservation of scarred trees, or comprehensive salvage excavations.
- Unknown archaeological significance – Conservation where possible. Further investigation under the OEH Code of Practice (2010) will be required to assess the extent and significance of the PAD. Test excavation is not a mitigation measure.

Table 5 provides a summary of the consequence of impacts and indicative management and mitigation measures. This information would be updated once the progressed concept design has been integrated into this report and the impact assessment revised.

Table 5: Summary of impacts and mitigation/management measures

Site ID	Site names	Site type	Significance	Consequence of Impact	Mitigation/management measures
45-5-0455	Bungarrabee 10 Blacktown	Artefact Scatter	Moderate	Total loss of value	None required

Site ID	Site names	Site type	Significance	Consequence of Impact	Mitigation/management measures
45-5-0465	Bungarribee 18 Blacktown	Artefact Scatter	Low	Total loss of value	None required
45-5-4433	BP AS6	Artefact Scatter	Moderate	Total loss of value	None required
-	SZ PAD1	PAD	Moderate (likely level of archaeological significance)	Possible partial loss of value	Mitigation measures to be determined in ACHAR following finalisation of impacts
-	SZ PAD2	PAD	Unknown	Total loss of value	Further investigation in accordance with OEH code of practice required

14.2.1 AHIMS Sites 45-5-0455, 45-5-0465 and 45-5-4433

AHIMS sites 45-5-0455, 45-5-0465 and 45-5-4433 have been assessed as demonstrating low archaeological significance and low research potential. No further archaeological investigation of the three recorded Aboriginal sites is recommended.

14.2.2 SZ PAD1

SZ PAD1 has been assessed as likely to demonstrate moderate archaeological significance based on the results of archaeological salvage excavation at Bungarribee North by Artefact (2015). As such, archaeological test excavation in accordance with the OEH code of practice to determine the archaeological significance of SZ PAD1 is not recommended.

The current layout plan for Sydney Zoo includes extension of the car park to cover approximately 0.4 hectares of SZ PAD1. A final impact assessment will be incorporated into the ACHAR prior to works commencing. The ACHAR will outline the exact extent of impact and what, if any, archaeological mitigation measures will be required prior to impacts. Potential archaeological mitigation measures includes archaeological salvage excavation within that portion of SZ PAD1 that will be impacted by the works.

14.2.3 SZ PAD2

SZ PAD2 will be directly impacted by the proposal, resulting in total loss of value.

The archaeological significance of SZ PAD2 is at present unknown. The PAD has been assessed as having moderate archaeological potential. If impacts to the PAD cannot be avoided by the proposal, test excavation in accordance with the OEH code of practice is recommended in order to determine whether sub-surface intact archaeological deposits and Aboriginal objects are present in that area. The purpose of these excavations would be to assess the nature and significance of potential sub-surface archaeology at SZ PAD2 and not to mitigate against impacts.

14.3 Management Strategies

A comprehensive discussion of management strategies and processes would be prepared as part of the ACHAR in consultation with registered Aboriginal stakeholders. This discussion would outline procedures for management of unexpected archaeological finds, including human remains, along with processes to manage changes in proposed impacts.

15.0 CONCLUSIONS AND RECOMMENDATIONS

The following recommendations were based on consideration of:

- Statutory requirements under the EP&A Act 1979.
- The requirements of the SEARs.
- The results of the background research, site survey and assessment.
- The likely impacts of the proposed development.
- The interests of DLALC.

The findings of the ASR are:

- Three previously recorded Aboriginal sites are located within the study area (AHIMS sites # 45-5-0455, #45-5-0465 and # 45-5-4433). These sites were assessed as demonstrating low archaeological significance.
- Two areas of Potential Archaeological Deposit (PAD) were identified during the study (SZ PAD1 and SZ PAD2).
- Disturbance was generally assessed to be low with the exception of the modified drainage channel and pipeline located in eastern and western portion of the study area respectively.

It is therefore recommended that:

- No further archaeological investigation of AHIMS sites 45-5-0455, 45-5-0465 and 45-5-4433 is recommended.
- As the likely archaeological significance of SZ PAD1 has been determined based on archaeological salvage excavation in a comparable landform at Bungarribee North, archaeological test excavation in that portion of SZ PAD1 that will be impacted is not required.
- Archaeological test excavation in accordance with the OEH code of practice as best practice is recommended at SZ PAD2 to determine the extent and archaeological significance of PAD in that area.
- Following completion of archaeological test excavation at SZ PAD2, a report would be prepared that outlines the findings of the investigation and assesses the archaeological significance of the PAD.
- Following the completion of archaeological test excavation and reporting at SZ PAD2, an Aboriginal Cultural Heritage Assessment Report (ACHAR) would be prepared for the study area that includes the results of consultation with registered Aboriginal stakeholders, an assessment of cultural significance, a final impact assessment and management measures for the proposal.
- The ACHAR would include an outline of what mitigation and management measures would be required within that portion of SZ PAD1 impacted by the extension of the car park into that area.
- If changes are made to the proposed works which may impact any area not investigated in this ASR, further archaeological investigation may be required.

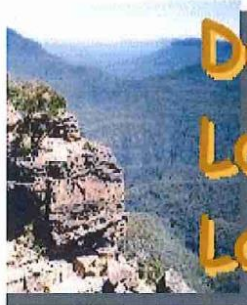
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17.0 APPENDICES

17.1 Appendix A Comments received from DLALC



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Sydney Zoo
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Our Ref: 2579

15 September 2015

PROTECTION OF ABORIGINAL CULTURAL HERITAGE

Sydney Zoo

Western Sydney Parkland, Doonside

Attention: Jake Burgess,

A representative of Deerubbin Local Aboriginal Land Council inspected the area of the proposed Sydney Zoo, Doonside on Monday, 3 August 2015. An Aboriginal cultural heritage assessment was undertaken to evaluate the likely impact the proposed development has on the cultural heritage of the land.

Although the findings were, that, no Aboriginal cultural material had been located during the walkover of the study area, nevertheless, Deerubbin Local Aboriginal Land Council, recommends, that the area be further investigated, particularly in light of the fact that previous assessment work and subsequent (archaeological) investigations of the land within close proximity to the study area led to several Aboriginal sites being found

Yours Faithfully,

Steven Randall

(Senior Aboriginal Cultural Heritage Officer)

c.c. Miranda Firman – Office of Environment & Heritage

c.c. Josh Symon - Artefact



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