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2.3.5 Flora and Fauna

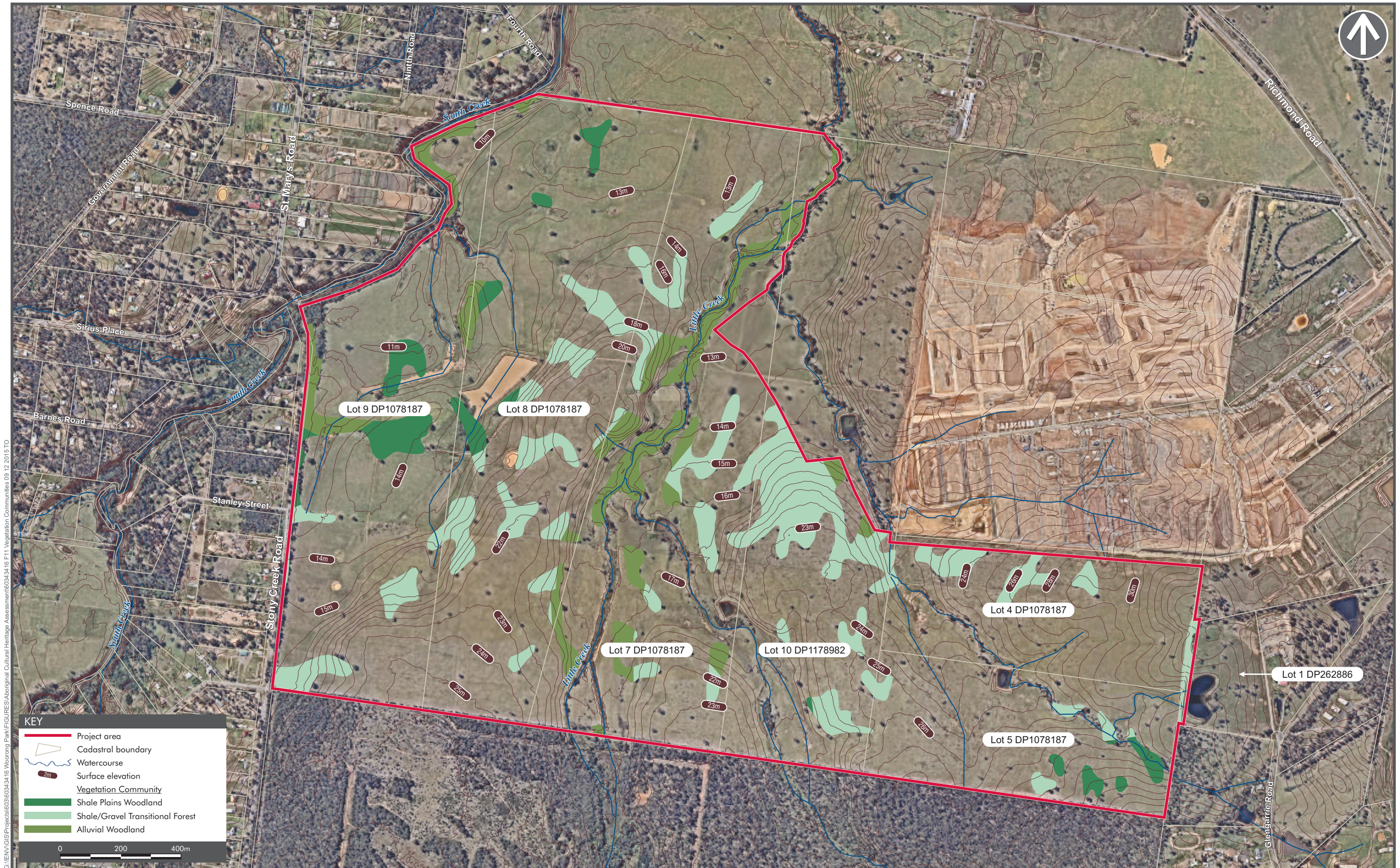
Native vegetation within the Project area has been extensively modified as a result of agricultural and pastoral land use activities, with the majority cleared historically for grazing and/or cropping. Vegetation today consists predominantly of mixed native and exotic grassland with scattered paddock trees. However, linear strips of remnant and/or regenerating woodland are also present along drainage lines. Historical clearance notwithstanding, existing native vegetation mapping for the Cumberland Plain suggests that the Project area was once covered in a mixture of woodland and open forest communities, with at least three distinct vegetation occupying different landscape positions within the site: Alluvial Woodland, Shale Plains Woodland and Shale/Gravel Transition Forest (**Figure 10**).

As its name implies, Alluvial Woodland appears to have been restricted to alluvial valley floors in association with drainage lines. This community is most often dominated by Cabbage Gum (*Eucalyptus amplifolia*) and Forest Red Gum (*E. tereticornis*), with Apple Box (*Angophora floribunda*) occurring less frequently (Tozer 2003). Parramatta Green Wattle (*Acacia parramattensis*), Swamp Oak (*Casuarina glauca*) and Flax-leaved Paperbark (*Melaleuca linariifolia*) can also occur. A shrub stratum is usually evident though is often sparse and dominated by Blackthorn (*Bursaria spinosa*). A dense ground cover of grasses such as Basket-grass (*Oplismenus aemulus*), Weeping grass (*Microlaena stipoides*), Bordered Panic (*Entolasia marginata*) and Forest Hedgehog Grass (*Echinopogon ovatus*) is also typical as is the presence of herb species such as Forest Nightshade (*Solanum prinophyllum*), Whiteroot (*Pratia purpurascens*) and Native Wandering Jew (*Commelina cyanea*).

Shale Plains Woodland seems to have been represented in both creek flat (floodplain) and elevated ridgeline/rise contexts, a distribution consistent with that described by Tozer (2003: 19) for the community as a whole. The most widely distributed native vegetation community on the Cumberland Plain, Shale Plains Woodland is typically dominated by Grey Box (*E. moluccana*) and Forest Red Gum (*E. tereticornis*), with Narrow-leaved Ironbark (*E. crebra*), Thin-leaved Stringybark (*E. eugenioides*) and Spotted Gum (*Corymbia maculata*) also occurring, though less frequently. A shrub stratum dominated by Blackthorn (*Bursaria spinosa*) is usually also present. Common ground stratum species for this vegetation community include Kidney Weed (*Dichondra repens*), Threeawn Speargrass (*Aristida vagans*), Weeping Grass (*Microlaena stipoides*), Kangaroo Grass (*Themeda australis*), Brunoniella (*Brunoniella australis*), Tender Tick-trefoil (*Desmodium varians*), Thin Leaf Stink Weed (*Opercularia diphylla*), Blue Bell (*Wahlenbergia gracilis*) and Shorthair Plumegrass (*Dichelachnemicrantha*).

Concentrated on elevated landform elements underlain by Tertiary alluvium, Shale/Gravel Transition Forest is an open-forest community dominated by Broad-leaved Red Ironbark (*E. fibrosa*), with Grey Box (*E. moluccana*) and Forest Red Gum (*E. tereticornis*) occurring less frequently. A small tree stratum of White Feather Honey Myrtle (*Melaleuca decora*) is frequently present. A sparse shrub stratum is also usually present and contains species such as Blackthorn (*Bursaria spinosa*), Gorse Bitter Pea (*Daviesia ulicifolia*) and Peach Heath (*Lissanthe strigosa*). Common ground stratum species for this community include Weeping Grass (*Microlaena stipoides*), Poison Rock Fern (*Cheilanthes sieberi*), Kangaroo Grass (*Themeda australis*), Stinkweed (*Opercularia diphylla*), Many-flowered Mat-rush (*Lomandra multiflora*), Threeawn Speargrass (*Aristida vagans*), Whiteroot (*Pratia purpurascens*) and Sprawling Bluebell (*Wahlenbergia gracilis*).

While available historical records provide only limited insight into Aboriginal exploitation of plants across the Cumberland Plain, and Sydney Region more broadly (see, in particular, Attenbrow 2010: 76-78 and Kohen 1986: 36-52), it can be confidently asserted that the original vegetation communities of the Project area and its environs will have supplied Aboriginal people camping within or travelling through the area with an extensive array of edible and otherwise useful plant species. Recorded native vegetation communities and locally occurring watercourses would likewise have supported a large and diverse range of economic terrestrial, aquatic and avian fauna. Historical evidence for Aboriginal peoples' use of the floral and faunal resources of Sydney's Cumberland Plain is discussed in further detail in **Section 4.4.1**.



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2.3.6 Historical Context and Land Disturbance

Formal European settlement of the Marsden Park area can be traced to the early 1800s, with land grants and formal improvements to Richmond Road in 1816 and 1822 attracting a range of settlers. Difficult farming conditions in the area are reported to have led to an emphasis on grazing and the exploitation of timber resources (GML 2009). For the current Project area, early-to-mid 19th century parish maps indicate that the overwhelming majority of land within this area comprised part of two large land grants (1,500 and 1,100 acres respectively⁶) to surgeon, public servant and landholder Dr John Harris, with a small sliver of land in the easternmost portion of the site⁷ comprising part of an adjoining 1,350 acre grant to convict, settler and public servant Richard Fitzgerald. Bordered to the north by Walter Lang's Clydesdale estate and to the south by the Rooty Hill estate, Harris's 1,500 and 1,100 acre grants made up the majority of his Shanes Park estate, which also included a third, smaller grant of 700 acres to the west of Portion 115 along South Creek (GML 2013: 14). Upon his death in 1838, Harris's land was inherited by his three nephews (Samuel, Robert and David Harris), with Robert and Samuel's sons, both named John, subsequently receiving the land in equal shares and further subdividing it (GML 2013: 14).

Aerial photographs from 1947 show that sections of South Creek floodplain in the westernmost portion of the Project area had by this point in time been largely cleared of vegetation and were, in places, being used for cropping (**Figure 12**). With the exception of a few lightly vegetated areas in the northern portion of the site, the remainder of the Project area remains moderately to densely vegetated, with land use presumably limited to grazing. Subsequent aerials attest to progressive native vegetation clearance across the site and suggest an overall emphasis on grazing, with multiple farm dams constructed along and away from drainage lines. Cropping, meanwhile, appears to have restricted to the South Creek floodplain. Aerials from 1986 show a Project area more-or-less identical to that of the present day in terms of an exceedingly sparse vegetative cover, with the significant stands of trees occurring along drainage lines.

More broadly, historical aerial photographs for the Project area provide a framework for assessing the nature and extent of post-European settlement land use activities and ground disturbance across the Project area. Aerials from 1947 (**Figure 12**), 1955 (**Figure 13**), 1965 (**Figure 14**), 1986 (**Figure 15**), 2005, 2007 and 2009, for example, indicate a range of activities and associated ground surface impacts. These include:

- Extensive native vegetation clearance pre- and post-1947, the form of which (i.e., cut and burn versus ripping) is unknown;
- Pastoral activities including fencing and the construction of multiple farm dams;
- Cropping in the westernmost and northern portions of the Project area (i.e., on the South Creek floodplain);
- Powerline installation;
- Vehicle track construction and use;
- Environmental rehabilitation works (i.e., planting) along part of the easternmost tributary of Little Creek;
- The construction of various buildings and structures within and outside of the Woorong Park homestead complex;
- Localised cut and fill works adjacent to Little Creek; and
- Erosion (sheet and creek bank).

To varying degrees, all of the above-cited land use activities and associated ground impacts are relevant to the survival, integrity and identification of Aboriginal archaeological evidence within the Project area. Key implications for the current archaeological investigation include:

- The disturbance of pre-existing archaeological deposits, both surface and subsurface, through direct (e.g., earthworks) and indirect (e.g., erosion) means, resulting in a loss of archaeological integrity;
- A reduced likelihood for the presence of culturally scarred trees; and
- An increase, in areas affected by erosion, of archaeological site visibility.

⁶ Portions 115 (1,500 acres) and 117 (1,100 acres) of the Parish of Rooty Hill

⁷ That portion of Lot 1 on DP262886

Figure 16 comprises a land disturbance map for the Project area, with two basic levels of disturbance - 'minimal to moderate' and 'high' - recognised. Areas of 'minimal to moderate' disturbance within the Project area are defined here as those that, while cleared historically and used for cropping and/or grazing, have not been subject significant ground disturbance(s) (e.g., heavy earthworks, severe erosion). Highly disturbed areas, in contrast, comprise those that have been grossly disturbed through activities such as cut and fill earthworks, building and dam construction, powerline installation, severe erosion and vehicle track construction/use. Highly disturbed areas within the Project area are assessed as having negligible potential for intact archaeological deposit.

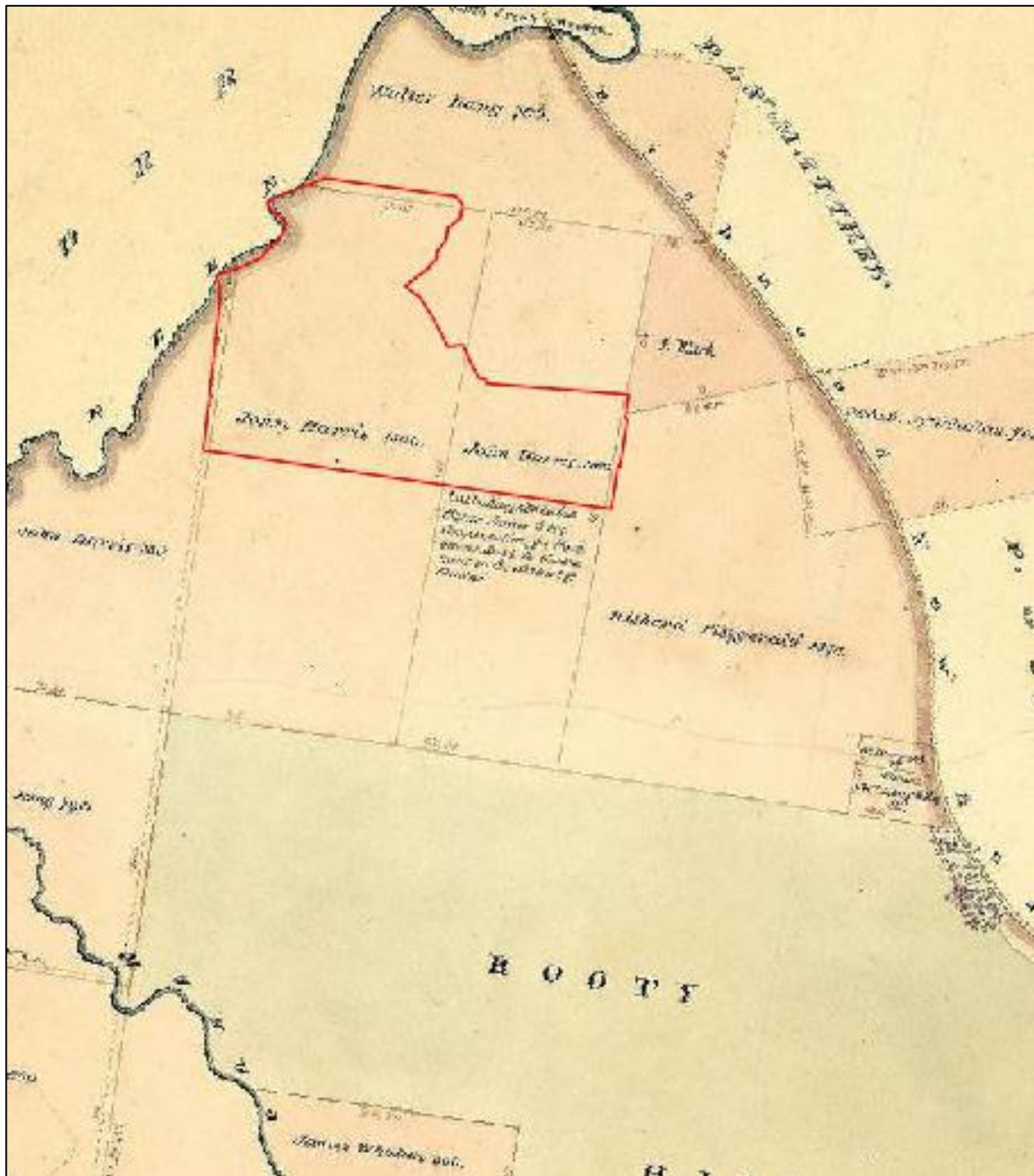


Figure 11 Part of 1835 plan of Parish of Rooty Hill. Approximate location of Project area marked in red (Source: Land & Property Information NSW).

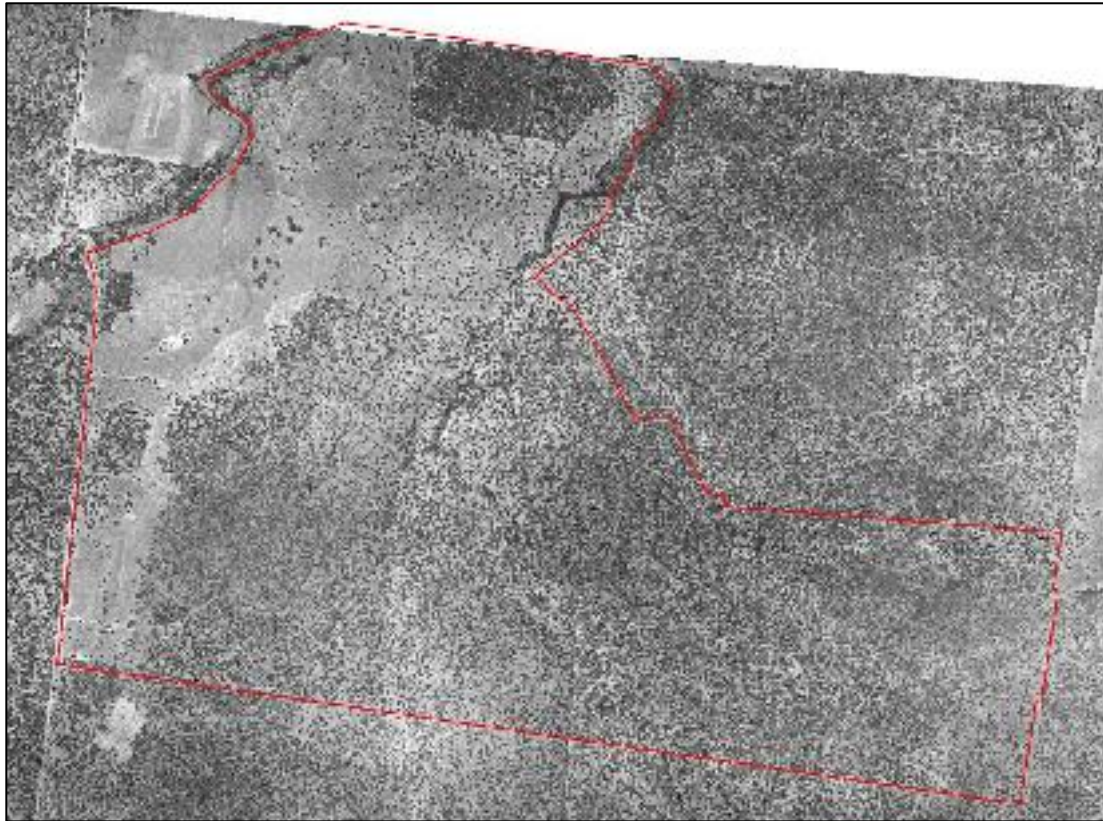


Figure 12 Composite 1947 aerial photograph of the Project area (Source: Land & Property Information NSW).



Figure 13 Composite 1955 aerial photograph of the Project area (Source: Land & Property Information NSW).



Figure 14 Composite 1965 aerial photograph of the Project area (Source: Land & Property Information NSW).



Figure 15 Composite 1986 aerial photograph of the Project area (Source: Land & Property Information NSW).



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2.3.7 Key Observations

Key observations to be drawn from a review of the existing environment of the Project area are as follows:

- The topography of the Project area is typical of Bannerman and Hazelton's (2011) Cumberland Lowlands physiographic region and can be broadly characterised as flat to gently undulating, with level ($\leq 1^\circ$) to very gently inclined ($1-3^\circ$) creek flats (floodplains) in the central, northern, western and eastern portions of the site giving way to low, variably-dissected ridgelines and/or rises.
- Elevated, low gradient landform elements adjacent to higher order streams are well represented within the Project area and are likely to have been favoured for sustained/repeated occupation on the basis of factors such as proximity to potable water and other water-dependent resources, ease of access and comfort.
- The Project area contains parts of several, ephemeral to intermittent watercourses ranging in magnitude from 1st to 4th order streams. South Creek, a regionally significant perennial watercourse, flows in part along the western boundary of the Project area. Little Creek, an intermittent tributary of South Creek, is the primary and only named watercourse within the Project area. Following Strahler (1952), the creek enters the Project area as a 3rd order stream and exits it as a 4th order stream, being fed within the site by two unnamed, north-northwesterly trending tributaries, both of which comprise 3rd order streams.
- At present, Little Creek and its tributaries can be classified as highly degraded, intermittent watercourses with semi-continuous incised channels. However, field observations and available historical reference materials for the greater Marsden park area suggest that the pre- and early post-European settlement morphology of these watercourses was likely that of chains of ponds.
- Stone suitable for flaked and/or ground stone artefact manufacture is, at present, widely and abundantly distributed within the Project area. Together with available geological mapping, field observations indicate the presence of extensive surface and subsurface deposits of Rickabys Creek Gravels (Tr) within the site, with intercepted examples of the latter interpreted as deflated expressions of the formation as opposed to *in situ* deposits. Aerially extensive deposits of loose polymictic gravels belonging to this formation occur on the Project area's three flat-topped ridgelines. Gravels derived from the formation are also present in the bedloads of Little Creek and its major tributaries.
- Prior to European settlement, the floral and faunal resources of the Project area and environs will have been sufficient to facilitate intensive and/or repeated occupation by Aboriginal people;
- Native vegetation within the Project area has been extensively modified as a result and agricultural and pastoral land use activities, with the majority cleared historically for grazing and/or cropping. Nonetheless, there remains some, albeit limited, potential for the Project area to contain mature trees with cultural scarring;
- Examination of historical aerial imagery for the Project area indicates a range of historical land use activities and associated ground surface impacts. Major activities/impacts include native vegetation clearance, cropping (South Creek floodplain only), fencing, the construction of farm dams and erosion (sheet and creek bank).
- Historical land use activities notwithstanding, the majority of land within the Project area is assessed as retaining a moderate degree of integrity.

3.0 Aboriginal Community Consultation

Aboriginal community consultation acknowledges the right of Aboriginal people to be involved, through direct participation, on matters that directly affect their heritage. Involving Aboriginal people in all facets of the assessment process ensures that they are given adequate opportunity to share information about cultural values, and to actively participate in the development of appropriate management and/or mitigations measures. The successful identification, assessment and management of Aboriginal cultural heritage values are dependent on an inclusive and transparent consultation process.

Aboriginal community consultation for the current assessment was undertaken in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a) (Consultation Requirements). The results of the consultation process undertaken are detailed below. A consultation log is provided as **Appendix A**.

3.1 Stage 1 - Notification and Registration

The aim of Stage 1 of the Consultation Requirements is to identify, notify and register Aboriginal people who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places in the Project Area.

3.1.1 Consultation with Regulatory Agencies

Section 4.1.2 of the Consultation Requirements stipulates that proponents are responsible for ascertaining, from reasonable sources of information, the names of Aboriginal people who may hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places. Proponents are required to compile a list of Aboriginal people who may have an interest for the proposed Project Area and hold knowledge relevant to determining the cultural significance of Aboriginal objects and/or places by writing to:

- a) the relevant regional office of the NSW Office of Environment & Heritage (OEH);
- b) the relevant Local Aboriginal Land Council(s);
- c) the Registrar, Aboriginal Land Rights Act 1983 for a list of Aboriginal owners;
- d) the National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements;
- e) Native Title Services Corporation Limited (NTSCORP Limited);
- f) The relevant local council(s); and
- g) The relevant catchment management authorities for contact details of any established Aboriginal reference group.

In accordance with this requirement, the following agencies were contacted via letter or email on 13 May 2015 requesting information on relevant Aboriginal persons and organisations:

- Office of Environment and Heritage - Parramatta Office;
- Deerubbin Local Aboriginal Land Council (Deerubbin LALC);
- Office of the Registrar, *Aboriginal Land Rights Act 1983* (NSW);
- The National Native Title Tribunal (NNTT);
- NTSCORP Limited;
- Blacktown City Council; and
- Sydney Catchment Authority.

Responses were received from five agencies and are attached as **Appendix C**:

- Deerubbin LALC responded on 13 May 2015 advising that they would like to register their interest in the Project;
- The NNTT responded on 14 May 2015 advising that, as freehold land, native title has been extinguished over the Project area;

- NTSCORP responded on 15 May 2015 advising that although their privacy guidelines restrict them from providing proponents with contact details for Traditional Owners, they would forward our correspondence to any individuals, groups and organisations whom they are aware assert traditional interests within or hold cultural knowledge about the Project area;
- Blacktown City Council responded on 15 May 2015 providing the details of nine Aboriginal persons and organisations who may wish to be consulted as part of the assessment; and
- OEH responded on 20 May 2015 providing the details of 35 Aboriginal persons and organisations who may wish to be consulted as part of the assessment.

3.1.2 Public Notification

Section 4.1.3 of the Consultation Requirements requires that, in addition to writing to the Aboriginal people identified by the agencies listed in **Section 3.1.1**, the proponent must also place a notice in the local newspaper circulating in the general location of the proposed project. The notification must outline the project and identify its location.

In accordance with this requirement, a public notice was placed in the Rouse Hill Times on 15 May 2015 (**Appendix D**). The closing date for registration via this notice was 4 June 2015, which provided the necessary minimum 14 day period for expressions of interest.

No responses to the notice were received prior to, or after, this date.

3.1.3 Invitations for Expressions of Interest

Section 4.1.3 of the Consultation Requirements requires that proponents must write to the Aboriginal people whose names were obtained through the regulatory agencies and the relevant Local Aboriginal Land Council(s) to notify them of the proposed project and invite them to register an interest in participating in a process of community consultation.

In accordance with this requirement, on 2 June 2015, a letter inviting expressions of interest and containing summary information on the project was sent to all Aboriginal persons and organisations identified by the regulatory agencies. A total of 36 Aboriginal stakeholders were invited to register an interest in being consulted. The closing date for expressions of interest was 17 June 2015, which provided the necessary minimum 14 day period for expressions of interest.

By the closing date for expressions of interest, 39 organisations had registered an interest in the assessment. Summary information on all RAPs, including registration dates, is provided in **Table 4**.

Table 4 Registered Aboriginal Parties

Organisation	Date of registration	Method	Contact Person
Deerubbin Local Aboriginal Land Council	13/05/15	Email	Steve Randall
Darug Aboriginal Cultural Heritage Assessments	22/05/15	Phone	Celestine Everingham
Warragil Cultural Services	02/06/15	Email	Aaron Slater
Corroboree Aboriginal Corporation	03/06/15	Email	Steve Johnson
Darug Land Observations	03/06/15	Email	Gordon Workman
Kamilaroi-Yankuntjatjara Working Group	05/06/15	Letter	Phil Khan
Merrigan Indigenous Corporation	10/06/15	Email	Shaun Carroll
Murri Bidgee Mullangari Aboriginal Corporation	10/06/15	Email	Darleen Johnson
Amanda Hickey Cultural Services	10/06/15	Email	Amanda Hickey
Darug Aboriginal Land Care Inc	10/06/15	Email	Des Dyer
Gunjeewong Cultural Heritage Aboriginal Corporation	05/06/15	Letter	Cherie Turrise
Darug Custodian Aboriginal Corporation	16/06/15	Phone	Justine Coplin
Darug Tribal Aboriginal Corporation	16/06/15	Phone	John Reily

Organisation	Date of registration	Method	Contact Person
Gunyu	04/06/15	Email	Darlene Hoskins-McKenzie
Tocomwall Pty Ltd	29/05/15	Phone	Danny Franks
Aboriginal Archaeology Service	16/06/15	Phone	Tony Williams
Wurrumay Consultant	16/06/15	Email	Kerrie Slater
Kawul Cultural Services	16/06/15	Email	Vicky Slater
Murrumbal	03/06/15	Email	Levi McKenzie-Kirkbright
Wingikara	03/06/15	Email	David Bell
Bilinga	03/06/15	Email	Christopher Payne
Munyunga	03/06/15	Email	Peter Foster
Walbunja	04/06/15	Email	Hika TeKowhai
Nundagurri	04/06/15	Email	Aaron Broad
Ngunawal	04/06/15	Email	Edward Stewart
Badu	04/06/15	Email	Karia Bond
Tharawal	04/06/15	Email	Violet Carriage
Eora	04/06/15	Email	Kahu Brennan
Wandandian	04/06/15	Email	William Bond
Ngarigo	04/06/15	Email	Newton Bond
Yerramurra	04/06/15	Email	Nicholas Glover
Gangangarra	04/06/15	Email	Kim Carriage
Elouera	04/06/15	Email	Lenard Nye
Goobah	14/06/15	Email	Basil Smith
Murramarang	14/06/15	Email	Roxanne Smith
Cullendulla	14/06/15	Email	Janaya Smith
Gulaga	14/06/15	Email	Wendy Smith
Biamanga	14/06/15	Email	Seli Storer
Wullung	17/06/15	Email	Leeroy Boota

3.1.4 Notification of Registered Aboriginal Parties (RAPs)

Section 4.1.6 of the Consultation Requirements requires that the proponent make a record of the names of each Aboriginal person who registered an interest and provide a copy of that record, along with a copy of the EOI letter forwarded to the Aboriginal parties, to the relevant OEH regional office and LALC. Section 4.1.5 of the Consultation Requirements provides the opportunity for Aboriginal persons to withhold their details from being forwarded to these parties.

In accordance with these requirements, on 6 June 2015, a list of the 38 RAPs that had not requested their details be withheld was forwarded to the relevant OEH regional office (Parramatta) and the Deerubbin LALC. A copy of the EOI letter sent out on 2 June 2015 was included in this correspondence.

3.2 Stage 2 - Presentation of Information about Project

The aim of Stage 2 of the Consultation Requirements is to provide RAPs with information about the scope of the proposed project and the proposed cultural heritage assessment process.

For the current assessment, presentation of information about the Project area and proposed development was provided to RAPs as part of the registration of interest process detailed in **Section 3.1.3**. Basic information on the proponent and proposed development was included in the Expression of Interest (EOI) letter mailed on 2 June 2015.

3.3 Stage 3 – Gathering Information about Cultural Significance

The aim of Stage 3 of the Consultation Requirements is to facilitate a process whereby RAPs can:

- a) Contribute to culturally appropriate information gathering and the assessment methodology;
- b) Provide information that will enable the cultural significance of Aboriginal objects and/or places on the proposed Project Area to be determined; and
- c) To have input into the development of any cultural heritage management measures.

For current assessment, consultation with RAPs regarding the cultural heritage values of the Project Area included:

- A request with the draft assessment methodology for any initial comments regarding the Aboriginal cultural heritage values of the Project Area;
- Discussion of cultural heritage values during fieldwork; and
- The provision of a draft report to all RAPs for comment prior to finalisation.

3.3.1 Draft Survey Methodology

Sections 4.3.1 and 4.3.2 of the Consultation Requirements require that the proponent present and/or provide the proposed methodology for the cultural heritage assessment to RAPs and that RAPs be given a minimum of 28 days to review and provide feedback on this methodology.

In accordance with these requirements, on 16 June 2015, all RAPs (excluding Wullung) were sent a draft of AECOM's proposed methodology for this cultural heritage assessment (**Appendix E**). A request for any initial comments regarding the cultural values of the Project area was also made in the cover letter accompanying the methodology. The specified closing date for comments was 15 July 2015, which provided the necessary minimum 28 day period for comment. Wullung, who registered on 17 June 2015, were forwarded a copy of the draft methodology and cover letter the same day.

Responses to the draft methodology were received from 14 RAPs, 13 written and one verbal. Responses are summarised in **Table 5**, with written responses attached as **Appendix F**. As indicated, all RAPs who provided a response to the draft methodology indicated that they supported it.

Information regarding the cultural values of the Project area was provided by two RAPs in their response to the draft methodology. Celestine Everingham of Darug Aboriginal Cultural Heritage Assessments advised that the Project area forms part of a much larger and highly significant cultural landscape for Darug people, noting that recent excavations at the PT12 site adjacent to the Hawkesbury River at Windsor, northwest of the Project area, have demonstrated Aboriginal occupation from the Late Pleistocene. Phillip Khan of Kamilaroi-Yankuntjatjara Working Group, meanwhile, advised that “[o]f Koori people walked all over this country and looked after it and protected it as they moved around it using it in Spiritual ways to Survive” [sic].

No other specific cultural heritage values relating to the Project area were identified by RAP respondents. However, Cherie Carroll Turrise from Gunjeewong Cultural Heritage Aboriginal Corporation provided some personal recollections of her upbringing in the Marsden Park area, as well as some thoughts regarding the importance of documenting Aboriginal archaeological sites in this area before they are destroyed. The relevant section of Cherie's response is reproduced below:

“As I'm sure you already know my family have lived in the area most of our lives. My dad used to tell me lots of stories about our ancestors. He used to show me where the ancestors used to camp and tell stories. That's why I think it's so important we find and mark where our ancestors roamed over the lands, their lands, which are disappearing at an alarming rate. I go back to my old area, but when I return it's no longer my place...I know that as time goes by our lands will be gone. I would like to farewell places I loved and enjoyed”

Table 5 RAP responses to draft methodology

Registered Aboriginal Party (RAP)	Date of response	Method of response	Summary of response to proposed methodology	AECOM response to RAP comments
Darug Aboriginal Cultural Heritage Assessments	22-06-15	Verbal	DACHA is happy with the proposed methodology	None required
Warragil Cultural Services	16-06-15	Written	Warragil Cultural Services accept and agree with the methodology	None required
Kamilaroi-Yankuntjatjara Working Group	19.06.15	Written	Kamilaroi-Yankuntjatjara Working Group is happy with the proposed methodology.	None required
Merrigan Indigenous Corporation	03-07-15	Written	Merrigan Indigenous Corporation agrees with the draft methodology	None required
Murri Bidgee Mullangari Aboriginal Corporation	03-07-15	Written	Murri Bidgee Mullangari Aboriginal Corporation agree with the methodology	None required
Darug Aboriginal Land Care Inc	16-07-15	Written	Darug Aboriginal Land Care Inc agree with the methodology	None required
Gunjeewong Cultural Heritage Aboriginal Corporation	25-06-15	Written	Gunjeewong Cultural Heritage Aboriginal Corporation <i>"agree with any decisions and believe that you [AECOM] have our ancestors Aboriginal interests in safe keeping"</i> .	None required
Aboriginal Archaeology Service	16-06-15	Written	AAS agree with the methodology and advise that they <i>"would like to see all artifacts collected to be displayed in the council library or reburied on site at the entry to the property with a information plaque [sic]"</i> .	AAS's request for artefacts recovered from the Project area - presumably those recovered through test excavation - to be displayed at the local council library or reburied at the entrance to "Woorong Park" with an information plaque is noted. In accordance with Requirement 16B of the Code of Practice, all stone artefacts recovered from the Project area as part of the test excavation program detailed in AECOM's AAR (Appendix B) will be stored temporarily at AECOM's head office (Level 8, 420 George Street, Sydney) while options for their long term management, such as on-site reburial or deposition at a local library, are being investigated, as determined through consultation with RAPs. Requirement 26 of the Code of Practice provides standard procedures for the deposition of stone artefacts dealt with under AHIPs and the Code of Practice. These

Registered Aboriginal Party (RAP)	Date of response	Method of response	Summary of response to proposed methodology	AECOM response to RAP comments
				procedures will be strictly adhered to.
Wurrumay Consultant	15-07-15	Written	Wurrumay agrees with the draft methodology	None required
Kawul Cultural Services	15-07-15	Written	Kawul Cultural Services agrees with the draft methodology	None required
Murramarang	01-07-15	Written	Murramarang support the methodology	None required
Cullendulla	23-06-15	Written	Cullendulla support the methodology	None required
Gulaga	01-07-15	Written	Gulaga support the methodology	None required
Biamanga	23-06-15	Written	Biamanga support the methodology	None required

3.3.2 Archaeological Survey and Test Excavation Program

All RAPs were offered the opportunity to participate in the fieldwork component of the archaeological investigation detailed in **Appendix B**. EOI notifications for the proposed field assessment, including insurance requirements and selection criteria, were provided in writing to all RAPs on 6 July 2015 (**Appendix G**). The specified closing date for expressions of interest was 15 July 2015. In the end, a total of 35 RAPs provided representatives for fieldwork. RAP field representatives are listed by organisation in **Table 6**.

RAP field representatives involved in fieldwork identified the following social or cultural values for the Project area in conversations with AECOM field staff:

- Prior to European settlement, South Creek would have been an important resource feature for Aboriginal people occupying the Project area;
- The quantity of artefacts recovered from the TP11 expansion excavation indicates that the smaller of the Project area's two residual rises was a favoured camping spot;
- The lithic assemblage recovered during test excavation is typical of those found locally in terms of being dominated by artefacts manufactured out of silcrete; and
- Stones used for flaked stone artefact manufacture in the Project area were likely quarried from locally occurring gravel deposits.

Table 6 RAP field representatives by organisation

Organisation	Field representative(s)
Deerubbin Local Aboriginal Land Council	Raymond Adams
Darug Aboriginal Cultural Heritage Assessments	Dennis Hardy
Warragil Cultural Services	Greg Slater
Corroboree Aboriginal Corporation	Steve Johnson
Darug Land Observations	Jamie Workman
Kamilaroi-Yankuntjatjara Working Group	Marbuck Khan
Merrigan Indigenous Corporation	Shaun Carroll
Murri Bidgee Mullangari Aboriginal Corporation	Ryan Johnson
Darug Aboriginal Land Care Inc	Shaun Lynch
Gunjeewong Cultural Heritage Aboriginal Corporation	Bruce Turrise
Darug Custodian Aboriginal Corporation	Lana Wedgwood
Darug Tribal Aboriginal Corporation	Mark Newham
Gunyu	Peter Foster
Tocomwall Pty Ltd	Danny Franks & John Phillips
Aboriginal Archaeology Service	Andrew Williams
Wurrumay Consultant	Rod Hickey
Kawul Cultural Services	Rod Hickey
Murrumbal	Jacob Murray & Peter Foster
Wingikara	Jarrod Strudwick, Matong Foster & Peter Foster
Bilinga	Matong Foster
Munyunga	Peter Foster & Matong Foster
Walbunja	Basil Smith
Nundagurri	Basil Smith

Organisation	Field representative(s)
Ngunawal	Basil Smith
Badu	Andrew Bond
Tharawal	Basil Smith
Eora	Andrew Bond
Wandandian	Robert Parson
Ngarigo	Andrew Bond
Yerramurra	Basil Smith
Gangangarra	Newton Bond
Elouera	Newton Bond
Goobah	Basil Smith
Murramarang	Andrew Bond & Robert Parson
Biamanga	Basil Smith

3.4 Stage 4 - Review of Draft Assessment Report

The aim of Stage 4 of the Consultation Requirements is to prepare and finalise an Aboriginal cultural heritage assessment report with input from RAPs.

In accordance with Section 4.4.2 of the Consultation Requirements, on 23 December 2015, all RAPs were sent a draft of this ACHAR and the Project's AAR for review and comment. The specified closing date for comments was 21 January 2016, which provided the necessary minimum 28 day review period. However, in order to provide those RAPs who had not responded by the official closing date with additional time to respond, on 21 January 2016, all relevant RAPs were notified in writing that the review period had been extended until Close of Business (COB) on 27 January 2016.

Seven written and four verbal responses to the draft reports were received from RAPs by COB on Wednesday 27 January 2016. RAP responses are summarised in **Table 7**, with written responses attached as **Appendix H**. No other RAPs provided comment on the draft report.

Table 7 RAP responses to draft ACHAR

Registered Aboriginal Party (RAP)	Date of response	Method of response (contact person)	Summary of response to draft ACHAR	AECOM response to RAP comments
Gunjeewong Cultural Heritage Aboriginal Corporation	24-12-15	Text message (Cherie Carroll Turrise)	Ms Carroll Turrise advises that she has read both reports and agrees with them.	None required
Kamilaroi-Yankuntjatjara Working Group	13-01-16	Letter (Phil Khan)	Mr Khan advises that he has read the report and is happy with it (including the recommendation for salvage excavation) but is a little disappointed that no attempt was made to identify and protect - as an Aboriginal heritage conservation area - an area along South Creek or Little Creek within the Project area. Mr Khan advises that alluvial floodplains associated with these creeks are areas of potential for burial sites.	As indicated in Section 7.0 , during the assessment process, attempts were made to identify archaeological conservation areas within the Project area that could be set-aside from development impacts and managed in perpetuity as Aboriginal heritage conservation areas. Initially, it was determined that portions of the South Creek and Little Creek valleys earmarked for environmental conservation (or parts thereof) might prove suitable for long-term conservation. However, through discussions with Project engineers, it was determined that the nature and extent of ground disturbance works in these areas was of a scale sufficient to compromise their suitability as conservation zones. Regarding the potential for burials on the South Creek and Little Creek floodplains, it is noted that existing archaeological data for the Cumberland Plain indicate that burials are a regionally rare site type and thus are unlikely to occur within the Project area. Nonetheless, the current ACHAR includes a formal management procedure for any potential human remains (Section 8.1) revealed by construction activity.
Murra Bidgee Mullangari Aboriginal Corporation	19-01-16	Email with letter attachment (Ryan Johnson)	Murra Bidgee Mullangari Aboriginal Corporation agree with AECOM's management recommendations. Regarding management of test-excavated artefacts, MBMAC advise that they would like to see these go to a library or museum if possible.	In the absence of an alternate majority preferred long term management option, all Aboriginal objects recovered from the Project area as a result of the test excavation program detailed in AECOM's AAR (Appendix B) and the salvage program outlined in Appendix D of the same report, will be lodged with the Australian Museum.
Darug Aboriginal Landcare	20-01-16	Email with letter attachment (Des	Darug Aboriginal Landcare have no objections to the proposed development and agree with	Darug Aboriginal Landcare's request for on-site reburial is noted. Should the majority of RAPs identify - as part of

Registered Aboriginal Party (RAP)	Date of response	Method of response (contact person)	Summary of response to draft ACHAR	AECOM response to RAP comments
		Dyer)	AECOM's proposed management strategy. In addition, Darug Aboriginal Landcare would like to see a plan of management developed for the reburial of salvaged artefacts, with artefacts to be reburied in a non-impact area close to where they are recovered.	post-salvage consultation - on-site reburial as the preferred long term management option for salvaged Aboriginal objects, AECOM will consult with RAPs regarding an appropriate reburial location and - if required - submit an application to OEH to vary the relevant condition of any issued AHIP. In the absence of a majority-preferred option, all Aboriginal objects recovered from the Project area as a result of the test excavation program detailed in AECOM's AAR (Appendix B) and the salvage program outlined in Appendix D of the same report will be lodged with the Australian Museum.
Darug Aboriginal Cultural Heritage Assessments	21-01-16	Verbal (Celestine Everingham)	DACHA are happy with the reports and management recommendations	None required
Darug Tribal Aboriginal Corporation	21-01-16	Verbal (John Reily)	DTAC are happy with the reports	None required
Deerubbin Local Aboriginal Land Council	21-01-16	Verbal (Steve Randall)	Deerubbin LALC are happy with how the project unfolded and have no problems with the reports	None required
Darug Land Observations	21-01-16	Verbal (Gordon Workman)	DLO are happy with the reports and proposed salvage program	None required
Aboriginal Archaeology Service	21-06-16	Email with letter attachment (Andrew Williams)	AAS would like to commend AECOM on the way it has engaged with RAPs and advise that the assessment methodology was comprehensive. AAS recommends that AECOM be a preferred provider for Aboriginal heritage assessments in the northwest sector, a highly significant area for local Aboriginal people.	None required
Darug Custodian Aboriginal Corporation	25-01-16	Email with letter attachment (Justine Coplin)	DCAC advises that, apart from the large number of people consulted with for the assessment, they support the ACHAR. In addition, DCAC wishes to be involved in any future fieldwork and consultation. DCAC also wish to note that Darug sites "are a complex and not all separate sites" and recommend that the connections between sites are investigated throughout the project.	DCAC's concerns regarding the large number of RAPs consulted with for this project are noted. Aboriginal community consultation for the current assessment was conducted in strict accordance with OEH's Consultation Requirements, which require consultation with all RAPs. DCAC's recommendation regarding the investigation of links between sites is likewise noted. AECOM can confirm that such links will be explored as part of the salvage

Registered Aboriginal Party (RAP)	Date of response	Method of response (contact person)	Summary of response to draft ACHAR	AECOM response to RAP comments
				program, with excavated lithic assemblages, for example, to be contextualised through comparative intra- and inter-Project area assessments of assemblage size and composition.
Corroboree Aboriginal Corporation	27-01-16	Email with letter attachment	CAC advises that, following an extensive review of the ACHAR from all their members, they have no objections to the report and that the proposed salvage program is consistent with their views. In addition, they advise that no additional recommendations are sought.	None required

4.0 Review of Background Information

4.1 Regional Archaeological Context

4.1.1 The Sydney Region

Available archaeological data indicate that Aboriginal people have occupied the Sydney region⁸ for at least 36,000 years (Jo McDonald CHM 2005b; Williams *et al.* 2014). Late Pleistocene/early Holocene occupation of the region is evidenced by radiometric dates from both coastal and hinterland sites (see Attenbrow, 2010:18, Table 3.1). Excavated material culture assemblages from these periods have been interpreted as evidence of relatively small populations of Aboriginal people employing settlement patterns of high residential and low logistical mobility (Attenbrow 2010:152-154; McDonald 2008: 39). Late Pleistocene/early Holocene chipped stone assemblages attest to a preference for silicified tuff sourced from secondary geological sources such as the Hawkesbury-Nepean River gravels (McDonald 2008; Williams *et al.* 2014). However, they also indicate the exploitation of other raw material types such as silcrete, quartzite and quartz. Direct freehand percussion appears to have been the dominant reduction technique employed by Late Pleistocene/early Holocene Aboriginal knappers, with bipolar flaking comparatively poorly represented in available assemblages. Retouched 'tools' include unifacially-flaked pebble implements, dentated saws, burins and a variety of scrapers, with unmodified utilised flakes also well represented (Kohen *et al.* 1984; Williams *et al.* 2014). Stone tools such as these will have been complemented by a range of organic implements such as wooden digging sticks, spears and boomerangs. However, these do not survive archaeologically (Attenbrow 2010:154).

Compared with the late Pleistocene/early Holocene, archaeological evidence for mid-to-late Holocene Aboriginal occupation of the Sydney Region abounds (for recent syntheses see Attenbrow 2010; McDonald 2008). In keeping with broader Australian developments (e.g., Allen and O'Connell 1995; Beaton 1985; Brumm and Moore 2005; Attenbrow *et al.* 2009; Lourandos 1983, 1997; Lourandos and Ross 1994), the social and economic systems of Aboriginal groups living in the region during this period appear to have become increasingly complex. Available archaeological data, for example, suggest a significant increase in site establishment and population densities over time, as well as a concomitant growth in the size and complexity of social aggregation (but see Attenbrow (2012) and Hiscock (2008) for cautionary notes on the interpretive significance of radiometric date graphs). Growing economic specialisation is indicated by the emergence and/or proliferation of complex fishing and stoneworking technologies, with the latter linked variously to increased foraging risk associated with greater climatic variability as well as other variables such as redefinition of social space, reduction of resources and increased logistical pre-equipping (Attenbrow *et al.* 2009; McDonald 2008: 40). Complex, long-distance exchange networks are also attested archaeologically (e.g., Attenbrow *et al.* 2012; Grave *et al.* 2012) as are important developments in artistic activities (McDonald 2008). Higher levels of stylistic heterogeneity in pigment and engraved art across the region, for example, have been linked to increasing territoriality (McDonald 2008: 42).

With some modification, McCarthy's (1967) *Eastern Regional Sequence* (ERS) of stone artefact assemblages remains the dominant chronological framework for Aboriginal occupation of the region (**Table 8**). Based on appreciable changes in the composition of chipped stone artefact assemblages over time, the ERS hypothesises a three phase sequence of 'Capertian' (earliest), 'Bondaian' and 'Eloueran' (most recent) assemblages and was developed on the basis of McCarthy's (1948, 1964) pioneering analyses of stratified flaked stone assemblages from Lapstone Creek rockshelter, on the lower slopes of the Blue Mountains eastern escarpment, and Capertee 3 rockshelter in the Capertee Valley north of Lithgow. At present, the most widely cited characterisation of the ERS in the Sydney region is that of a four-phase sequence beginning with the *Pre-Bondaian* (McCarthy's *Capertian*) and moving successively through the Early, Middle and Late phases of the *Bondaian*, the last of which equates to McCarthy's (1967) *Eloueran* phase. The tripartite division of the Bondaian is based principally on the presence/absence and relative abundance of backed artefacts (Attenbrow 2010: 101). However, other factors, such as changes in the abundance of bipolar artefacts and different stone materials, as well as the presence/absence of edge-ground hatchet-heads are also relevant.

⁸ Following Attenbrow (2012a), the land bounded by the coast on the east, by the Hawkesbury-Nepean River on the north and west, and by a line running east-west through Picton and Stanwell Park in the south.

Table 8 McCarthy's (1967) Eastern Regional Sequence (ESR) of stone artefact assemblages

Current phasing	McCarthy's (1967) Phasing	Approximate date range	Backed artefact frequency	Bipolar artefacts	Edge-ground hatchet heads
Pre-Bondaian	Capertian	40,000-8,000 BP	Absent	Rare	Absent
Early Bondaian	Bondaian	8,000-4,000 BP	Very low	Rare	Absent
Middle Bondaian		4,000-1,000 BP	Very high	Increasingly common	Present
Late Bondaian	Eloueran	1,000 BP to European contact	Low	Very common	Present

4.1.2 The Cumberland Plain

Concentrated archaeological investigation of the Aboriginal archaeological record of Sydney's Cumberland Plain can be traced to the early-to-mid 1980s, a period marked by a rapid growth in residential and other forms of development across the Plain. Intensive development activities since this time have secured the Cumberland Plain's place as one of the most intensively investigated archaeological regions in Australia, with hundreds, if not thousands, of Aboriginal archaeological investigations involving survey and/or excavation having now been undertaken, the majority as part of larger Environmental Impact Assessments associated with residential development and affiliated infrastructure projects. Unsurprisingly, these investigations have varied significantly in scale and scope, ranging from targeted small-scale surveys to complex, multi-phase survey and excavation projects over large areas. Nonetheless, together, they have revealed a rich and diverse record of past Aboriginal occupation, with thousands of Aboriginal archaeological sites registered on OEH's Aboriginal Heritage Information Management System (AHIMS) database. To date, useful syntheses of this record have been compiled by Attenbrow (2010), Jo McDonald CHM (1997b), McDonald (2008) and Przywolnik (2007). Key investigation themes are detailed in brief in the sections below.

4.1.2.1 Open Artefact Sites: Distribution, Contents and Definition

Surface and subsurface distributions of stone artefacts, variously referred to as open artefact sites, open sites and open camp sites are the most common and widely distributed form of Aboriginal archaeological site on the Cumberland Plain (see Attenbrow 2010: Plate 12; Przywolnik 2007: 46., Table 4.2). Other site types, such as scarred trees, quarries, grinding grooves and rock shelters with deposit and/or art or PAD, have also been identified but are comparatively rare. Accordingly, open artefact sites remain the most intensively investigated component of the Aboriginal archaeological record of the Cumberland Plain, with site distribution and the technology of associated flaked stone artefact assemblages, in particular, comprising key research topics (e.g., AMBS 2000; Craib et al. 1999; Jo McDonald CHM 2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b; Kohen 1986; White & McDonald 2010).

Existing archaeological survey data for the Cumberland Plain indicate a strong trend for the presence of open artefact sites along watercourses, specifically, on creek banks and 'flats' (i.e., flood/drainage plains), terraces and bordering lower slopes (Kohen 1986:). Although this distribution pattern can be attributed in part to geomorphic dynamics and archaeological sampling bias, with extensive fluvial erosion activity along watercourses resulting in higher levels of surface visibility and, by extension, concentrated survey effort, an occupational emphasis on watercourses is supported by the results of numerous subsurface investigations (e.g., AECOM 2013b, 2015; AMBS 2000; Craib et al. 1999; GML 2012; Jo McDonald CHM 2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b). Collectively, these investigations have demonstrated that assemblage size and complexity tend to vary significantly in relation to stream order and landform, with larger, more complex⁹ assemblages concentrated on elevated, low gradient landform elements adjacent to higher order watercourses. Outside of these contexts, surface and subsurface artefact distributions have typically been found to be sparse and discontinuous and are often referred to as 'background scatter'.

Flaked stone artefacts dominate archaeological finds assemblages from recorded open artefact sites on the Cumberland Plain, with heat shattered rock also well represented. Items such as complete and broken grindstones, hammerstones and edge-ground hatchet heads have also been recorded though comparatively infrequently. With the notable exception of 'knapping floors', a relatively common component of the Aboriginal archaeological record of the Cumberland Plain, associated archaeological features (e.g., hearths and heat

⁹ Those containing a wider variety of raw materials and technological types and/or higher mean artefact densities and features such as knapping floors.

treatment pits) have likewise proven elusive (but see McDonald and Rich 1994; Jo McDonald CHM 2009a for examples). Investigated knapping floors across the Plain have varied considerably in size and complexity, with the largest and most complex examples identified through excavation as opposed to surface survey (e.g., Jo McDonald CHM (2001, 2005a, 2006b, 2007). Backed artefacts (i.e., Bondi points, geometric microliths and elouera) are a common feature of knapping floors and most of these features were likely specifically associated with their production. As in other NSW contexts, most notably the Hunter Valley (e.g., Hiscock 1993; Moore 2000), available evidence supports the suggestion that backed artefact manufacture on the Cumberland Plain was a highly structured or systematic activity.

Although relevant to a variety of site types, geomorphic processes such as soil erosion and colluvial/fluvial aggradation are of particular relevance to the identification and definition of open artefact sites. As in other archaeological contexts (e.g., Dean-Jones & Mitchell 1993; Fanning & Holdaway 2004; Fanning *et al.* 2009; Holdaway *et al.* 2000), it is now widely accepted by archaeologists working on the Cumberland Plain that the visibility of open artefact sites across the Plain can, for the most part, be attributed to contemporary and historical geomorphic processes which have variously exposed and obscured them. As demonstrated by numerous large scale salvage projects across the Cumberland Plain, surface artefacts invariably represent only a fraction of the total number of artefacts present within recorded surface open artefact sites, with a typical surface to subsurface artefact ratio of 1:25 (Jo McDonald CHM 2005b: 35). Artefact exposure, unsurprisingly, is highest on erosional surfaces and lowest on depositional ones. At the same time, in many areas, surface artefacts have been shown through dispersed testing to form part of more-or-less continuous subsurface distributions of artefacts, albeit with highly variable artefact densities linked to environmental variables such as distance to water, stream order and landform (e.g., White & McDonald 2010). Critically, the presence or absence of surface artefacts on the Cumberland Plain is not a reliable indicator of Aboriginal archaeological sensitivity.

4.1.2.2 Flaked Stone Artefact Technology

Virtually indestructible, flaked stone artefacts are a ubiquitous element of the Aboriginal archaeological record of the Cumberland Plain and have assumed a prominent position in archaeological reconstructions of past Aboriginal land use across the region. To date, hundreds, if not thousands, of surface-collected and excavated flaked stone assemblages from across the Cumberland Plain have been analysed, with individual assemblage sizes, research questions, aims, analytical methodologies and terminological schemes varying significantly between researchers and projects. Studies to date have ranged from basic descriptive accounts of assemblage composition in typological terms to detailed reconstructions of past stone reduction and quarrying behaviours through rigorous technological analyses. Particularly informative analyses in the context of the Cumberland Plain include those conducted by Jo McDonald CHM (2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b) as part of archaeological salvage projects associated with development activities within the Rouse Hill Development Area (RHDA), the former Australian Defence Industries (ADI) site at St Marys and the Colebee Release Area (CRA).

Available technological and typological data for surface collected and excavated chipped stone artefact assemblages from the Cumberland Plain suggest that the majority of these assemblages belong to what is known as the 'Australian small-tool tradition', a term coined by Gould (1969) to describe what was then thought to be the first appearance, in the mid-Holocene¹⁰, of a new suite of flaked stone tool forms in the Aboriginal archaeological record of Australia, including backed artefacts (i.e., Bondi points and geometric microliths), adzes and points, both unifacially and bifacially flaked. Complex, hierarchically-organised reduction sequences associated with the production of these tools contrast markedly with the simple sequences of earlier periods (Moore 2011).

Tools of the Australian small-tool tradition, it has been suggested, formed part of a portable, standardised and multifunctional tool kit aimed specifically at risk reduction (Hiscock 1994, 2002, 2006). Stone artefact assemblages from late Pleistocene and early Holocene contexts, in contrast, are described by archaeologists as belonging to the 'Australian core tool and scraper tradition', a term first used by Bowler *et al.* (1970) to describe the Pleistocene assemblages recovered from Lake Mungo in western New South Wales. Bowler *et al.* (1970) saw the main components of these assemblages - core tools, steep-edged scrapers and flat scrapers - as characteristic of early Australian Aboriginal assemblages and as being of a distinctly different character to those associated with the proceeding small-tool tradition. In southeastern Australia, including the Cumberland Plain, the Australian 'small-tool' and 'core tool and scraper' traditions are most commonly described in terms of McCarthy's (1967) ERS, with 'Capertian' assemblages assigned to the latter tradition and 'Bondaian' assemblages, the former.

¹⁰ More recent research into the chronology of backed artefacts and points in Australia (e.g., Hiscock & Attenbrow 1998, 2004; Hiscock 1993b) has demonstrated a long history of production and use for these implement types, with both types now known to have been produced, albeit in small numbers, in the early Holocene and likely in the late Pleistocene as well.

Flaked stone artefact assemblages from excavated and surface collected open artefact sites on the Cumberland Plain attest to the exploitation of a diverse range of lithic raw materials (Corkill 1999, 2005). However, two rock types - silcrete and silicified tuff (also known as indurated mudstone) - dominate the region's existing stone artefact record. Other, less commonly exploited raw materials represented in excavated and surface collected assemblages include quartz, quartzite, petrified wood, chert and various fine-grained volcanics. Alongside silcrete and silicified tuff, these materials occur variously in a number of geological formations and units across the Cumberland Plain (for a detailed review see Corkill 1999). Oft-cited sources, for example, include the Tertiary St Marys (Ts) and Rickabys Creek Gravel (Tr) formations, as well as the various unconsolidated Pleistocene units that line as terraces the present day and abandoned channels of the Nepean/Hawkesbury River (e.g., Agnes Bank Sand (Qpa) and Cranebrook Formation (Qpc)).

In common with the Sydney region as a whole (Attenbrow 2010:120-121), various excavated assemblages from the body and peripheries of the Cumberland Plain (e.g., Jo McDonald CHM 2001a, 2005a; Williams *et al.* 2012; Williams *et al.* 2014) attest to a shift, over time, in the relative significance of particular raw materials for flaked stone artefact manufacture, principally silcrete and silicified tuff but also quartz. An 'early' (i.e., Pre-Bondaian) emphasis on the procurement and reduction of silicified tuff, for example, appears to have given way to a 'later' (i.e., Bondaian) emphasis on silcrete. Quartz use, meanwhile, appears to have peaked in the late Holocene. For the Cumberland Plain, these changes have been linked, in particular, to broader changes in settlement organisation, with a decline in levels of residential mobility over time prompting more intensive use of locally available stone (Jo McDonald CHM 2005a).

In the northwestern portion of the Cumberland Plain, the Tertiary St Marys Formation has been singled out as a particularly important source of silcrete for stone artefact manufacture. Mapped at various localities across the Mulgoa Creek, South Creek and Eastern Creek catchments, the best known and most intensively investigated outcrops of this formation occur on Plumpton Ridge, a low but prominent ridgeline separating the floodplains of Eastern and Bells Creek between the suburbs of Plumpton and Riverstone. The subject of numerous archaeological investigations since the early-1980s (e.g., AMBS 2002b; Baker 1996; McDonald 1986), recent large-scale archaeological salvage works across what is now Stonecutters Ridge Golf Club have unequivocally identified Plumpton Ridge as a major Aboriginal quarry site (Jo McDonald CHM 2006b). At the same time, they have highlighted a number of important trends in relation to the procurement and reduction of silcrete obtained from this source. Trends in the relative frequencies of raw material types, artefact types and the size of silcrete artefacts in local excavated assemblages, for example, have been attributed to a process of 'distance-decay'. As one of only three systematically investigated Aboriginal quarry sites on the Cumberland Plain, the other two being the ADI-EPI and ADI-FF22 sites within the former ADI site at St Marys (Jo McDonald CHM 2006a, 2008a), Plumpton Ridge is widely regarded as a feature of high scientific and cultural significance.

Backed artefacts dominate the retouched components of the majority of dated and undated Bondaian assemblages from the Plain and, as such, the technology of their manufacture has received considerable analytical and interpretive attention. Studies by Jo McDonald CHM (2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b), in particular, have demonstrated that backed artefact manufacture on the Cumberland Plain was a highly structured or systematic activity involving a complex system of raw material procurement, transportation, preparation and reduction. Differences in the technological character of recovered cores across the region attest to a significant degree of variability in the methods used by Aboriginal knappers to produce flakes for backed artefact manufacture. However, certain techniques (e.g., asymmetric alternating flaking and Hiscock's (1993) 'tranchet technique') are particularly well represented. Evidence for the deliberate heat treatment of silcrete blanks, both as part of systematic backed artefact manufacture activities and other reduction activities, is abundant and widespread, with excavated and surface collected assemblages attesting to the use of heat at various points in the reduction process. As in other contexts (e.g., Hiscock 1993), the thermal alteration of Cumberland Plain silcrete appears to have significantly improved the flaking quality of the stone, increasing the lustre and smoothness of fracture surfaces.

4.1.2.3 Chronology

In common with the Sydney region as a whole, evidence for late Pleistocene/early Holocene (i.e., Pre-Bondaian/Early Bondaian) Aboriginal occupation of the Cumberland Plain is rare, with dated and undated evidence from these periods obtained from only twelve sites: Rouse Hill sites RH/CC2 (Jo McDonald CHM 2001), RH/SC5 (Jo McDonald CHM 2002b), RH/CD12 (Jo McDonald CHM 2002a) and RHCD7 (Jo McDonald CHM 2007); Richmond site RMI (Jo McDonald CHM 1997a); SA23 in the Colebee Release Area (Jo McDonald CHM 2006b); PT12 near Pitt Town (Williams *et al.* 2012; Williams *et al.* 2014); Jamisons Creek, Emu Plains (Kohen *et al.* 1984); Power Street Bridge 2, Doonside (McDonald 1993), Regentville RS1, Regentville (Koettig & Hughes 1995; McDonald *et al.* 1996), RTA-GI at Parramatta (Jo McDonald CHM 2005b) and the Windsor Museum site

(Austral Archaeology 2011; Williams *et al.* 2012; Williams *et al.* 2014). Claims of a c.40 ka year old date for five 'flaked pebbles' recovered from a gravel pit associated with the Cranebrook Terrace near Penrith (Nanson *et al.* 1987) have been widely rejected, with legitimate concerns raised over the artefactual status of these pebbles, their provenance and association with available dates. For most sites, late Pleistocene/early Holocene occupation has been inferred on the basis of the technological and typological characteristics of recovered flaked stone artefact assemblages as opposed to radiometric dates.

At present, the oldest securely dated archaeological site on the Cumberland Plain is the PT12 site at Pitt Town, with compliance-based archaeological excavations across a source-bordering dune at this site, which overlooks the Hawkesbury River, producing a suite of OSL dates suggestive of Aboriginal occupation from at least 36,000 years ago (and potentially earlier) (Williams *et al.* 2012; Williams *et al.* 2014). Closer to the coast, Late Pleistocene/early Holocene occupation of a sandy fluvial terrace adjacent to the Parramatta River, excavated in three separate development contexts as sites 'RTA-GI', 'CGI' and 'GG3', has been proposed by Jo McDonald CHM (2005b) and seems likely on the basis of available radiometric dates and assemblage characteristics.

In stark contrast to the late Pleistocene/early Holocene, evidence for mid-to-late Holocene (i.e., Middle to Late Bondaian) Aboriginal occupation of the Cumberland Plain abounds, with numerous excavated sites producing assemblages that can be confidently assigned to these periods on the basis of radiometric dates and/or their typological/technological profiles. Available radiometric dates indicate a steady increase in the number of sites occupied over the course of the Holocene, with a peak in the 2nd millennium BP (see, for example, Przywolsnik 2007: 53, Fig. 4.6). Taken at face value, these data suggest a progressive increase in the Aboriginal population of the Cumberland Plain over the course of the Holocene. However, as argued by Hiscock (2008), albeit on a national scale, it seems likely that the directional population growth suggested by such data is, to a certain extent at least, a product of differential site preservation, with younger sites better preserved than older ones. Other factors, such as the burial of older sites through sediment deposition and bias in the location of archaeological surveys and excavations, may also be relevant.

4.1.2.4 Site Distribution and Occupation Models

A number of Aboriginal site distribution and occupations models have been proposed for the Cumberland Plain over the past four decades, with early models (e.g., Kohen 1986; Smith 1989) based almost exclusively on surface evidence and more recent models (e.g., AMBS 2000; Jo McDonald CHM 1997b) taking into account both surface and excavated evidence. As indicated in **Table 9**, Aboriginal site distribution on the Cumberland Plain has been linked to a variety of environmental factors, with proximity to water, stream order, landform and geology (including proximity to known stone sources) variously highlighted as key determinants.

Table 9 Aboriginal site distribution and occupation models for the Cumberland Plain

Researcher(s)	Year	Summary of model
Dallas and Witter	1983	- Sites closer to silcrete and other raw material sources will tend to contain more cores and waste chips and less utilized material than sites which are located further away. They will also contain more block fractured pieces, a higher frequency of cortex, and the artefacts will generally be larger than those at sites not associated with raw material sources; - In areas of raw material abundance, artefacts will be discarded earlier in the reduction sequence and will generally be larger and occur in a variety of forms; - Raw material abundance, quality and size will influence assemblage variability; and - Sites located away from raw material sources will exhibit a wider variety of activities and a higher number of utilized pieces than those closer to them.
Kohen	1986	- Proximity to water and geological context key determinants for site location; - Sites can be categorized as one of three types according to their function: - camping sites, which have a wide range of activities represented in the archaeological record; - woodworking sites, where there is a high proportion of implements to debitage present; and - hunting sites, which contain a relatively small number of unworked flakes and are sometimes associated with backed blades. - Greatest proportion of sites located on Wianamatta Shale substrates. - Number of artefacts found at a site and site size more closely correlated to the nature and degree of disturbance at a site than any behavioural factors. The more

Researcher(s)	Year	Summary of model
		disturbed the site, the greater the visibility and hence the greater quantity of artefacts recorded. Sites with high artefact densities tend to be found within 100m of permanent water sources.
Smith	1989	- Sites are most likely to occur in association with water sources. Permanency of the water source, however, is not a determining factor for site location, with a significant quantity of sites found along temporary creek lines. - Sites on the Londonderry Clay/Rickabys Creek Formation are likely to be found in association with gravel exposures. - Sites dominated by silcrete are less likely to be found west of Marsden Park and South Creek than east of those areas. Isolated finds in these areas are also less likely to be made from silcrete. - Sites east of South Creek are likely to be principally stone tool and silcrete manufacturing and processing sites. - Sites in the northern Cumberland Plain are expected to have a lower frequency of implements than those in the south. - Woodland areas will typically contain sites at lower densities than open forest areas. - Surface sites appear to be more common than subsurface sites, and undisturbed stratified sites are rare due to the degree of disturbance. - Sites with over 50 artefacts are rare, although very large sites (500+ artefacts) do occur. There is no apparent patterning to the occurrence of these large sites. The pattern of distribution of site size appears to be determined predominantly by visibility. - Sites cannot be divided neatly into 'single use' categories, as most sites were the location of numerous activities.
Jo McDonald CHM	1997b	- Open sites with subsurface archaeological deposits are the most commonly occurring sites. - Sites cannot be adequately characterized on the basis of surface evidence alone. - Where open sites are found in stable and aggrading landscapes, many will be intact and have the potential for internal structural integrity, with sites in alluvium and other depositional environments containing the best potential for intact archaeological remains and stratification. - Many sites contain extremely high artefact densities, with variability depending on the range of activity areas and site types present. - Artefacts are not evenly distributed across the landscape. Site patterning can be related to gross environmental factors, with sites on permanent water being more complex than those situated on ephemeral or temporary water lines. However, there is not always a direct correlation between site location and the environment. - Major confluences, particularly along major creeks, are prime site locations. - Proximity to water and underlying geological units are key factors in site distribution. However, distribution can be further measured according to stream order, with sites located in close proximity to established, permanent, and resource rich drainage channels (e.g., 3rd and 4th order creeks) are more likely to have higher artefact densities and a greater diversity of tools than sites associated with lower order water courses. - Temporary water sources and minor gullies tend to have single-use or occasionally repeated visits and hence lower density sites. - Locations between creeks, such as ridge-tops and spurs, may possibly contain archaeological evidence, which may vary according to proximity to water sources. - Sites in close proximity to an identified stone source will contain a range of size and cortex characteristics in their assemblages. As distance increases from the source, artefact size and percentage of cortex in the assemblage will decrease.
AMBS	2000	Spatial patterning in chipped stone artefact distributions adjacent to major creek lines can - in certain instances - be accommodated under a three-tiered model of

Researcher(s)	Year	Summary of model
		'Activity Overprint Zones' incorporating 'complex', 'dispersed' and 'sparse' zones. • Complex zones will exhibit overlapping knapping floors and high density concentrations of artefacts indicative of repeated, long-term occupation events. • Dispersed zones may include knapping floors. However, these are typically spatially discrete due to less frequent occupation. • Sparse zones will exhibit consistently low frequencies/densities of artefacts. Artefact discard in these zones is likely to have resulted from discard in the context of use or loss rather than manufacture. • Chipped stone artefact production and maintenance will leave a more obtrusive archaeological signature than resource extraction (e.g. food collection and processing). These activities will also occur closer to the residential core while resource extraction will typically occur away from it.

White and McDonald's (2010) analysis of lithic artefact distribution in the Rouse Hill Development Area (RHDA) provides a suitably robust dataset for assessing the validity of some of the key predictions of the models outlined above. Based on the results of over a decade of intensive test excavation in the RHDA, this study remains the most comprehensive of its type currently available for the Cumberland Plain. As indicated, Aboriginal site distribution on the Cumberland Plain has been linked to a variety of environmental factors, with distance to water, stream order, landform and geology (including proximity to known stone sources) variously highlighted as important influences. White and McDonald's (2010) analysis both supports and negates various aspects of the postulated relationships between these factors and Aboriginal site patterning on the Cumberland Plain. Key findings can be summarised as follows:

- Artefact distributions do not, as implied by the models of Kohen (1986) and Smith (1989), form bounded 'sites' but rather 'landscapes'.
- Artefact distribution does, as variably expressed by AMBS (2000), Kohen (1986), Jo McDonald CHM (1997b) and Smith (1989), appear to vary with proximity to water, albeit to different extents based on stream order.
- Artefact density does, as suggested by Jo McDonald CHM (1997b), appear to vary significantly with stream order.
- Artefact density does, as suggested by Jo McDonald CHM (1997b), appear to vary significantly with landform.
- Aboriginal archaeological sites on the Cumberland Plain cannot, as proposed by Jo McDonald CHM (1997b), be adequately characterized on the basis of surface evidence alone. Most areas, regardless of surface indications, contain subsurface archaeological deposit(s).
- The orientation of open land surfaces appears to have influenced the selection of artefact discard locations in the lower portions of valleys, with generally higher densities on lower slopes facing north and north-east.
- Distance from known silcrete sources does not, on present evidence at least, appear to have influenced intensity of artefact discard (cf. Dallas & Witter 1983).
- Trends in artefact density and distribution indicate long-term, large scale patterns. Short term models of settlement organization are insufficient to account for these artefact distributions; and
- Social and/or symbolic factors may have influenced site selection along with the distributions of economic and other resources.

4.2 Local Archaeological Context

4.2.1 AHIMS Database

The AHIMS database, administered by OEH, contains records of all Aboriginal objects reported to the Director General of the Department of Premier and Cabinet in accordance with Section 89A of the *National Parks and Wildlife Act 1974*. It also contains information about Aboriginal places, which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

Searches of the AHIMS database on 19 November 2015 for a 15 x 15 km area centred on the Project area (AHIMS search area) returned 778 site entries. Removal of duplicate, deleted and non-site entries (n = 10) provides a revised total of 768 registered Aboriginal sites. As is typical for the Cumberland Plain, open artefact sites with and without other forms of archaeological evidence (i.e., scarred trees, evidence of stone quarrying and PAD) are the most common site type represented within the AHIMS search area, accounting for 89.1% (n = 684) of known sites. Remaining sites consist principally of areas of Potential Archaeological Deposit (PAD) (n = 80, 10.4%), with scarred trees (n = 3, 0.5%) and a single contact site, being the Blacktown Native Institution (BNI) site, also present.

Centroid coordinates for AHIMS registered Aboriginal sites located within 50 m of the Project area (n = 10) place nine sites within the project boundary (**Figure 17**). However, a review of associated reporting (i.e., AMBS 1997; Kelleher Nightingale 2010, 2012) indicates that two of these sites - open artefact sites GROS6 (45-5-2392) and GROS9 (45-5-2395) - are, in fact, located outside of the Project area, bringing the total number of previously recorded sites within the Project area to seven. Summary data on AHIMS registered Aboriginal sites within the Project area, including their respective landform contexts and contents, is provided in **Table 11**.

Table 10 AHIMS Search Results

Site type	Site Feature(s)	Number	%
Open artefact site	Artefact(s) (AFT); Potential Archaeological Deposit (PAD); Quarry (STQ);	684	89.1
Potential Archaeological Deposit (PAD)	PAD	80	10.4
Scarred tree	TRE	3	0.4
Contact site	ACD	1	0.1
Total	-	768	100

Table 11 AHIMS registered Aboriginal sites within the Project area

AHIMS Site ID	Site name	AHIMS Centroid Coordinates		Site type	Current AHIMS status	Landform context (as recorded by KNC)	On-site disturbance(s) (as recorded by KNC)	Site Dimensions	Number of artefacts recorded	Raw materials	Reference
		MGAE	MGAN								
45-5-4158	MPP-01	296099	6268407	Open artefact site (isolated artefact)	Valid	Crest	Erosion & vehicle track use	0.5 x 0.5 m (0.25 m ²)	1	Silcrete	KNC 2012
45-5-4159	MPP-02	296245	6268750	Open artefact site (artefact scatter)	Valid	Flat / open depression	Erosion, vegetation clearance, cattle treadage; revegetation works	770 x 160 m (123,200 m ²)	32 + 2 potlids	Silcrete (32); S.tuff (2)	KNC 2012
45-5-4160	MPP-03	295841	6268870	Open artefact site (artefact scatter)	Valid	Open depression	Erosion	230 x 65 m (14,950 m ²)	4	Silcrete (2); S.tuff (2)	KNC 2012
45-5-4161	WP 1	297189	6268648	Open artefact site (artefact scatter)	Valid	Slope / open depression	Vegetation clearance & erosion	150 x 575 m (86,250 m ²)	10	Silcrete (6); Quartz (2); S.tuff (2)	KNC 2010
45-5-4164	WP 6	295938	6269646	Open artefact site (artefact scatter)	Valid	Crest	Introduced fill, vegetation clearance & vehicle track use	110 x 50 m (5,500 m ²)	5	Silcrete (1); S.tuff (3); Basalt (1)	KNC 2010
45-5-4166	WP 5	295992	6269259	Open artefact site (artefact scatter)	Valid	Terrace / bench	Erosion & flooding	240 x 115 m (27,600 m ²)	24	Silcrete (18); Chert (4); S.tuff (2)	KNC 2010
45-5-4170	MPP-07	295309	6270180	Open artefact site (isolated artefact)	Valid	Flat	Erosion	0.5 x 0.5 m (0.25 m ²)	1	S.tuff	KNC 2012