ABORIGINAL HERITAGE DUE DILIGENCE ASSESSMENT

For

LOT 1, DP 1156433

Lang Drive Bolwarra Heights

FINAL DRAFT

A Report to

K. Gale

By

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1. INTRODUCTION & BACKGROUND

The consultant was engaged by K. Gale of 23 Lang Drive Bolwarra Heights to carry out an Aboriginal Heritage due diligence assessment. The assessment was required in order to determine likely Aboriginal heritage constraints and opportunities for a development proposal of land identified as: LOT1 DP 1156433 Lang Drive Bolwarra Heights. The proposed sub-division project is being carried out by property developer Mr K. Gale.

Currently the land is zoned RU5 Large Lot Residential under the Maitland City Council Local Environment Plan (2011). The land is located within Maitland City Council Local Government Area (See Figures 1 & 2: Appendix 1). The assessment area covers approximately 4.05 ha or 0.04km2

The aims of this due diligence assessment were to:

- Review any relevant existing Aboriginal heritage information and relevant data-bases;
- Carry out an archaeological risk assessment to identify likely Aboriginal heritage issues on the ground and make an assessment of likely Aboriginal heritage potential;
- Provide advice as to the likely land use restrictions posed by known Aboriginal heritage objects or potential Aboriginal heritage objects;
- Provide appropriate risk management advice in order to reduce any likely impacts on identified Aboriginal heritage places or sites as a result of the development proposal; and
- Determine whether or not further archaeological investigation is required.

1.1 Project Description

The proposed 4.0 ha site consists of one major lot (Lot 1 DP 1156433, Figure 2: Appendix 1) within this area there are seven proposed lots with a minimum lot size of 5000sqm (Figure 2: Appendix 1). Lot 1 (Figure 2: Appendix 1 and Plate 1: Appendix 2) within the seven proposed lots contains existing dwellings and will not be developed. The proposed subdivision will require the construction of one road with a road reserve width of 18 m, some minor storm water drainage and only relatively minor utility service augmentation.

2. LEGISLATIVE FRAMEWORK

2.1 The National Parks and Wildlife Act 1974 (NSW)

The *National Parks and Wildlife Act 1974* (NSW) (the 'NPW Act') is the primary piece of legislation for the protection of Aboriginal cultural heritage in New South Wales. The Office of Environment and Heritage (OEH) administer the NPW Act. The NPW Act provides statutory protection for Aboriginal objects by making it illegal to harm Aboriginal objects and Aboriginal places, and by providing two tiers of offence against which individuals or corporations who harm Aboriginal objects or Aboriginal places can be prosecuted. The NPW Act defines Aboriginal objects and Aboriginal places:

> *Aboriginal object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non Aboriginal extraction, and includes Aboriginal remains.*
>
> *Aboriginal place means any place declared to be an Aboriginal place under section 84.*

The highest tier offences are reserved for knowledgeable harm of Aboriginal objects or knowledgeable desecration of Aboriginal places. Second tier offences are strict liability offences – that is, offences regardless of whether or not the offender knows they are harming an Aboriginal object or desecrating and Aboriginal place – against which defences may be established under the *National Parks and Wildlife Regulation 2009* (NSW) (the 'NPW Regulation').

Section 87 of the NPW Act establishes defences against prosecution under s.86 (1), (2) or (4). The defences are as follows:

- An Aboriginal Heritage Impact Permit (AHIP) authorising the harm (s.87 (1));
- Exercising due diligence to establish Aboriginal objects will not be harmed (s.87 (2)) Due diligence may be achieved by compliance with requirements set out in the *National Parks and Wildlife Regulation 2009* (the NPW Regulation) or a code of practice adopted or prescribed by the NPW Regulation (s.87 (3));
- Undertaking "low impact" activities (s.87 (4)).

This assessment report follows the Due Diligence Code and aims to establish whether Aboriginal objects would be harmed by the proposed development of residential land in accordance with S.87 (2) of the NWP Regulation.

2.2 The National Parks and Wildlife Regulation 2009 (NSW)

The NPW Regulation 2009 (cl.80A) assigns the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (NSW Department of Environment, Climate Change and Water 2010) (the Code) as one of the codes of practice that can be complied with pursuant to s.87 of the NPW Act.

In addition the NPW Regulation describes "certain low impact activities" in s.80B. Disturbed land is defined by cl.80B (4) as "disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable". Examples given in the notes to cl.80B (4) include "construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure)".

2.3 The Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales 2010

The Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (the Code) describes the process that must be followed and the actions that must be taken by a proponent, and the site conditions that must be satisfied, to show due diligence in the consideration of potential harm to Aboriginal objects.

The Due Diligence Code sets out a basic framework with the following steps followed in order to make an assessment of whether or not proposed activities may impact Aboriginal objects:

Step 1. *Will the activity disturb the ground surface?*

Step 2a. *Search the AHIMS database and use any other sources of information of which you are already aware*

Step 2b. *Activities in areas where landscape features indicate the presence of Aboriginal objects*

Step 4. *Desktop assessment and visual inspection*

Step 5. *Further investigations and impact assessment*

The process set out in the Code involves consideration of harm to Aboriginal objects at increasing levels of detail, with additional information incorporated at each step and used to support the decisions being made. If the proposed activities are not "low impact activities" (a defence for which is provided under the Regulation) the considerations result in a determination of whether or not:

- Further approval (an AHIP) under the NPW Act is required; or
- Due Diligence obligations for the protection of Aboriginal objects are discharged by the process under the Code.

Under the Due Diligence Code (DECC 2010) significant disturbance means disturbance of the topsoil or surface rock layer of the ground, such as by digging, grading, bulldozing, scraping, ploughing, drilling or dredging; erecting a building or structure the clearing of native vegetation by disturbing root systems and exposing the underlying soil (See Appendix 3).

3. BACKGROUND ABORIGINAL HERITAGE RESEARCH

Through the NSW Office of Environment and Heritage (OEH) an extensive Aboriginal Heritage Information Management System (AHIMS) search was conducted by ARAS Pty Ltd on 25th of April 2016 (AHIMS search ID 222190). The search covered an area of approximately 2 km^2 that encompassed the assessment area. There are no registered Aboriginal archaeological sites located near (within at least 1 km) or directly on the search area. The AHIMS search results are presented in Table 1 below. A majority of these thirty six registered Aboriginal sites are located to the west and south of the assessment area (Figure 3: Appendix 1).

Table 1: AHIM's search results (ID# 222190) for sites located near the assessment area

OEH Site ID No.	Site name	Eastings	Northings	Site Type
38-4-0061	Bolwarra Burial Site	365747	6379933	Burial
38-4-0066	Two Mile Creek 1	367330	6373300	Isolated Find
38-4-0067	Two Mile Creek 4	367510	6373320	Isolated Find
38-4-0068	Two Mile Creek 3	367720	6373450	Isolated Find
38-4-0069	Two Mile Creek 2	367728	6373220	Open Campsite
38-4-0077	Farley: W	359900	6376800	Axe Grinding Groove
38-4-0120	Bolwarra 1: Bolwarra heights	365750	6380500	Open Campsite
38-4-0155	Walka	364350	6379300	Axe Grinding Groove
38-4-0161	Delta 3	366300	6372700	Open Campsite
38-4-0162	Delta Site 2	366000	6372300	Isolated Find
38-4-0163	Delta Site 1	365900	6372200	Open Campsite
38-4-0164	Delta 4	366300	6372600	Open Campsite
38-4-0165	Delta 5	365700	6372300	Isolated Find
38-4-0166	Delta 6	366500	6372200	Open Campsite
38-4-0330	Delta Colliery Waterhole	366550	6372070	Waterhole/Well
38-4-0417	Kyle Street 1: KS 1	359860	6379440	Open Campsite
38-4-0418	Kyle Street 2: KS 2	360350	6379750	Open Campsite
38-4-0419	Kyle Street 3: KS 3	360360	6379650	Isolated Find
38-4-0420	Kyle Street 4: KS4	360360	6379550	Open Campsite
38-4-0421	Kyle Street 5: KS5	360410	6379400	Open Campsite
38-4-0422	Kyle Street 6: KS6	360450	6379170	Open Campsite
38-4-0423	Kyle Street 7: KS7	360420	6379100	Open Campsite

OEH Site ID No.	Site name	Eastings	Northings	Site Type
38-4-0424	Kyle Street 8: KS8	360510	6379220	Open Campsite
38-4-0425	Black Hill 3: BH3	373100	6365820	Open Campsite
38-4-0426	FMC 3	370500	6372450	Open Campsite
38-4-0677	Aberglasslyn Rd PAD	362800	6380200	Potential Archaeological Deposit
38-4-0430	Bolwarra 5: B5	366400	6381230	Open Campsite
38-4-0384	Bolwarra 4:	366780	6381220	Open Campsite
38-4-0383	Bolwarra 3	365890	6381150	Open Campsite
38-4-0144	WW3	363760	6379890	Axe Grinding Groove
38-4-0422	Kyle Street 6: KS6	360450	6379170	Open Campsite
38-4-0142	WW2	364050	6379400	Open Campsite
38-4-0119	Bolwarra 2: Bolwarra Heights	366880	6381110	Scarred Tree
38-4-0120	Bolwarra 1: Bolwarra Heights	365750	6380500	Open Campsite
38-4-0061	Bolwarra Burial Site	365747	6379933	Burial
38-4-0059	Bolwarra Heights: Bolwarra	366635 6381321	366635 6381321	Scarred Tree
38-4-0058	Hunter River: Bolwarra	365928 6380028	365928 6380028	Open Campsite

The above Aboriginal site distribution list is only a small portion of what is known for the entire Lower Hunter Plains region in the Sydney Basin. Aboriginal occupation sites have been recorded along the following major alluvial/riverine landforms, creek catchments and associated forest/wetlands but are not necessarily registered:

- Hunter River;
- Paterson River;
- Four Mile Creek;

- Two Mile Creek;
- Swamp Creek;
- Howes Lagoon;
- McClement's Swamp;
- Woodberry Swamp;
- Wentworth Swamp;
- Woodville Swamp;
- Wallis Creek; and
- Scotch Dairy Creek.

The land is located within the tribal boundary area of the Wonnarua Aboriginal language group (Capel 1970, Tindale 1974, and Horton 1994). According to OEH database records, there are no existing or proposed Aboriginal place declarations for the land in question.

3.1 Previous Archaeological Research and Predictive Modelling

Previous archaeological work in the Lower Hunter (See, Baker (1997), Beasant (2002), Brayshaw (1984), Hamm (2008), HLA-Envirosciences Pty Ltd (1995) Kuskie (1994, 2000, 2004, 2006, 2008), Kuskie & Clarke (2006), Kuskie & Kamminga (2000), Umwelt Australia (1991, 1999a, 2001a); ERM (2002a); Dagg (1996); Curran (Resource Planning 1994); Curran (Resource Planning 1993); Dean-Jones (1986) and Silcox & Ruig 1995) have provided solid evidence concerning the known site patterning and Aboriginal occupation models. In the Hunter Valley Aboriginal occupation has been reported to be as old as 20,000 years BP (Koetigg 1987). In the Lower Hunter at Moffats Swamp, Baker reports Aborginal occuaption dating back to 17,000 years BP (Baker 1994). However the majority of dated archaeological sites in the Lower Hunter region are ususally no older than 5,000 years BP (Brayshaw 1994, Kuskie & Clarke 2004).

At a local government level Maitland City Council commissioned a study to look at Aboriginal heritage landscapes in the general Thornton area (i.e. Thornton Masterplan). This study (Beasant 2002) came up with a number of criteria showing where Aboriginal sites and objects would be detected. It predicted that:

- Sites increase in density on slopes less than 5 degrees;
- Sites increase in density as they are found near or adjacent to existing wetlands;

- Knolls located adjacent to wetlands containing outcrops of flakeable stone are likely to contain sites; and
- Sites are less likely to occur on land with slopes greater than 10 degrees (Beasant 11: 2002).

In her work in the Rouse Hill area in Sydney, McDonald (2001) suggests that site patterning and intensity of occupation correlates well with stream order. Sites located near permanent water were more likely to contain complex and overlapping use over longer periods of time. The amount of land-use disturbance is also a significant factor in the survival of archaeological evidence as is the nature of the depositional environment.

In a recent article about the archaeology of the central Lowlands of the Hunter Valley: *Why so few early sites have been found in this archaeologically rich landscape*, (Hughes et al 2014) Hughes argues that it is likely that due to the soil formation processes that sites containing archaeological material older than 10,000 years have been either completely removed or have been widely dispersed across the landscape and are no longer recognisable as Pleistocene age occupation surfaces (Hughes et al 2014:34). The best potential to detect Pleistocene age open sites is located within sand bodies. However Hughes et al (2014:35) also make the good point that archaeologists have failed to properly investigate the potential for Pleistocene age occupation in the B horizon of the commonly occurring Duplex or Texture Contrast Soils in the Hunter Valley. Nearly all the archaeological material recovered in these soil types has been within the A2 soil horizon.

Whilst no regional or local Aboriginal heritage study is available for the Lower Hunter region, it is acknowledged that evidence of Aboriginal occupation is widespread and in some locations particularly abundant. The NSW Department of Environment and Conservation (DEC 2006) has provided a broad Aboriginal site location model which predicts the location of different types of prehistoric Aboriginal land-use (Figure 4: Appendix 1).

A regional study completed for the Upper Hunter which covers parts of the Central Lowlands land system (ERM 2004) tried to model which areas of landscape might offer unique potential for Aboriginal archaeological resources. In their base-line report on behalf of the Upper Hunter Heritage Trust (ERM) states that:

> *The overwhelming majority of archaeological sites recorded in the study area are stone artefact scatters and isolated artefacts. These sites are common in most regions, have been recorded, and many (in the Central Lowlands) have been salvaged and the assemblages are available for archaeologists for further investigation. Most other site types are quite rare and have not been well recorded studied or salvaged* (ERM 2004:74).

These rarer site types include: Burials, Scarred Trees, Carved Trees, Stone Arrangements and estuarine Shell Middens.

In addition to the above site-type assessment, some landscapes and geomorphic units contain potential for unique archaeology or Pleistocene Age cultural remains. Some of these landform types are also considered to be poorly understood for the region. These landform features include:

- Sand dunes;
- Sand sheets; and
- Hunter River terraces.

As well as these rarer landforms, which could contain significant cultural resources, other local landscapes may contain cultural landscape values which are important to Aboriginal people. Examples of these cultural landscapes in the Lower Hunter region may include: fringe campsites and mission sites, pristine wetlands, riverine corridors, untouched woodlands, forested landscapes and prominent scenic escarpments, all having a natural and cultural heritage quality.

Kuskie and Kamminga (2000) have further argued that in parts of the Lower Hunter Aboriginal occupation is concentrated where multiple resource zones were present (primary zones), and that the larger and more reliable the resource base was, the more frequent and longer the occupation episodes became (2000:604). In areas outside of primary resource zones (secondary zones), Aboriginal occupation is more sporadic and only focused within 50 m of higher order watercourses and associated level to very gently inclined valley flats (2000:605). These locations were more likely to be utilised seasonally and camp sites were occupied by small groups of people for varying lengths of time (but of typically short duration). In areas outside of primary and secondary zones, Aboriginal land-use tended to involve hunting and gathering activities by small parties of men and/or women and children, along with transitory movement between locations and procurement of stone raw materials (2004:605).

The most significant archaeological work conducted near the Maitland/Bolwarra area is that undertaken by Kuskie and Kamminga at Black Hill and Woods Gully (Kuskie & Kamminga 2000). This project was located within the Hexham land-system (Story et al 1963) approximately 17 km north-west of Newcastle and approximately 30 km south-east of Maitland. The area consists of undulating low hills and rises. Hexham Swamp is located approximately 36 km south-east of the study area, with the Hunter River located a few kilometres to the north. The land under investigation was to be developed as part of the RTA's F3 freeway extension between Minmi and the New England Highway.

Three archaeologists have contributed to this project (Effenberger 1995, Baker 1996, Kuskie & Kamminga 2000). The most significant excavation and salvage work has been undertaken by Kuskie & Kamminga (2000). The original survey work and sub-surface testing was focussed on two sites: Black Hill 2 (38-4-376) and Woods Gully (38-4-410). Both sites were originally recorded as scatters of stone artefacts with extensive sub-surface deposits. However, the main concern for researchers was how much sub-surface evidence was actually present at the two sites.

The principal problem in the salvage of both sites was to determine the extent of sub-surface deposits and to ascertain how that could be effectively recovered. The work of Kuskie and Kamminga (2000) is significant in that it attempts to use a range of recovery techniques, assessing the validity of each one. It also uses finer scale analytical techniques. These include:

- On-site lithic work station, where every lithic item was examined under a low magnification binocular microscope and identified and recorded database;
- Residue and usewear analysis on a significant number of recovered items using a total retrieval process;
- Replicative microblade and microlith knapping experiments; and
- A combination of test excavation, broad area excavation by shovel and trowel, and mechanical surface scrapes.

The main results are summarised below:

- In the first phase, 612 test pits (0.25 m x 0.25 m) were dug, initially measuring 38.25 m^2. These were excavated 3 m apart on a rectangular grid across each site. This approach was used to initially detect the basic patterns of sub surface evidence.
- In the second phase, larger areas were opened up using broad area excavation by shovel and trowel.
- At Black Hill, 63 m^2 were excavated on a ridge crest. At Woods Gully, 87 m^2 were excavated adjacent to a watercourse including 39 m^2 of narrow trench leading away from the creek upslope. Hand excavation was carried out, digging in 0.25 m x 25 m unit squares in successive 5 – 10 cm spits. Each bucket of deposit was labelled and transported to a sieving station. The method of 'total sieve retrieval' was used for the first time anywhere in the Hunter Valley. This method involved retention of all residues in the sieve, which was artificially dried. Items were later extracted under laboratory conditions.
- In the third phase, surface scrapes were used to detect larger features such as hearth and heat treatment pits. Five surface scrapes were used to remove grass cover and upper soil

layers at Black Hill 2 and two at Woods Gully. After each surface scrape had been undertaken, spoils were examined carefully and any material recovered. An additional area was identified for broad excavation (8 m^2) using this technique.

- A total area of 196.25 m^2 was excavated by hand with surface scrapes making up a combined area of 34,422 m^2. A total of 72.4 tonnes of soil were excavated. A total of 37,585 cultural items were identified and recorded. This was made up of 22,921 recognisable artefacts with 14,664 lithic fragments. Approximately 546.2 artefacts/m^3 were recovered from Black Hill 2 and 209.5 artefacts/m^3 from Woods Gully.
- 44 artefact categories were defined for Black Hill 2 and Woods Gully. Six stone working activities were identified, these being: bi-polar, microblade production, non-specific stone working, and backing retouch of microblades, loss or intentional discard of non-microlithic tools and intentional loss or discard of microlithic tools. Production of microblades was the most common stone working activity.
- Replicative microblade and microlithic knapping experiments using silcrete and rhyolitic tuff (mudstone) showed that possibly less than 150 Bondi points were made on site at broad area C3/B and less than half that number at broad area F5/A. A huge amount of microblade debitage was recovered showing a high percentage of 'waste'. A considerable time was spent preparing silcrete for heat treatment and subsequent flaking. Researchers concluded that given the amount of Bondi point production, its role and purpose may have been of some social significance.
- Artefact assemblages are predominantly small (89 %) measuring less than 20mm in length. Over 60 % of all artefacts recorded measured less than 10 mm in length. This recording of high density numbers of small artefacts was probably the result of intense microblade production and the use of the total sieve retrieval method. Over 70 % of the assemblages from Black Hill 2 and Woods Gully contain rhyolitic tuff with silcrete making up just over 20 % of the raw materials used.
- There is substantial evidence that a high proportion of silcrete assemblages have been heat-affected, with two heat-treatment pits being identified for the Black Hill 2 site.
- Spatial analysis of environmental variables shows that human activity was focused on the level crest and gently inclined north-facing upper slope at zone C3 (Black Hill 2). A single direct date of 2,130+ years BP was retrieved from a fireplace from Woods Gully. It is assumed that no site was likely to be older than 4,000 years BP.

Kuskie and Kamminga argue that broad area excavation has allowed them to address all of their relevant research questions. They suggest that tuff and silcrete were the primary stone raw materials used for production of tools in the Central Lowlands of the Hunter Valley. Heat treatment of silcrete was widespread. A majority of artefacts recorded are the result of microblade production with implements occurring widely but in low numbers. Bi-polar knapping occurs on sites but in low frequency.

A model of occupation was put forward for Black Hill 2 and Woods Gully. Human settlement probably represented one or more nuclear or extended family base camps, involving low numbers of people and several episodes of short-term occupation.

3.1.1 Woodberry Swamp Test Excavations: Thornton North Lot 2 & 310

Archaeological test excavation work undertaken at Thornton North by Hamm (2008) for land overlooking Woodberry Swamp has also revealed interesting regional archaeological results. This area is located within the Lower Hunter Wetlands environmental zone and has relevance to the current study. The principal method of archaeological testing used was shovel test pitting and grader scrapes. Shovel testing was also used where intact deposits may have been detected. The grader scrapes were strategically positioned near existing sites on Lots 2 and 310 and within a ridge crest land unit on Lot 2, the results are as follows:

- A total of 67 (1.0 m x 0.50 m x 0.20 m averaged) shovel test pits were excavated parallel to the main ephemeral drainage on Lot 2 within 50 – 100 m of the existing flood-line. A total of 209 artefacts were recovered from these test pits.
- A total of 13 grader scrapes were undertaken across Lots 2 & 310. These were positioned in relation to the main gully/ephemeral stream section on Lot 310 adjacent to the existing sites and on the main ridge crest land unit on Lot 2. A total of 58 artefacts were recovered as a result of this mechanical testing.
- A total 14.23 tonnes of soil was wet sieved using standard 5 mm and 8 mm sieve mesh.
- A total of 267 artefacts were recovered from the shovel test pits and grader scrapes at Lot 2.
- No artefacts were recovered from Lot 310 as a result of grader scrapes.
- No cultural features (i.e. hearths or campsite structures) were recorded for Lots 310 or 2.
- The majority of the artefacts recovered were made from red or yellow silcrete, with minor quantities of tuff being present.

- The majority of the artefacts recovered were broken flakes, followed by complete flakes and flaked pieces made from silcrete raw materials. Retouched or utilised stone tool items were poorly represented within the salvaged assemblage. Only 5 exhausted blade like cores were recovered and three broken backed items.

Artefact analysis shows that the majority of the assemblage recovered reveals opportunistic flaking patterns and general maintenance activity associated with small tool production and manufacture principally with silcrete raw materials. A large piece of heat treated silcrete also adds weight to the argument that people were preparing stone for specialised flaking rather than general domestic use. It is likely that prepared cores were already in use while Aboriginal people were camping in this area in the past.

A low density retouched assemblage and an absence of finished tools (i.e. food processing type tools) indicates that Lot 2 was probably a hunting camp more likely to be associated with gearing up tool kits for backed item production. A lack of hearth like structures and associated hearth heat retainers would also indicate a short term hunting camp rather than a more permanent base camp occupation area with multiple activities taking place on site.

The location of a site on Lot 2 adjacent to an existing drainage feature associated with Woodberry Swamp supports previous land-use models for the general area (i.e. Kuskie 2004, 2006). The relationship to stream type and the impact of land-use is critical in detecting larger more significant base camp sites in this region.

The archaeological material recovered on Lot 2 is assessed to be commonly represented in the local area and not considered scientifically significant based on previous archaeological research, Aboriginal community values, past land-use impacts and the nature of the recovered material.

The above evidence also indicates that surface evidence alone cannot adequately detect the real extent of prehistoric Aboriginal settlement patterns in this type of Lower Hunter Wetland landscape.

- The distribution and size of recovered artefacts shows that flood damage may have removed a larger proportion of smaller items from the deposits over time.
- The distribution pattern and the density of artefacts recovered show a narrow band of occupation from within 50 – 70 m either side of the existing creek-line within a gentle slope alluvial land-unit.
- A lack of artefacts detected on top of Lot 2's main ridge crest indicates that Aboriginal people were rather specific about where they positioned their hunting camps in the past.

- It is likely based on previous research in the area and given the nature of the sediments excavated that the artefacts recovered are likely to be no more than late Holocene in age (i.e. within the last 2,000 years BP).
- The grader scrapes and shovel testing have revealed that much of the deposits within Lots 310 & 2 are disturbed from either ploughing and or bioturbation through plant and insect activity. No charcoal deposit examined can be described as cultural in origin. As a result no samples were extracted for dating purposes.

Archaeological test excavation work undertaken by Niche Environment & Heritage (Niche Environment & Heritage 2012) at Thornton Rural Fire Brigade site for the RTA revealed an extensive open site. This area is part of the Woodberry swamp complex. Over 22,000 artefacts were recovered in the test excavation work from an area of approximately 400 m^2 tested.

3.1.2 Four Mile Creek Catchment and adjoining wetland assessments

Kuskie (2008) carried out a series of archaeological investigations of an area comprising Lots 463 and 464 DP 870019, Lot 64 DP 651132 and Lot 469 DP 881116 of approximately 64 ha (proponent Investa Housing) and part Lot 12 DP 603613 of approximately 120 ha (proponent County Property Group, formerly Beechwood Homes), Raymond Terrace Road, at Thornton. The land is located approximately 6 kms south-east from the present project.

Kuske's original archaeological survey (Kuskie 2004) located seven open archaeological sites see Table 2 below with fifteen loci identified.

Table 2: Site's located as a result of Kuskie's survey of Investa Land (Kuskie 2004a)

Site Name/OEH ID	Location	Site Type	Land Unit
Site Thornton North 2 (TN2): 38-4-884	Area C: Investa Land	Isolated Find: Silcrete flake	Ridge Crest – Simple Slope
Site Thornton North 8 (TN8): 38-4-803	Area C: Investa Land	Isolated Find: Silcrete flake	Ridge Crest – Gentle Slope
Site Thornton North 9 (TN9): 38-4-804	Area C: Investa Land	Artefact Scatter: 43 artefacts	Drainage depression Four Mile Creek
Site Thornton North 20 (TN 20): 38-4-883	Area C: Investa Land	Isolated Find: Single silcrete flake	Drainage depression gently inclined
Site Thornton North 21 (TN 21): 38-4-882	Area C: Investa Land	Artefact Scatter: 2 artefacts	Four Mile Creek flats gently sloping
Site Thornton North 26 (TN26): 38-4-881	Area C: Investa Land	Artefact Scatter: 5 artefacts	Spur Crest Four Mile Creek flats
Site Thornton North 27 (TN 27): 38-4-889	Area C: Investa Land	Isolated Find: 1 silcrete flake	Drainage depression

A total of 54 artefacts were recorded at these sites. These stone artefacts were dominated by silcrete (72 % of the assemblage), with a lower density of volcanic tuff (25 %) and other stone raw materials. The assemblage mainly consist of flakes (45 % of the artefact assemblage), flake portions (28 %) and microblades and microblade portions (16 %). Two microlith implements were identified, a silcrete Bondi point and a tuff geometric microlith. Several non-microlith tools were also identified, a silcrete utilised flake and a silcrete retouched/utilised piece ('scraper').

Following this survey, a number of artefact locations within this survey area were subsequently tested using subsurface excavation methods. The results of this testing are shown in Table 3 below.

Table 3: Subsurface Testing Results Investa Land and Lot 12 Metford from Kuskie and Clarke (2006)

Site Name-Test Unit	Location	Land Unit	Excavation Results
Site TN 3 – Test Area: 5A	Lot 12	Gentle slope down to drainage depression	3 artefacts
Survey Unit TN7 – Test Areas: 3A & 3B	Lot 12	Gentle spur crest	3A: 19 artefacts 3B: 1 artefact
Site TN8 – Test Areas: 4A & 4B	Lot 12	Gentle simple slope-ridge crest	4A: 91 artefacts 4B: 1 artefact
Site TN 9 – Test Area: 5C	Lot 12	Drainage depression Four Mile Creek	71 artefacts
Survey Unit TN 12 – Test Area: 5B	Lot 12	Gently sloping drainage depression	58 artefacts
Survey Unit TN 13 – Test Areas: 2A & 2B	Lot 12	Gentle spur crest	2A: 11 artefacts 2B: 7 artefacts

These test excavations were undertaken in nine separate areas and involved a sample from each of the key different 'environmental/cultural contexts' identified within the study area (Figure X: Appendix 1). Each test area comprised 22 units, each measuring 0.5 x 0.5 m in area, excavated at five metre intervals on a 50 x 5 metre grid. Hence, for each area a total of 5.5 m^2 was excavated. A total, 198 test units were excavated, resulting in a total excavation area of 49.5 m^2, with a total volume of deposit of 22.6 m^3 (22,608 litres) was excavated by hand and wet-sieved (Kuskie and Clarke 2006a).

A total of 262 artefacts were recovered from these test excavations. The artefact densities per conflated square metre was 5.25. The overall mean density of artefacts per cubic metre was 11.50. Artefacts were present in 37 % of the test units (Kuskie & Clarke 2006a).

Further sub surface testing was undertaken in 2007 in the same general landscape of Investa Land now also called Lots 463 and 464 DP 870019, Lot 64 DP 651132 and Lot 469 DP 881116 of approximately 64 ha (proponent Investa Housing) and part Lot 12 DP 603613 (now Lot 121 and Part Lot 122 DP 1108020) of approximately 120 ha (current proponent County Property Group, formerly Beechwood Homes), Raymond Terrace Road, Thornton, under a section 87 permit (Kuskie 2008).

The research design used by Kuskie was based on five distinct environmental contexts ('archaeological terrain units') which were identified within "Area C" study area (Lot 12 and Investa Land, See Table 4 below). These comprised of the gentle ridge crest, very gentle spur crest, gentle spur crest, gentle simple slope and gentle drainage depression units.

Kuskie argues that within a single archaeological terrain unit can also vary, in relation to different use of the area by Aboriginal people with the land unit classificatory system emphasising similarities and masking differences. The land-use by Aboriginal people of each survey area which makes up an archaeological terrain unit could in fact differ, for cultural, environmental or other site location reasons. Prehistoric land-use will vary overtime with one area being preferred over another. Individual survey areas on these simple slopes may host different types and proportions of evidence, reflecting different ways in which these locations were utilised. The results of Kuskie (1994a, 1994b) in the nearby Somerset Park Estate and Kuskie and Clarke (2006a) in Lot 12 support such hypotheses. Repeated use of a general campsite location will mean a greater accumulation of cultural material reflecting a wider range of cultural activities. If this material is quickly buried by soil formation processes then more of the archaeological record is likely to be preserved overtime and be found reasonably intact.

Table 4: Environmental/Cultural Contexts Identified within the "Area C" Survey Area, including the Present Section 87 Investigation Area and Adjacent "Lot 12"(from Kuskie 2008)

Environmental Unit	Cultural Context	Environmental /Cultural Context #	Survey Areas	Identified Heritage Sites	Investa Land (present s87 study area)	Lot 12 (adjacent property)
Gentle ridge crest	Dominant ridgeline leading from East Maitland hills to Hunter River flats and wetlands within 300 m of wetlands	1a	TN1	-	-	TN1
Very gentle spur crest		2a	TN13	TN13	TN13	TN13
Very gentle spur crest	Dominant spur crest leading from dominant ridgeline to Four Mile Creek flats/wetlands - further than 300 m from wetlands	2b	TN13	TN13	-	TN13

Environmental Unit	Cultural Context	Environmental /Cultural Context #	Survey Areas	Identified Heritage Sites	Investa Land (present s87 study area)	Lot 12 (adjacent property)
Gentle spur crest	Spur crest leading from dominant ridgeline to Four Mile Creek flats/wetlands – within 300 m of wetlands	3a	TN7, TN26	TN7, TN26	TN26	TN7
Gentle spur crest	Spur crest leading from dominant ridgeline to Four Mile Creek flats/wetlands - further than 300 m from wetlands within 300 m of wetlands	3b	TN7, TN26	TN7, TN26	TN26	TN7
Gentle simple slope		4a	TN6, TN8, TN10, TN14, TN16, TN18, TN21, TN28	TNS, TN21	TN10, TN14, TN16, TN18, TN21, TN28	TN6, TN8, TNIO, TN18
Gentle simple slope	Further than 300 m from wetlands	4b	TN2, TN4, TN6, TN8, TNIO, TN21, TN23	TN2, TN8, TN21	TN21, TN23	TN2, TN4, TN6, TN8, TN1O
Gentle drainage depression gentle drainage depression	Ephemeral first order drainage further than 300 m from wetlands	5a	TN3, INS, TN9, TN22, TN24	TN3, TN9	TN22, TN24	TN3, TNS, TN9
	Ephemeral first order drainage within 300 m of wetlands	5b	TN11, TN12, TN15, TN17, TN19, TN20, TN27	TN12, TN20, TN27	TN15, TN17, TN19, TN20, TN27	TN11, TN12, TN17, TN19, TN20
Gentle drainage depression gentle simple slope, very gentle spur crest, gentle spur crest	Second order drainage within 300 m of wetlands	5c	TN9, TN25	TN9 TN13, TN26	TN25	TN9
	Potential Pleistocene terrace remnants	6a	TN10, 1N13, TN26		TN1O, TN13, TN26	-

The test excavations were undertaken within six separate test areas (see Table 5 below). Each test area comprised a sample of units, each measuring 0.5 x 0.5 m in area, excavated at five metre intervals on a 50 x 5 m grid, 22 test units were excavated for a total area of 5.5 m^2 in each test area (Kuskie 2008).

In total, 132 test units, each measuring 0.25 m^2 in area were excavated, resulting in a total excavation area of 33 m^2. In total, 616 separate excavation unit spits (0.5 x 0.5 m area x 10 cm deep 'spit') were excavated. On average, 4.6 spits were excavated in each test unit with a maximum of seven spits (up to 0.7 m depth) required (Kuskie 2008).

Table 5: Summary of Kuskie's Test Excavation Artefact Data Lot 12 and Investa Land (Kuskie 2008)

Test Area	# Units Excavated	Plan Area Excavated (m^2)	Volume Excavated (m^3)	# Artefacts	Mean Artefact Density per conflated m^2	Peak Count per Test Unit (0.25m^2)	Peak Density per conflated m^2 ^	Peak Count per Unit Spit (0.25m^2/10cm spit)	Mean Artefact Density per m^3
2A	22	5.5	1.68	104*	18.91	13	52	10	61.90
3A	22	5.5	2.86	30*	5.45	5	20	3	10.49
3B	22	5.5	2.64	6	1.09	2	8	1	2.27
4A	22	5.5	1.99	68	12.36	32	128	18	34.17
4B	22	5.5	2.01	14	2.55	4	16	4	6.97
6A	22	5.5	2.98	485*	88.18	98	392	33	162.75
	Total 132	**Total 33**	**Total 14.17**	**Total 707**	**Mean 21.42**	**Highest 98**	**Highest 392**	**Highest 33**	**Mean 49.89**

* Includes unprovenanced artefacts: 12 in 2A, 3 in 3A, 3 in 6A. ^ Peak density/m2 extrapolated from 0.25m^2 area.

A total volume of deposit of 14.17 m^3 (14,166 litres) was excavated and wet-sieved. On average, about 107 litres of deposit was excavated from each unit, with a mean of 38.8 litres excavated from each unit spit. Artefacts were present in 80 (60.6 %) of the test units. 6.16 artefacts were located in each test unit and 1.23 artefacts in each excavation unit spit. The overall mean count of artefacts per conflated square metre is 21.42. The maximum artefact count in a single 0.25 m^2 test unit is 98 (unit H5 in Test Area 6A). The maximum artefact count in a single excavation unit spit is 33 (spit 2 of unit H5 in Test Area 6A).

The mean density of artefacts per cubic metre is 49.89. By volume, artefact density per individual excavation unit spit varied substantially, from nil to a peak of 733.26 artefacts/m^3 in spit 2 of unit H5 in Test Area 6A (Kuskie 2008).

3.1.3 Summary of the Test Excavation Results

Artefact densities varied between the different test areas and environmental/cultural contexts. By volume, the mean artefact density ranged from a very low 2.27/m^3 in Test Area 3B to a relatively high 162.75/m^3 in Test Area 6A. By area, the mean artefact density varied from 1.09/conflated m^2 in Test Area 3B to 88.18/conflated m^2 in Test Area 6A (Kuskie 2008).

Kuskie concluded that within the study area (Lot 12 & Investa Land) some *in situ* heritage evidence is likely to be preserved and has potential to exist in the areas not directly sampled. However, he says a portion of the heritage evidence has been subject to post-depositional impacts resulting in horizontal or vertical displacement of items. Bioturbation, erosion and recent human impacts are assumed to be the main agents of disturbance and primarily have affected the vertical, rather than horizontal, integrity of the evidence (Kuskie 2008).

A total of 707 lithic items were identified in the test excavations within the Investa Land (Kuskie 2008). A further 71 lithic items were identified in the broader initial "Area C" survey study area (Kuskie 2004a) of which 17 lie within the Investa Land (Sites TN20, TN21, TN26 and TN 27).

Five different categories of stone material were identified in the excavated lithic item assemblage. Silcrete was the most common material (63.65 % of the combined assemblage), followed by tuff (28.43 %), quartzite (5.52 %), quartz (1.56 %) and chert (0.85 %). Although no quartz items were identified during the initial survey, the proportion of the other stone materials were very similar in comparison with the test excavation data, with 71.8 % of the survey assemblage artefacts being silcrete and 25.4% tuff (Kuskie 2004a).

The test excavation assemblage is overwhelmingly dominated by items representing non-specific stone flaking. These items represent 94.2 % of the combined test assemblage (n=666). Specific activities are represented in the test excavation assemblage in very low frequencies. Microliths are discarded in very low frequencies, representing only 1.27% (n=9) of the assemblage. Backing retouch of microliths on-site is represented by 0.71% (n=5) of the combined assemblage (Kuskie 2008).

A number (n=27, 3.8 % of total assemblage) of non-microlith tools (retouched flakes) were identified within the combined stone artefact assemblage, predominantly retouched flakes and flake portions, along with a utilised piece and a utilised retouched piece. Tools were only recovered from Test Areas 2A, 4A and 6A, perhaps indicating a trend in the spatial distribution of activities within the study area however it is also possible that this distribution reflects the sample bias created by the greater numbers of artefacts recovered from these Test Areas.

Therefore, although 4.1 % of the total assemblage shows evidence of utilisation (including both microliths and non-microliths with use-wear), indicating use of and in some cases manufacture of tools on-site, and the vast majority (94.2 %) of the stone artefact evidence represents debitage from which the specific activities cannot be reliably inferred. A proportion of this evidence may relate to the production of microliths and formal tools (Kuskie 2008).

Kuskie argues that there are a range of variables potentially influencing the nature and extent of human occupation within the Investa Land, it is concluded that the proximity to the wetlands/former Hunter River estuary and its associated resources is the primary factor. The intensity of land-use was significantly greater within 300 m of the wetlands than in areas further than 300 m from the wetlands. Close to wetlands, occupation was typically of a higher intensity on the spur crests than on the simple slopes, indicating some preferential location of activities in relation to landform unit. Aboriginal occupation was focused on one environmental/cultural context (6a) the gentle spur crest within 300 m of the wetlands and possible Pleistocene terrace remnant, and to a lesser extent context 2a (very gentle spur crest within 300 m of the wetlands). Evidence of microlith discard (in contexts 2a and 6a) and backed artefact manufacture (in context 6a) was only identified in contexts in close proximity to the wetlands and only on spur crests (Kuskie 2008).

3.1.4 Bolwarra Heights Assessments

In 1984, Brayshaw and MacDonald (1984) carried out an archaeological survey of 120 ha of Telecal, Landcom area at Bolwarra Heights. This work was commissioned for the preparation of Maitland City Council's Local Environment Plan. The work was paid for by the then NSW Land Commission (Landcom). A single open site (B1) and a possible scarred tree were located (See Figure 3: Appendix 1: Sites 38-4-0384 & 38-4-0383).

In 1995, Brayshaw carried out a survey of an 86 ha parcel of land on behalf of Telecal Pty Ltd at Bolwarra Heights (See Figure 2: Appendix as Landcom, Telecal and Maitland City land (Brayshaw 1995: 1). Approximately 20 % of this area was proposed for a planned subdivision. The land originally was owned by Hunter Water Corporation containing the Bolwarra Waste Water Treatment Works.

Brayshaw argued that a resurvey of the area was necessary for three reasons. The first one involved the length of time since the original survey and the possibility that previously invisible archaeological remains may have been exposed through erosion. The second one involved changes to NPWS archaeological assessment requirements, and the third was a request by the Mindaribba Local Aboriginal Land Council. Mindaribba considered that its interests and priorities had changed from those held by the superseded Central Region Aboriginal Sites Protection Committee which had been in place at the time of the original 1984 survey (Brayshaw 1995: 1).

This above survey identified two new open sites Bolwarra 3 (B3), and Bolwarra 4 (B4). The site B3 comprised six artefacts visible in a dam wall in the North West corner of the combined study area. Site B4 comprised two artefacts 40m from one another either side of a dam . The scarred tree was

also re-examined and the scar assessed as not being Aboriginal in origin, resulting in a recommendation that the tree be no longer considered an Aboriginal relic or site. Sub-surface testing was recommended at the open sites B3 and B4 and at other locations within the study area judged to have potential owing to their land form such as along the main ridge within the study area (Brayshaw 1995: See Table 1 below).

Table 6: Brayshaw recorded Aboriginal Sites and Objects (1984 & 1995) Aboriginal Site Descriptions and Locations (after Brayshaw 1995)

OEH Site Number	Site Name	Site Features	Comments
38-4-0384	Bolwarra 4	Artefact Scatter. Junction of two small drainage lines. Dam margin. Simple Slope Bare Soil patch: 50 m x 2 m amd 5 m x 5 m exposure. No cultural deposits present. There is no hearth or visible bone material associated with the site's contents. The site is in poor condition.	2 artefacts located on dam rim on exposed dry surface covering an area of 50 m x 2 m and 5 m^2. No artefacts were observed in situ. The site is in poor condition. E:366780 N:6381220
38-4-0383	Bolwarra 3	Artefact Scatter. 80 m east of Hunter River. 10 – 12 artefacts are likely to have been lagged as a result of flooding and cattle trampling north of an existing dam. Cultural deposits present within 10 – 15 m of dam margin. There is no hearth or visible bone material associated with the site's contents. The site is in poor condition.	10 – 12 artefacts located on dam margin mostly made up of Yellow Ryholitic Tuff. Artefacts lie in a ploughed paddock further north of the dam and fence-line. Lagoon rim on E:365890 N:6381150

3.1.5 Australian Museum Business Services: Baker Assessment for Archaeological Test Excavations at Landcom Project 12163.00 Bolwarra Heights Hunter Valley: OEH Sites, 38-4-1177, 38-4-0383 and 38-4-0384

In 1996, Australian Museum Business Services (AMBS) under Neville Baker undertook an archaeological test excavation programme at Bolwarra Heights. Part of this subdivision proposal

area also covered the existing Lot 68 HunterGlen Drive project area. The land was owned by Landcom and identified for a proposed subdivision project managed by Atkinson and Tattersall Pty Ltd. The area of land was approximately 49.44 ha in size.

AMBS carried out the archaeological test excavation work under a Section 87 Permit of the *National Parks & Wildlife Service Act 1974* (N.Baker pers comm 2012). Apart from small pockets of mature trees acting as wind breaks along fence-lines, the land had been ploughed for pasture improvement in the past and is principally used for cattle grazing. There were are three dams located within the test excavation area.

The test excavation area consisted of a gentle hill crest and upper slope with a shallow, stony, texture contrast soil derived from Permian sandstone and conglomerate. Crest and lower slopes with a narrow fluvial terrace or bench close to the 1:100ARI flood level. The aim of Baker's research designed was to:

- explore the extent of subsurface archaeological material within the Landcom study area;
- explore other elevated areas within the study area for the presence of subsurface material;
- to compare results of the stone artefacts analysis with data from other test excavation projects in the lower Hunter Valley; and
- to retrieve a useful sample of artefacts from the soil for technological analysis in locations where test excavations revealed artefact concentrations (Baker: 9: 1997).

The above work was looking to understand the distribution of buried archaeological material based on predictive work already undertaken by Brayshaw in 1995. Sites B3(38-4-0383) and B4(38-4-0384) were the main targets of the AMBS proposed test excavation programme. The final assessment of OEH site 38-4-1177 were the results of this testing programme.

3.1.6 Test Excavation Methods

AMBS used both shovel test pitting and backhoe test pits to test excavate areas within the proposed subdivision allotment. The distribution of these test pits were constrained by the unexpected depth of soil especially around site B3 dam (B3 DAM) and B3 crest (B3 EAST). Transects of shovel test pits measuring 50 cm x 50 cm and backhoe test pits measuring 1 m^2 were excavated over areas deemed to have high archaeological potential (See Figure 3: Appendix X).

Site B3 Test Methods

The following test excavation methods were used for site B3:

- At the B3 site adjacent to the dam site, a grid of 25 shovel test pits, each being 0.25 m^2 (50 cm x 50 cm) in size dug at 5 m intervals were dug over a 25 m^2 area.
- A grid of 19 backhoe test pits each 1 m^2 in size dug at 40 m intervals over a 200 m x 80 m area.
- A long transect of 32 x 0.25 m^2 shovel test pits dug at 20 m intervals along the ridge between major peaks.

- Two test pits of 1 m^2 area dug by hand in areas of high artefact concentration.

B3 DAM: Lower Spur Land Unit

This area was defined by AMBS as a low spur lying between the Hunter River to the west, a minor back swamp (drained) to the north-east and a steeper slope (5°) to the south. The following test excavations were carried out by AMBS at B3 DAM:

- Twenty five shovel test pits adjacent to the farm dam, dug in 10 cm spits at 5 cm intervals within a 25 m^2 grid.
- Back hoe 1 m^2 test pits N40E0, N40E40, and N40E80.
- A single 1 m^2 test pit dug in 5 cm spits at N23E44.
- Soils within the area were deep containing a gravel layer noticeable between 10 and 30 cm.

B3 SLOPE: Ridge Slope Land Unit

This area is defined by AMBS as a 5 degree slope gradient immediately to the south of B3 DAM . The soil profile is deep containing sandy loams overlying sandy clays and decaying sandstone. The following test excavations were carried out:

- Sixteen 1 m^2 back hoe pits dug in a single unit in three lines at 40 m intervals.

B3 EAST: Ridge Crest Land Unit

This area was referred to by AMBS as the “crest area”, which included a transect of pits dug along the ridge between two major peaks within the study area. The following test excavations were carried out:

- Twenty nine shovel test pits (0.25 cm^2) dug in 10 cm spits.
- A single test pit 1 m^2 dug by hand using trowel and shovel method.

Both dry and wet sieving methods were used through nest sieves (5 mm over 2.2 mm). Wet sieving was only used for the B3 SLOPE backhoe pits. Shovel test pits were dry sieved by laying out each 10 cm spit on a geotextile mat and then put into a shaker sieve device.

3.1.7 Test Excavation Results

The AMBS test excavation programme found that there was an extensive distribution of stone artefacts in the western part of the study area within view of the Hunter River. In addition to this result, several clusters of grinding grooves were also identified along a series of sandstone conglomerate benches perpendicular to the Hunter River channel.

Artefact Distribution and Densities

A total of 822 artefacts were recovered from the testing of site B3.

Table 7 shows the distribution of artefacts across the B3 site.

Table 7: AMBS Test Excavation Results for site B3 (after Baker 1997)

B3 Test Excavation Area	Artefact Density	Land Unit
B3 DAM	537	Lower Spur
B3 EAST	251	Ridge Crest
B3 SLOPE	34	Ridge Slope

Further analysis of artefact densities across the test excavation area can be made by breaking down the density of artefacts recovered by test pit size shown in Table 8 below.

Table 8: Artefact densities for different test pits sizes and different areas of site B3 (after Baker 1997)

Testing Method	B3 Area	Artefacts Recovered	Area Excavated	Artefacts/m^2
Shovel Test pits 50 cm x 50 cm	B3 DAM	294	6.25 m^2	47/m^2
Backhoe Test pit 1 m^2	B3 DAM	243	4 m^2	61/m^2
Shovel Test pit 50 cm x 50 cm	B3 EAST	52	8.75 m^2	6/m^2
Backhoe Test pit 1 m^2	B3 EAST	199 (T50/50)	1 m^2	199/m^2
Backhoe Test pit 1 m^2	B3 SLOPE	34	19 m^2	2/m^2
Totals		822	39 m^2	21/m^2

The above results show that the B3 DAM area has 52 artefacts per square metre compared to B3 EAST with 26 artefacts per square metre. B3SLOPE has 1.8 artefacts per square metre. The most concentrated area by test pit is T50/50 a single backhoe pit within B3 EAST producing 199 artefacts.

Excavation by shovel test spit level also shows that a majority of artefacts recovered (196) in the B3 DAM area come from between 10 and 40 cm depth. In the test pits along the ridge crest (B3 EAST) a majority of artefacts were recovered between the 10 – 20 cm layer which was also the level at which a gravel layer was pronounced. The vertical distribution of artefacts from 1 m^2 back hoe pits is also influenced by the distribution of gravel layers. Artefacts are more concentrated on the ridge crest land unit (B3 EAST) probably due to the fact that gravel is more concentrated withinthe soil profile (10 – 20 cm depth). Artefacts recovered within the B3 DAM are less concentrated (i.e. 10 – 30 cm depth) due to a reduction in the amount of gravel in this soil horizon.

A majority of artefact types recorded also shows that waste products or debitage (flakes and broken flakes) dominate the excavated assemblage. These account for 95 % (778) of artefacts recovered). Retouched items or implements only make up 2 % (18) of the entire excavated assemblage recovered.

The above results show that there were concentrated areas of stone artefacts, clustered enough to represent different activity areas between B3 DAM and B3 EAST (i.e. between the crest and the lower spur). At B3 DAM there was a greater variability in the artefacts recovered at higher densities with a broader range of tool types and discarded implements. At B3 EAST one area test pit T50/51 m had an assemblage of at 199 artefacts. Much of this material was silcrete debitage lacking finer flake components and also lacking retouched tools. AMBS argued that:

- There were differences in artefact technology between B3 EAST and B3 DAM areas.
- Within the ridge crest area (B3 EAST) suitable local stone may have been used (i.e. silcrete) to reduce silcrete from pebbles to large flakes. This indicates that people were undertaking coarse knapping at this site to produce large flakes.
- At the B3 DAM higher densities of retouched backed tools were found along with cores and implements demonstrating that people were using tools and repairing them to a discard stage.
- At B3 SLOPE lower densities of silcrete debitage were recovered.
- The distribution of cortex on flakes recovered also shows that primary reduction was taking place on the ridge crest more frequently in comparison with the lower spur slope or ridge slopes areas.

3.1.8 Site Predictive Model

In summary, the archaeological evidence from previous work undertaken by Kuskie 2004a, Kuskie & Kamminga 2000, Kuskie & Clarke 2006a, Kuskie 2008, Hamm 2008) in the Lower Hunter area and Baker (1997) at Bolwarra Heights rank certain landform/landscape elements as having high, medium or low archaeological potential for Aboriginal sites. The importance of this work is that it is based on test excavation and sub surface investigation (not on surface surveys which are limited in predictive statements), which provides a much more robust evaluation of the true distribution of Aboriginal occupation. Both landform type and site location criteria (i.e. environmental/archaeological context – and distance to wetland) are considered to be significant in determining the scale of previous prehistoric Aboriginal land-use pattern.

Kuskie (2008: 136) offers two probable site predictive location criteria:

1. Areas further than 300 m from the wetlands, in which a very low density distribution of artefacts consistent with background discard is present, with the only identified evidence relating to non-specific stone flaking and no identifiable activity areas present (at least in the small test excavation sample – a low density of discrete activity areas may occur in the wider area); and
2. Areas within 300 m of the wetlands, in which a low to moderate density distribution of artefacts is present, partially consistent with background discard but also with a number of discrete activity areas, some of which are related to microlith production, microlith discard and/or discard of non-microlith tools, but many for which the specific purposes cannot be identified from the test excavation sample (i.e. non-specific stone flaking).

The highest ranking for archaeological potential are Test Unit 6A which correlates to the gentle spur crest within 300 m of the wetlands, followed by Test Unit 2A which is a very gentle spur crest within 300 m of an existing wetland and Test Unit 4A which is a gentle simple slope also located within 300 m of an existing wetland.

Land in these areas will be relatively undisturbed (not ploughed or developed for intensive agricultural purposes) elevated and may contain protected woodland or forest. These areas are also likely to be protected from cold air drainage. They will also command an extensive view of the surrounding wetlands landscape. This land is likely to be within 300 m of an existing wetland and is likely to contain intact cultural deposits which may contain dense concentrations of stone artefact material and cultural features such as buried hearths.

The next level of medium potential are likely to be landform elements such as ridge-lines or spurs with some flat mid slope land units located above existing drainage lines such as Four Mile Creek and drainage depressions. The land may be modified by minor agricultural land-use such as broad acre ploughing or flood mitigation works (bringing in fill material) but is likely to contain pockets of undisturbed bush land or grassland. These land units correlate with Kuskie's Test Units 2B, 3B, 4B and 5A. This land is likely to be at least 300 or more metres from any main wetland or permanent creek and may or may not contain low density artefact scatters.

The lowest level of archaeological potential will contain undulating land with a high proportion of mid slope and lower slope landform elements with uneven land surfaces and containing rocky outcrops. This landform may also contain active floodplain low flat land which is constantly being inundated after higher rainfall events. This landform type will also be located more than 300 m from any permanent water way (not an ephemeral creek) or swamps or any potential stone tool quarry source and is likely to contain dense woodland or forest. The archaeological potential is also likely to be low due to a high level of previous land-use activities such as intensive agriculture (i.e. ploughing for crops, creation of dams, or development for infrastructure such as electricity, gas, telecommunications, roads and housing). The only site type expected in this landform will be low level Isolated Finds (stone artefacts probably made from silcrete) or on rare occasions scarred trees. These land units correlate with Kuskie's Test Units 1A, gentle ridge crest in a partially disturbed context.

Based on his sub surface testing results of OEH site 38-4-1177 at Bolwarra Heights Baker (1997) argues that:

- High artefact densities were found on lower spur land units close to the Hunter River floodplain;
- Greater diversity of artefact types and stone tools were found on a ridge crest land unit where access to local stone (silcretes) was possible;
- Evidence of Aboriginal occupation on ridge crests and ridge slopes was far less significant compared to evdience of occupation on lower spurs; and
- Geomorphic processes can effect the concentration of artefacts in a typcial texture constrast soil, with artefact densities in some stratigraphic units being over inflated.

Sites not expected to be found in the assessment area are carved trees, rock shelter deposits, stone arrangements, axe grinding grooves, rock art sites or shell midden deposits.

3.1.9 Site detection factors

One of the most important factors in locating sites or artefacts on the ground is whether they can be detected or discovered easily. A number of discovery factors will affect how well sites or artefacts are located within a survey area. Schiffer, Sullivan and Klinger (1978) provide a useful summary of what the most important factors are likely to be in detecting sites or artefacts on the ground (see Table 9 below, taken from Dancey, 1981).

Table 9: Site detection factors that may affect an archaeological survey (after Dancey 1981)

General Factors	Definition	Specific Examples
Abundance	The frequency or prevalence of site or artefact type in the study area	Sites and artefacts occur in highly variable quantities, from rare to abundant
Clustering	The degree to which archaeological materials are spatially aggregated	Various degrees of clustering may be found between dispersed and clustered
Obtrusiveness	The probability that particular archaeological material can be discovered by a specific technique	Artefact size, composition, surface morphology, heat retention, and other physical, chemical and Biological properties
Visibility	The extent to which an observer can detect the presence of archaeological materials at or below a given place	Site area, artefact density, artefact size, surface area of exposure, frequency of exposure
Accessibility	The effort required to reach a particular place	Climate, biotic environment, terrain, roads, land holding patterns

3.1.10 Definition of a 'site'

The NSW Office of Environment & Heritage (OEH) advises developers and consultants that the term 'site' is used to group Aboriginal Objects or define a location where an Aboriginal Object or cultural item occurs. They propose general criteria to assist in the classification of a site. Sites can be defined as:

- Exposures where archaeological evidence is revealed;
- A topographic or land form unit where occupation evidence has been recorded. This may be an entire landform unit (ridge, creek, valley) or part of a landform unit (saddle on ridge, creek bank);

- Sites which have physical boundaries defined by rocks (stone arrangement), earthworks (mounds) or cleared land (ceremonial ground);
- Sites defined by Aboriginal community groups as culturally significant;
- Arbitrary or the assignation of a boundary for the convenience of recording (in cases where the site would probably be much larger if based on the criteria above). Arbitrary criteria include the use of a fence-line, dirt track or gully as a boundary. In some cases the area may simply be designated as 50 m x 50 m, or as a smaller sample plot, on the basis of convenience;
- Artefact density. (In some cases a site boundary may be defined by the average number of flakes per square metre.) This is a specialised type of arbitrary criterion and justification of the rules used must be made explicit; and
- The chosen definition of a site or isolated find needs to be specified for the study. It is the consultant's responsibility to decide on an appropriate definition, suited to the particular project, the research goals and comparability with other regional studies. OEH requires site forms to be completed for isolated finds.

3.2 Aboriginal Site Types likely to be found in the General Assessment Area

Aboriginal site types that have been typically recorded in the general region include:

- Open campsites made up of stone artefacts dominated by tuff, chert, silcrete and quartz assemblages and sometimes containing hearth material in the form of burnt or cracked sandstone heat retainers. These sites vary in complexity and density depending on their physical condition in the modern landscape and their proximity to major resource zones;
- Isolated Find representing a single isolated artefact located on its own in the landscape;
- Artefact Scatter representing a collection or scatter of stone artefacts exposed by erosion that appear to be defined by their spatial relationship to one another and the land unit they are located on;
- Archaeological Deposit representing a buried surface which has some soil depth and structure likely to contain archaeological remains;
- Scarred Trees representing Aboriginal removal of bark material to make shelters, dishes, canoes, string, shields, boomerangs and carved trees. Within the assessment area most Aboriginal scars are found on River Red Gum (*Eucalyptus camaldensis*), White Box

(*Eucalyptus albens)* and Grey Box (*Eucalyptus largiflorens*). There is a strong correlation between large canoe type scars and more permanent river;

- Burial sites are sites that show evidence of Aboriginal burial in discrete locations. Burials in the study region are usually associated with major areas of occupation found next to rivers, lagoons, lakes, waterholes and some creeks. Skeletal material is normally discovered eroding out of sandy deposits, where interment is easiest. Burials may occur in an isolated context or they may be part of a larger cemetery;
- Contact sites. A contact site is site where there is evidence of Aboriginal people living traditionally in close proximity to European settlement. Aboriginal people may be using European items in traditional hunting and gathering practices, for instance bottle glass as a substitute for stone, or metal as a substitute for bone or stone;
- Sites may be associated with Aboriginal people working for European settlers, such as gathering bark sheeting for bark slab huts. Often historic items associated with that contact would be found in certain traditional campsites; and
- Waterhole/well. These types of sites, as well as being important places for obtaining water, may also be sacred places and of religious significance to living Aboriginal people.

4. LAND USE HISTORY

4.1 Existing Environment and Land Use History

The study area forms part of the East Maitland Hills physiographic system, described as part of the Bolwarra Heights soil landscape (Matthei, 1995). Much of the assessment area is dominated by rolling low hills with slope gradients of between 5 – 20 %. Local relief is generally 50 m but can range to 80 m. Elevations are 40 – 100 m with broad crests (200 m – 500 m) with short convex side slopes and narrowly incised drainage lines. Outcrops of local rock are rare (< 2 %) conciding with Murree Sandstone. Floodplains, alluvial fans deposits and broad delta (wetland) deposits are common to the north-east of the assessment area.

The soil types of the East Maitland Hills landform units are made up of moderately deep well drained Yellow Podzolic Soils , Red Podzolic Soils and Brown Podzolic Soils with some moderately deep well drained Lithosols on ridge crests and imprefectly drained yellow Soloths on lower slopes(Matthei 1995). There is minor to moderate sheet and rill erosion where ground cover is removed.

Little direct dating has been undertaken of landforms surrounding the study area however Roy (*et al* 1995) and Roy and Boyd (1996) have identified Pleistocene age river terraces located to the east of the assessment area where the Hunter River flooded during the last Interglacial period. According to Dr Peter Mitchell (pers comm. 2016) the current ridge crest land units, associated alluvium and colluvial soil units within the assessment area are likely to be no more than late- mid Holocene in age, due to their depositional nature and soil composition.

Early historical records of settlers and explorers such as Backhouse (1843:399) describes the surrounding landscape as 'one vast wood, interrupted by a few open swamps' and Lieutenant Breton (1833) described Maitland a thick vine brush, that was very difficult to penetrate. Similar observations were made by Cunningham (1825) who described the land between Maitland and Newcastle as being low and swampy, covered with stunted brush. Further inland he observed fertile locations, which were well watered but heavily timbered and brushy (Cunningham 1827:78-9).

Prior to European settlement apart the existing wetlands/estuary, the assessment area was a tall open Eucalypt forest. This open forest typically consisted of *Eucalyptus maculata* (Spotted Gum), *E. fibrosa* (Broad-leaved Ironbark), *E. paniculata* (Grey Ironbark), *E. tereticornis (Forest Red gum)* , *E. punctata* (Grey Gum) and *E. oblonga* (Narrow-leaved Stringybark) (Matthei 1995). Story (1963:141) also records *Angophora floribunda* (Rough -barked AppleThe understorey typically contains *Bursaria spinosa* (Blackthorn), paperbarks (eg. *Melaleuca nodosa)* and wattles (e.g. *Acacia falcata)* (Matthei 1995). *Casuarina* spp., *Exocarpus cupressiformis* (Native Cherry), *Persoonia* spp. (Geebungs) and abundant shrubs can form inpenetrable thickets in deep gullies (Story 1963). *M styphelioides* (Prickly-leaved Paperbark), *Backhousia myrtifolia* (Grey Myrtle), *Alphitonia excelsa* (Red Ash) and *Lantana camera* (Lantana) are common in drainage lines (Matthei 1995).

The land surrounding the assessment area was originally taken up in 1820's as part of a land grant to Scottish settler George Lang by Governor Macquarie. Lang built Dunmore Estate (homestead and outbuildings) in the ealrly 1830's overlooking the Paterson River where a range of farming practices were undertaken including a vineyard, cotton and tobacco crops. Dairy farming and cattle grazing were also established (OEH 2015). The assessment area became part of a cattle grazing area with little clearing undertaken.

The assessment area is dominated by mid sloping land units with some minor ridge crests. A small narrow ephmeral drainage line is located in the northern portion of the assessment area but this is considered seasonal and would not have been permanent or contained permanent pools of water for any length of time. The assessment area is located at least 200 m south-west of a main

wetland feature which contain a series of spurs and ridges sloping down to open swamp land (Figure 2: Appendix 1). There are minor outcrops of Murree sandstone in the north-west corner of the assessment area-none of which contain quality sandstone for grinding axe material or producing rock art. There are no obvious outcrops of flakeable stone such as silcrete or tuff located on the assessment area and no river gravels present in the ephemral creek-line.

Urban development in Bolwarra district began in earnest around the late 1880s to the 1920's. As Bolwarra grew and expanded more land was released in the area to the north (Bolwarra Heights) By the 1970's Dunmore Estate had been subdivided and smaller lots sold off for residential housing purposes. The houses located on the existing assessment area were built in the 1970's and some of the land was cleared around these houses. For most of that period, the assessment area has been subjected to minor clearing and cattle grazing. The assessment area has been owned by the Gale family since 1981 and has principally been used for residential and agricultural purposes.

4.2 Existing land use impacts on Lot 1 DP 1156433

The assessment area consists of a number of modern brick and steel framed houses with farm sheds, a number of dams and associated road access and vehicle access. Fencing has been constructred to divide the assessment area into three parcels of land. The largest area contains five blocks of land (Lots 3-7, Figure 2: Appendix 1) which have been previously cleared . This area (See Plates 5-10: Appendix 2) is made up of mid sloping land units which run in a north-south direction and are bisected by a small ephemeral creek or drainage line. Within one of these blocks located in the north-west contains the remains of a pool fill feature. This is a mound of redeposited soil which was excavated from the forming of an in-ground pool and was reshaped as a tennis court –this court however did not proceeed. (Plate 10: Appendix 2). Closer to the southern boundary of this area is a heavily disturbed vehicle access area where there is bad sheet erosion exposed.

The second area contains a cluster of mature Spotted gum lying on a ridge crest/ridge slope land unit (Lot 2: Figure 2: Appendix 1) . To the north of this area is a large farm shed and a small farm shed. A series of vehicle tracks crosses this land causing large scale sheet erosion in pockets. The third area (which is to remain underdeveloped, Lot 1: Figure 2: Appendix 1) contains a large house and associated sheds with a modern driveway providing access to Lang Drive (Plate 1: Appendix 2). There is also a dam located in this area.

The overall land-use for Lot 1 DP 1156433 is considered minor with limited tree clearing and a lack of ploughing of land prior to modern houses being erected. The majority of land use disturbance within the assessment area is associated with semi-rural activities and housing impacts.

5. ABORIGINAL CONSULTATION

As this project aims to avoid any culturally sensitive areas it did not require consultation with Aboriginal community stakeholders.

6. SURVEY ASSESSMENT METHODS

The assessment of the proposed development application area was carried out by senior ARAS archaeologist (Giles Hamm) on the 27th of April 2016. Field conditions were fine and access to the proposed assessment area was unimpeded. The survey methodology was based on walking foot transects in areas or locations where the likelihood of finding intact Aboriginal heritage sites was high.

This meant foot transects were placed in areas where there were good exposed areas of ground surface visibility. Each foot transect was recorded and the type of ground disturbance documented.

7. ASSESSMENT COVERAGE & SURVEY RESULTS

A total of two foot transects were completed are listed below in Table 10 (See Figure 2: Appendix 1, Plates 1 – 10: Appendix 2).

Table 10: Archaeological Foot Survey Transects Lot 1 DP 1156433

Transect No	1E	2E	3E	4E	Landform and Land-use	Results
1. (0.866 ha) Lot 2	0367886 6381772	0367813 6381758	0367801 6381831	0367841 6381866	Partially cleared open forest Ridge-crest and ridge slopes. Large modern shed-vehicle access tracks.	Visibility. 50 – 75 % Grasses, leaf litter and local gravels. No surface artefacts or cultural features identified.
2. (2.6 ha) Lots 3 – 7	0367807 6381757	0367590 6381828	0367763 631956	0367809 6381804	Mid slope land units. Cleared pasture grasses and weeds. Vehicle tracks. Fencing.	Visibility: 25 – 50 % with patches of exposed bare soil on vehicle tracks and on break of slope. No surface artefacts or cultural features identified.

8. RESULTS & DISCUSSION

No known Aboriginal objects or potential new Aboriginal sites/objects were identified within the area proposed for development as a result of this due diligence assessment. This result reflects the previous archaeological assessment, predictive modelling results, the distribution of landscape elements and the results of the field assessment.

It is likely that prior to European settlement the assessment area was in fact part of a tall open forest landscape. All the predictive modelling suggests Aboriginal occupation in this area was more likely to have been focussed on the gentle spur crest land units which are located further north-east (150 – 200 m distance) where better access to the wetland is possible (Figure 2: Appendix 2). There is a slight possibility that Aboriginal people in the past may have used part of the ridge crest in the assessment area however this use is only likely to have been very transitory in nature and it may have meant little in the way of cultural material being left behind during these movements. There was however no archaeological evidence found in the assessment area to support this prediction.

In terms of potential resources within the assessment area, Kuskie and Kamminga (2000) argue that within the Lower Hunter Aboriignal occupation is concentrated where mulitple resource zones were present. This prediction meant that larger base camps were likely to be associated with wetland occupation where people used elevated spurs and ridges which gave them good access to a multiple range of food and plant resources. Access to good stone raw material was

also likely to be another reason to locate a base camp in a particular area. Kuskie and Kamminga (2000) also argue that away from these primary resource zones, Aboriginal occupation is more sporadic and usually only focussed within 50 m of higher order watercourses (See Figure 4: Appendix 1).

Predictive modelling shows that the assessment area does not contain high order watercourses – it does not contain major wetlands, it does not contain access to good stone artefact raw material supply. Although it does contain a narrow ephemeral watercourse, this is not likely to have provided long term water resources or large scale access to wetland plants. The assessment area is also located away from a major riparian corridor like the Hunter and Paterson rivers where occupation was likely to be focussed, as has been shown with the subsurface investigations of Bolwarra Height sites 38-4-0383 & 384 (Baker 1997).

In terms of the field assessment, overall ground surface visbility was fair to good in some parts of the assessment area and Lots 5 & 6 in Transect 2 (Figure 2: Appendix 1, Plates: 5-10: Appendix 2) had the most potential for surface artefacts but none were located. The potential detection of surface artefacts was greatest in Transect 1 where sheet erosion was highest. No surface artefacts were however detected.

It is therefore argued that based on previous archaeological research, predictive modelling and the results of a field assessment; Lot 1 DP 1156433 is likely to contain low Aboriginal heritage potential.

9. RECOMMENDATIONS

The following recommendations are made based on the existing and proposed legal requirements of the *National Parks and Wildlife Act 1974* (NSW) and the results of previous archaeological assessments, predictive modelling and field assessment carried out on: LOT 1 DP 1156433 Lang Drive Bolwarra Heights.

It is recommended that:

1. The assessment area is considered to have low Aboriginal heritage potential and should not be subject to any further archaeological assessment.
2. If Aboriginal Objects are located during construction of any future works associated with the proposed housing sub-division for Lot 1 DP 1156433, then all work should stop and an **Aboriginal Heritage Impact Permit (AHIP)** consent approval should be obtained by a suitably qualified person on behalf of the proponent. These processes will require the proponent to undertake full Aboriginal community consultation as

defined by OEH guide-line: **Aboriginal cultural heritage consultation requirements for proponents 2010.**

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APPENDIX 1
Figures

APPENDIX 2
Plates

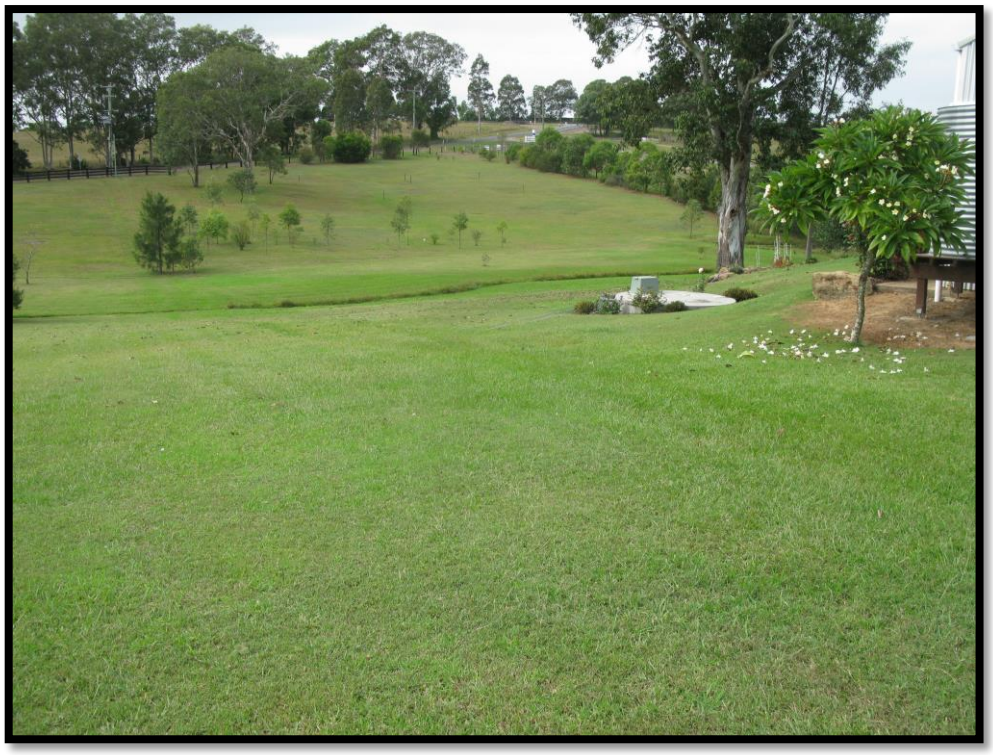

Plate 1: Part of Lot 1 looking east towards Lang Drive (not to be developed)

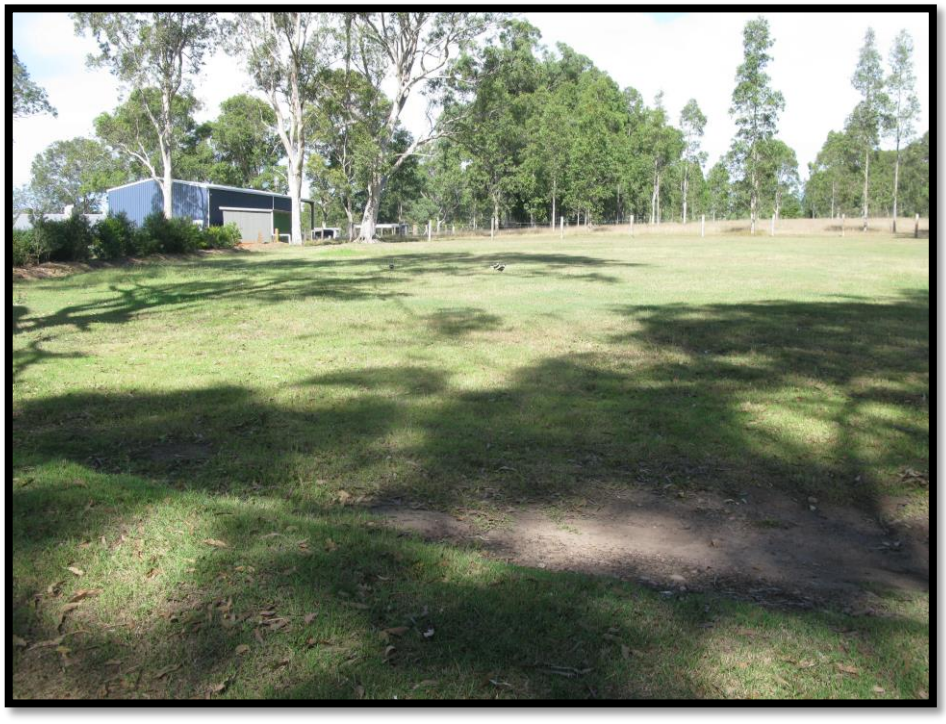

Plate 2: Transect 1, Lot 2 looking east along ridge crest land unit

Plate 3: Transect 1, Lot 2 looking south-west showing area of ground exposure

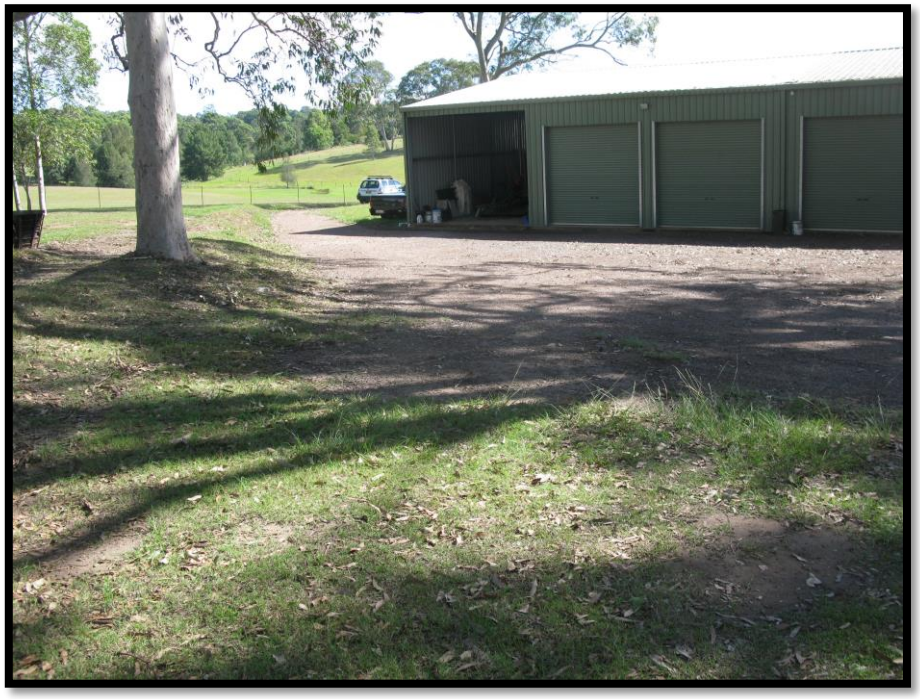

Plate 4: Transect 1 showing large modern shed and vehicle access track

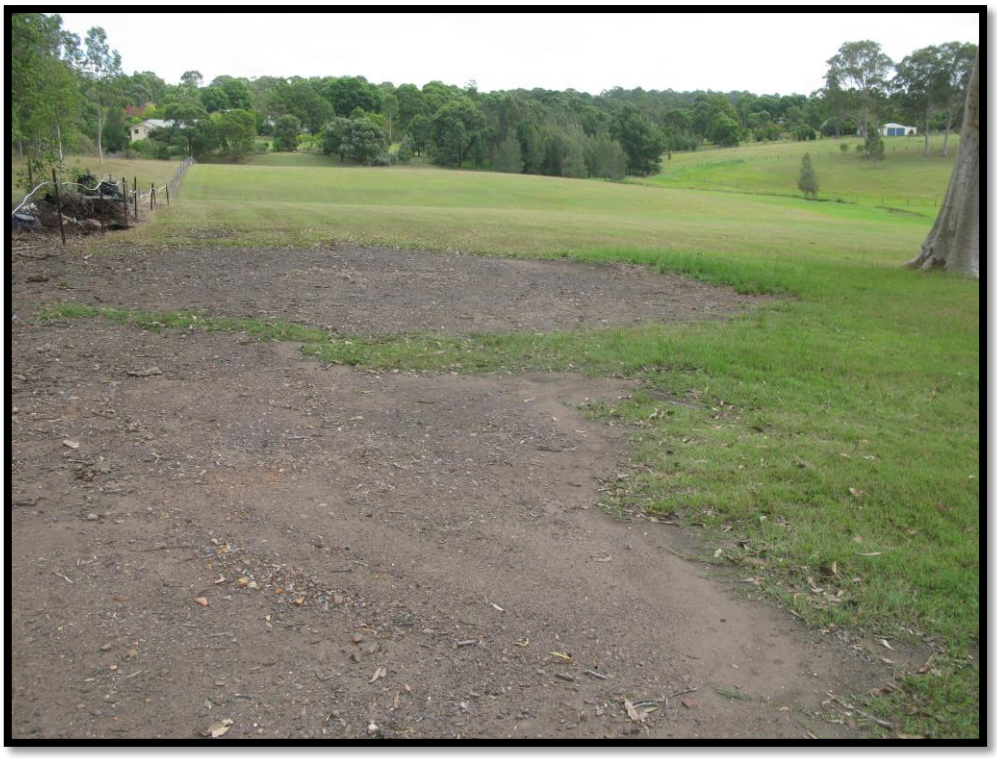

Plate 5: Transect 2, Lots 3-7 looking south along area of ground exposure

Plate 6: Transect 2, Lots 3-7 looking west along mid slope land unit

Plate 7: Transect 2, Lots 3-7 looking south along mid slope land units

Plate 8: Transect 2, Lots 3-7 looking downslope towards ephemeral drainage line

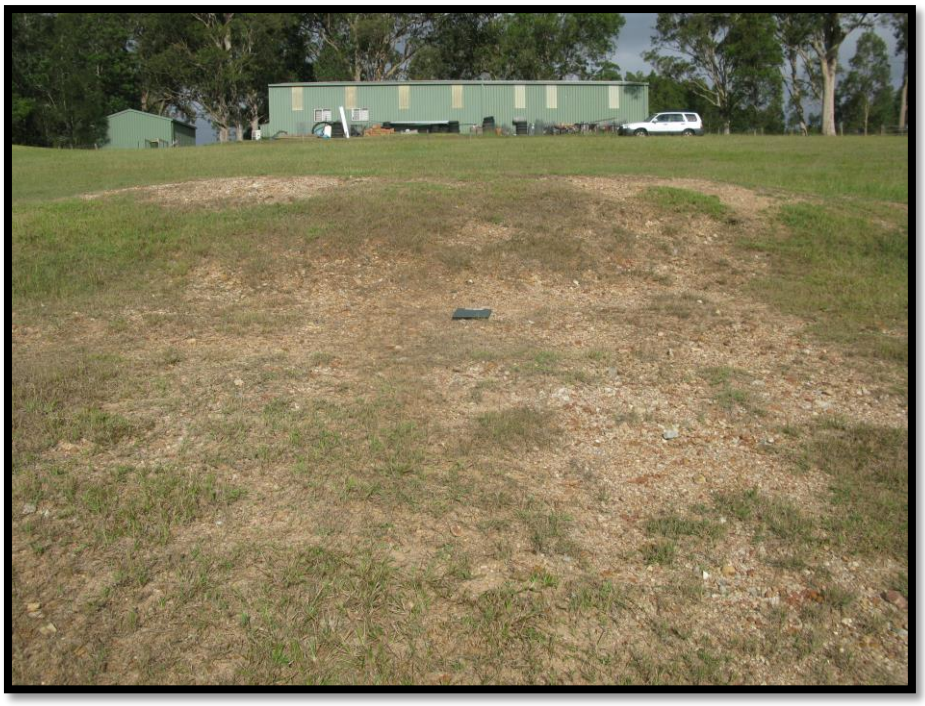

Plate 9: Transect 2, Lots 3-7 looking at area of ground disturbance and exposure

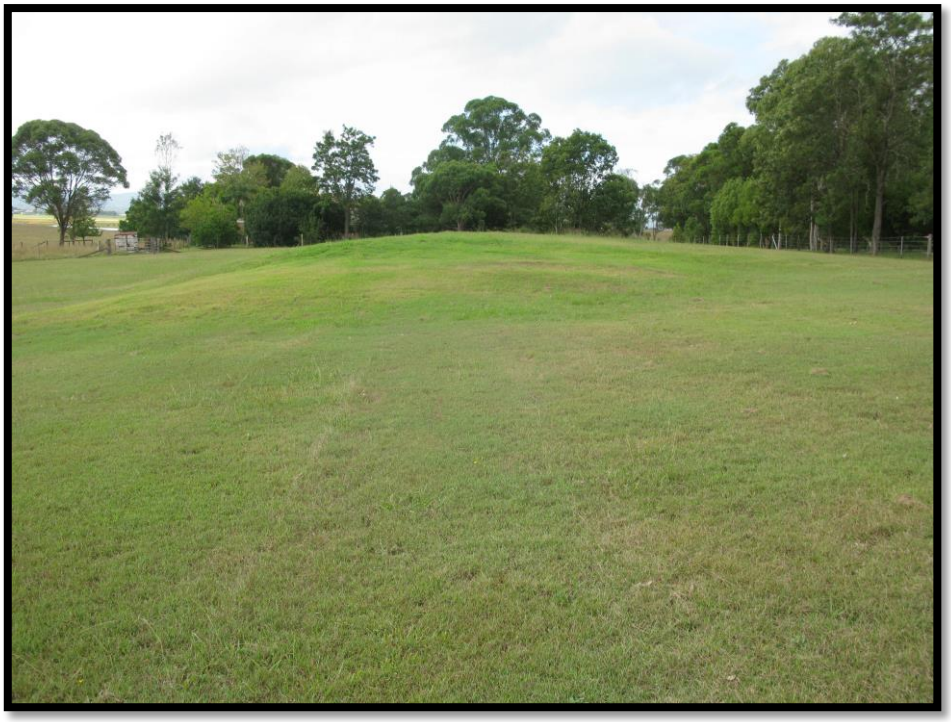

Plate 10: Transect 2, Lots 3-7 looking north at soil mound from an old pool excavation fill

APPENDIX 3
General Glossary of Terms

Aboriginal heritage impact permit	A permit issued by the Director-General of DECC allowing a person to harm Aboriginal objects (i.e. to destroy, deface, damage or desecrate objects or to move objects).
Aboriginal object	A statutory term defined under the National Parks and Wildlife Act 1974 meaning, 'any deposit, object or material evidence (not being handicraft made for sale) relating to Aboriginal habitation of the area comprising NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes human remains.
Aboriginal place (as defined in the *NPW Act*)	A place declared under s.84 of the NPW Act that, in the opinion of the Minister, is or was of special significance to Aboriginal culture.
Activity	A project, development, activity or work (this term is used in its ordinary meaning, and does not just refer to an activity as defined by Part 5 EP&A Act).
Additional surface disturbance	Clear, observable disturbance of existing ground surface or obvious changes to existing ground surface – e.g. removal of vegetation; construction of new fire trail, construction of new dam or contour banks, ploughing a previously grazed paddock.
Analysis	Evaluation of archaeological data to determine the archaeological significance of sites recorded within an impact area.
Analytical recording	A process of site recording which obtains detailed archaeological data useful in archaeological analysis.
Archaeological comparability	The evaluation of whether archaeological sites are uniformly different or similar across an impact area.
Archaeological data	Archaeological information that is recorded as a result of an archaeological investigation.
Archaeological deposit	A layer of soil material containing archaeological remains.
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.

Archaeological survey	A method of data collection for Aboriginal heritage assessment. It involves a survey team walking over the land in a systematic way, recording information about how and where the survey is conducted, recording information about the landscape and recording any archaeological sites or materials that are visible on the land surface. The activities undertaken by a survey team do not involve invasive or destructive procedures, and are limited to note taking, photography and making other records of the landscape and archaeological sites (e.g. sketching maps or archaeological features).
Artefact scatter	A collection of artefacts usually lying as a lag deposit on an eroding surface.
Artefact	▪ Any object made by human agency (e.g. stone artefacts). ▪ For the purposes of this Code, 'artefact' has the same meaning as object, (excluding the extension of the term to 'deposits') as defined in the NPW Act.
Assemblage	▪ A group of stone artefacts found in close association with one another; and ▪ Any group of items designated for analysis - without any assumptions of chronological or spatial relatedness (Witter 1995).
Avoidance	A management strategy which protects Aboriginal Sites within an impact area by avoiding them totally in development.
Broken flake	A flake which is either a distal fragment or proximal fragment.
Campsite	A site which contains a variety of artefactual data not specific to one type of stone tool reduction sequence.
Code of practice	A set of guidelines to be followed by members of a particular occupation or organisation; does not normally have the force of law.
Complete flake	A flake which is whole and not broken.

Conflict site	A site where confrontation occurred between Aboriginal and non-Aboriginal people or between different Aboriginal groups.
Contact site	A site relating to the period of first contact between Aboriginal and non-Aboriginal people.
Core	A lump or nodule of stone from which flakes have been removed.
Culturally modified tree	A tree that has been scarred, carved or modified by an Aboriginal person by: ▪ the deliberate removal, by traditional methods, of bark or wood from the tree; or ▪ the deliberate modification, by traditional methods, of the wood of the tree.
Debitage	Unmodified flakes or fragments of stone material removed as a result of stone tool manufacture or modification
Declared Aboriginal place	A statutory concept, meaning any place declared to be an Aboriginal place (under s.84 of the NPW Act) by the Minister administering the NPW Act, by order published in the Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal objects.
Disturbed land	For the purposes of this clause, land is disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable. Note 1. Examples of activities that may have disturbed land include the following: ▪ soil ploughing; ▪ construction of rural infrastructure (such as dams and fences); ▪ construction of roads, trails and tracks (including fire trails and tracks and walking tracks); ▪ clearing of vegetation;

- construction of buildings and the erection of other structures;
- construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, storm water drainage and other similar infrastructure);
- substantial grazing involving the construction of rural infrastructure; and
- construction of earthworks associated with anything referred to in paragraphs (a) – (g).

The Low Impact Activities prescribed by the NPW Regulation do not apply in relation to any harm to an Aboriginal culturally modified (scarred) tree.

Due diligence — The degree of care and caution required before making a decision.

Exposed in section and section — The vertical exposure of a soil that reveals the stratigraphy or the profile of the soil and any objects it may contain. Sections may:

- be revealed during archaeological excavations (formed by the walls of the excavation);
- occur naturally in creek and river banks, land slips, wind-eroded dune faces or other such naturally formed vertical profiles; or
- be formed artificially, for example in road and railway cuttings.

Exposure — Is 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 percentage 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' (see also Burke and Smith 2004: 78–80, NPWS 1999).

Exposure type	Refers to the results of erosional processes: sheet wash, gullying, blowouts, salt scalds, tracks or animal pads. As well as erosional processes, ground exposure may be caused by earth-moving machinery (e.g. bulldozers and graders, vehicle traffic etc.).
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Flaked piece	A fragment of stone where negative flake scarring is visible but no obvious striking platforms are present.
Full coverage survey	A survey conducted on foot in which all surfaces within the subject area are systematically observed and recorded.
Hand tools	Include spades, trowels, shovels, pans and brushes.
Harm an Aboriginal object (as defined in National Parks and Wildlife Act 1974)	▪ Destroy, deface, damage or desecrate an object; ▪ Move an object from the land on which it is situated; or ▪ Cause or permit an object to be harmed.
Hearth	The site of a campfire represented by charcoal, burnt earth, ash and sometimes stones used as heat retainers.
Impact area	An area that requires archaeological investigation and management assessment.
In situ	Latin words meaning 'on the spot, undisturbed'.
Isolated find	A single artefact found in an isolated context.
Knapping floor	A location on a site which normally represents a stone artefact reduction episode.
Landforms	Are the units (or similar) of land description explained and defined as 'landform elements' in The National Committee on Soil and Terrain (eds) *Australian Soil and Land Survey Field Handbook.* Landforms have a characteristic dimension of about 40 m. There are 70 landform elements defined in the *Australian Soil and Land Survey Field Handbook* (Speight 1990: 16; 17–44). Landforms are the primary subdivisions for the survey stratification.

Land system	An area, or group of areas, commonly delineated on a map, throughout which there is a recurring pattern of topography, soils, and vegetation.
Land unit	An area of common landform, and frequently with common geology, soils, and vegetation types, occurring repeatedly at similar points in the landscape over a defined region. It is a constituent part of a land system.
Landform	Any one of the various features that make up the surface of the earth.
Landscape	That part of the land's surface, more or less extensive being viewed or under study, that relates to all aspects of its physical appearance, including various vegetation associations and landforms.
Management plans	Conservation plans which identify short and long term management strategies for all known sites recorded within an impact area.
Material traces	Of past Aboriginal land use has the same meaning as 'Aboriginal object' in the NPW Act. See 'Aboriginal object'.
Methodology	The procedures used to undertake an archaeological investigation.
Minimum requirements	The minimum standard for which OEH will accept the reporting of an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
Objects	Has the same meaning as 'Aboriginal object' in the NPW Act. See 'Aboriginal object'.
Open area excavation	A method of excavation where large areas of an archaeological site are open at any one time. A horizontal representation of Aboriginal occupation of different archaeological features is considered to be more important than vertical stratigraphic relationships.

Open site	An archaeological site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill etc.).
Potential archaeological deposit (PAD)	Is an area where sub-surface stone artefacts and/or other cultural materials are likely to occur (DEC 2005: 67).
Research design	A research strategy for carrying out an intensive archaeological investigation and analysis.
Rock shelters	Are vertical or overhanging rock formations, including any flat or not steeply inclined ground surface below the overhang or at the base of the vertical face, which contain, or may be reasonably expected to contain, material traces of past Aboriginal land use (objects).
Salvage	A method by which an archaeological site or group of sites may be fully investigated before they are totally destroyed by a development.
Sample unit	An area of investigation which is uniform size or density and which can be quantified for analytical reasons.
Sampling	The process of selecting part of an area under archaeological investigation as a basis for generalising about the whole.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	A place where past human activity is identifiable
Sites	Is sometimes used as another name for Aboriginal objects and material traces of past Aboriginal land use. The term is commonly used in archaeological assessments and discourse.
Spatial significance	A site which may contain potential sub-surface deposits or in situ material useful in the analysis of human use of land and site formation process.
Subject area	Refers to the area that is the subject of archaeological investigation. Ordinarily this would include the area that is being considered for development approval, inclusive of the proposed development footprint and all associated land

	parcels. To avoid doubt, the subject area should be determined and presented on a project-by-project basis.
Summary recording	A process of site recording where archaeological data is collected on a summary level only.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.
Survey units	Are strictly defined by OEH to include only units of land that have been surveyed on foot. A survey unit may include more than one landform unit, correspond to a landform unit or be smaller than a landform unit depending on how the sampling strategy is structured. The survey unit is the minimum analytical or descriptive unit for the survey, and may be the same as the landform. A single survey unit should not cross the boundaries of different landforms, but there may be more than one survey unit within a landform. Sometimes survey units are also referred to as 'sampling units'.
Technological significance	Artefactual material which may contain types or items, although not unique, may be included in a sample to demonstrate an aspect of stone artefact variability.
Test excavation	A process of exploratory excavation carried out on a small scale and used to determine site extent, site condition and excavation potential.
Trivial or negligible acts	▪ Actions which have minimal impact on the environment; ▪ Examples of what may be "trivial or negligible acts" given in the OEH Code are "picking up and replacing a small stone artefact, breaking a small Aboriginal object when you are gardening or crushing a small Aboriginal object when you walk on a track, picnicking, camping or other similar recreational activities".
Types of sites or types of features	Refers to the particular characteristics of material traces of past Aboriginal land use. For example, a rock shelter site is a type of site distinct from a scared tree. In addition, a rock shelter site (and indeed many sites) may contain multiple archaeological or

	cultural features: rock art, stone artefacts, and archaeological deposits.
Vehicle traverses	Activities involving the archaeological observation of a subject area from a vehicle.
Visibility	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' (see also Burke and Smith 2004: 78–80, NPWS 1999).