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Hydro Aluminium Kurri Kurri Pty Ltd
12-Dec-2014

Hydro Aluminium Smelter Site & Associated Buffer Land

Aboriginal Cultural Heritage Assessment

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Aboriginal Cultural Heritage Assessment

Client: Hydro Aluminium Kurri Kurri Pty Ltd

ABN: 55 093 266 221

Prepared by

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			Name/Position	Signature
A	03-Sep-2014	Technical Review	Geordie Oakes / Archaeologist	
B	03-Sep-2014	QA Review	Sharmin Lubonski / Associate Director	
C	12-Dec-2014	Final	Kelly Pearsall / Principal Environmental Planner	

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Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to undertake an Aboriginal cultural heritage assessment of the Hydro aluminium smelter site and surrounding Hydro-owned buffer land, off Hart Road, at Kurri Kurri in the Lower Hunter Valley of New South Wales.

Smelter operations at the Kurri Kurri smelter site have been in care and maintenance mode since 2012, with Hydro undertaking preliminary investigations into land capability and future land uses across the smelter site and its associated buffer zone (the 'Project area') since this time. A Preliminary Masterplan has been developed for the Project area and is currently being used to inform further specialist investigations across the site. Alongside those generated through other specialist investigations, the results of the current Aboriginal cultural heritage assessment will assist Hydro in their finalisation of a planning proposal (the 'Planning Proposal') for the Project area, which incorporates residential and employment-related land uses as well as conservation and continuing rural land uses.

This Aboriginal cultural heritage assessment report is to form part of Hydro's Planning Proposal to Cessnock and Maitland City Councils and has been compiled with reference to the NSW Office of Environment and Heritage's (OEH) *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) (the 'Code of Practice'). Aboriginal community consultation for this assessment has been conducted in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (the 'Consultation Requirements') (DECCW, 2010a).

Archaeological survey of Project area was undertaken over an eight day period between 23 June 2014 and 2 July 2014 by a combined field team of two AECOM archaeologists and up to six rostered Registered Aboriginal Party (RAP) field representatives per day. The survey focussed on higher areas of Ground Surface Visibility (GSV) within the western half of the Project area. However, several transects were also completed in the eastern half of the site. In the northeastern and north-central portions of the Project area, particular attention was paid to areas of higher GSV along the margins of Wentworth Swamp, namely cattle tread and fluvial erosion exposures. All survey was conducted on foot, with a total of 51 transects completed over the course of the survey. Recorded transect data indicate that a total survey coverage of 137.5 ha, representing around 7**%** of the Project area, was achieved.

A total of 482 individual Aboriginal cultural lithic items were identified during the current survey, 475 or 98.5% of which are located within the Project area. Employing a 50 m distance convention for site definition, consideration of the location of these items against the mapped and/or described boundaries of valid AHIMS registered sites within the Project area (n = 23) provides a total of 65 new Aboriginal archaeological sites and 20 pre-existing sites (85 sites in total). Newly identified surface sites within the Project area include 31 artefact scatters and 34 isolated artefacts while pre-existing sites consist of 11 artefact scatters and nine isolated artefacts. Of the 20 previously recorded open artefact sites within the Project area, nine were relocated during the current survey.

In addition to identified sites, an assessment of the archaeological sensitivity of land within the Project area has also been undertaken, with three levels of sensitivity - Nil, Low and High - recognised on the basis of observed archaeology (i.e., its distribution and character), the results of previous Aboriginal heritage investigations within and surrounding the Project area, levels of past land disturbance and the predicted complexity of deposits within each category. Identified areas of high archaeological sensitivity within the Project area include elevated low gradient landform elements adjacent to Wentworth Swamp and higher order watercourses.

An assessment of the scientific significance of newly and previously recorded Aboriginal sites within the Project area has been undertaken. Moderate scientific significance has been attributed to eight sites and low scientific significance to 77 sites. No sites of high scientific significance have been identified within the Project area to date. Verbal and written advice received from the 32 RAPs for this assessment indicates that all identified sites within the Project area are culturally significant and need to be cared for appropriately.

Hydro's Preliminary Masterplan for the Project area has been reviewed in relation to its impact on Aboriginal cultural heritage. Consideration of the distribution of identified Aboriginal archaeological sites in relation to the Preliminary Masterplan indicates that 50 sites, including five out of eight sites assessed as being of moderate scientific significance, are located in conservation, rural land use and riparian corridor areas (or combinations thereof). These sites are unlikely to be directly impacted by future residential and employment-related development works within the Project area. A further four sites, two of which have been assessed as being of moderate scientific significance, extend into areas earmarked for employment land uses but are located principally in conservation or riparian corridor areas.

While recognising the potential for site impacts through environmental management works and ongoing rural land use activities, collectively, these 54 sites are considered to represent a significant preservation outcome for the surface Aboriginal archaeological record of the Project area. Compared with residential and employment-related development works, environmental management and ongoing rural land use activities are deemed significantly less likely to result in the destruction of identified sites.

Examination of the Preliminary Masterplan suggests that all remaining Aboriginal archaeological sites within the Project area (n = 31) are likely to be directly impacted by residential and employment-related development works. Impacted sites include 30 sites of low scientific significance and one site of moderate scientific significance. Archaeologically, the potential loss of these sites is considered to be offset by the retention, in conservation, rural land use and riparian corridor areas, of fifty-four sites of equal or greater scientific significance.

Consideration of the suitability of the Preliminary Masterplan with respect to the archaeological sensitivity of land within the Project area indicates a significant preservation outcome for land of high archaeological sensitivity, with the majority comprising conservation and rural land use land that will not be impacted by future residential and employment-related development works within the Project area. Attention is drawn, in particular, to the retention in conservation, rural land use and riparian corridor areas, of the majority of the highly sensitive land associated with Black Waterholes Creek, Swamp Creek and Wentworth Swamp. Land of low archaeological sensitivity is also well represented in areas zoned for conservation and continuing rural land use activities. Proposed residential and employment-related development areas within the Project area correspond principally with areas of low to nil archaeological sensitivity.

Management recommendations for identified Aboriginal heritage constraints within the Project area are as follows:

Aboriginal archaeological sites: where possible, these sites should be conserved as part of the master planning process, with decisions concerning their long-term management to be made in consultation with RAPs. However, where conservation is unfeasible, it is recommended that the Development Control Plan (DCP) for the Project area include a specific development control for known Aboriginal archaeological sites. This control should specify that any works which directly affect these sites will require an Aboriginal Heritage Impact Permit (AHIP) under Part 6 of the NPW Act 1974.

Archaeologically sensitive areas:

Areas of *high archaeological sensitivity* warrant a full Aboriginal cultural heritage assessment prior to any development impacts and it is recommended that the DCP for the Project area include a development control to this effect. Aboriginal cultural heritage assessments in areas of high archaeological sensitivity should be undertaken in accordance with OEH's *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) and *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a).

Areas of *low archaeological sensitivity* warrant an Aboriginal archaeological due diligence assessment prior to any development impacts and it is recommended that the DCP for the Project area include a development control to this effect. Due diligence assessments in areas of low sensitivity should be undertaken in accordance with OEH's *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c). Visual inspections undertaken for the purposes of a due diligence assessment should include an Aboriginal community representative.

Areas of *nil archaeological sensitivity* do not contain any known Aboriginal heritage constraints and it is recommended that the DCP for the Project area contain a development control to this effect. Nonetheless, the development control should also specify that Aboriginal objects may still occur in these areas and that if impacts to any identified objects cannot be avoided, an AHIP will be required.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to undertake an Aboriginal cultural heritage assessment of the Hydro aluminium smelter site and surrounding Hydro-owned buffer land, off Hart Road, at Kurri Kurri in the Lower Hunter Valley of New South Wales (**Figure 1** and **Figure 2**). Smelter operations at the Kurri Kurri smelter site have been in care and maintenance mode since 2012, with Hydro undertaking preliminary investigations into land capability and future land uses across the smelter site and its associated buffer zone (the 'Project area') since this time. A Preliminary Masterplan has been developed for the Project area and is currently being used to inform further specialist investigations across the site. Alongside those generated through other specialist investigations, the results of the current Aboriginal cultural heritage assessment will assist Hydro in their finalisation of a planning proposal (the 'Planning Proposal') for the Project area, which incorporates residential and employment-related land uses as well as conservation and continuing rural land uses.

This Aboriginal cultural heritage assessment report is to form part of Hydro's Planning Proposal to Cessnock and Maitland City Councils and has been compiled with reference to the NSW Office of Environment and Heritage's (OEH) *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) (the Code of Practice). Aboriginal community consultation for this assessment has been conducted in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (the Consultation Requirements) (DECCW, 2010a).

1.1 Assessment Background

The Kurri Kurri aluminium smelter commenced production in 1969 with a single potline. A second potline was commissioned in 1979 and a third added in 1985. In 2002, after assuming ownership of the smelter through its acquisition of VAW Aluminium AG, Hydro undertook an upgrade program - the Smelter Upgrade and Retrofit (SURF) Project - which raised the production capacity of the smelter to 170,000 tonnes of aluminium per annum. Severe financial pressures on the profitability of the smelter, however, resulted in the Hydro Kurri Kurri Board curtailing production from Potline 1 along with cessation of all pot relining effective February 2012. In April 2012, a further Board decision was made to curtail all production at the smelter, with primary metal production ceasing in September 2012 and the production of casthouse products ending the following month. After being in care and maintenance mode since October 2012, the decision to permanently close the Kurri Kurri aluminium smelter was taken in May 2014, allowing for remediation and redevelopment options for the site to be progressed.

Since October 2012, Hydro has undertaken preliminary investigations into land capability and future land uses across the Project area and have developed a Preliminary Masterplan for the site. The Preliminary Masterplan, shown on **Figure 3**, is currently being used to inform further specialist investigations across the Project area. As currently developed, Hydro's Preliminary Masterplan for the Project area presents an opportunity to:

- Create up to 3000 hectares of employment land;
- Provide 1,290 residential lots and 100 large lot residential lots;
- Achieve 730 hectares of conservation land;
- Maintain a viable agricultural landholding; and
- Protect riparian waterways and existing wetlands.

Alongside those generated through other specialist investigations, the results of the current Aboriginal cultural heritage assessment will assist Hydro in their finalisation of the Planning Proposal for the Project area.

Aboriginal cultural heritage assessments conducted for rezoning projects differ from those carried out as part of the traditional development planning approval process in NSW in that physical impacts to identified Aboriginal heritage sites, places and values are not proposed as part of the rezoning process. Rather, the primary aim of these assessments is to identify Aboriginal heritage constraints and opportunities relevant to the development of site masterplans and to provide guidance around the appropriate management of identified heritage values post-rezoning. Once rezoning has been completed, it is the responsibility of individual proponents to conduct, where appropriate, additional Aboriginal heritage investigations into the areas they propose to impact through their respective Development Applications (DAs). Where required, such assessments will involve opportunities for more detailed archaeological investigations (e.g., archaeological test excavation) and conservation outcomes.

As no ground surface impacts are proposed as part of Hydro's Planning Proposal, the current assessment will not be used to support applications for Aboriginal Heritage Impact Permits (AHIPs) under Section 90A of the *National Parks and Wildlife Act 1974* (NPW Act 1974). Such applications will need to be supported by standalone Aboriginal Cultural Heritage Assessment and Aboriginal Archaeological Reports prepared in accordance with the with OEH's *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the Code of Practice (DECCW, 2010b). A process of Aboriginal community consultation carried out accordance with the Consultation Requirements(DECCW, 2010a) would also need to be demonstrated.

1.2 Assessment Objectives

The overarching objectives of this Aboriginal cultural heritage assessment were as follows:

- to identify the Aboriginal cultural heritage values of the Project area using a combination of background research, Aboriginal community consultation and archaeological survey;
- to assess the suitability of the Hydro's Planning Proposal in relation to Aboriginal cultural heritage;
- to provide appropriate management recommendations for the identified Aboriginal cultural heritage values of the Project area; and
- to compile an Aboriginal cultural heritage assessment report that will assist Council in their assessment of the Hydro's Planning Proposal.

1.3 Project area

The Project area for this assessment, shown on **Figure 2**, comprises the existing Hydro aluminium smelter site and surrounding Hydro-owned buffer land to the immediate north of the township of Kurri Kurri, approximately 29 km northwest of Newcastle and 5 km southwest of Maitland in the Lower Hunter Valley of NSW. Together, the smelter and associated buffer land cover an area of approximately 1,964 ha across the Cessnock and Maitland Local Government Areas (LGAs), with the smelter site accounting for around 3.1% (60 ha) of this total. As shown on **Figure 2**, the recently completed Hunter Expressway traverses the southwestern portion of the Project area while the privately-owned historic Aberdare Railway, which comprises part of the South Maitland Railway, traverses the eastern third of the site.

Situated between MGA grid coordinates 355400 and 362000 east and 6369400 and 6374900 north on the Cessnock 9132-2N 1:100,000 topographic map sheet, the Project area falls wholly within the Central Lowlands region of the Hunter Valley (after Galloway, 1963) and crosscuts the 'Lower Hunter Plain' and 'East Maitland Hills' physiographic regions defined by Matthei (1995). Surrounding townships and hamlets include Abermain to the west-southwest, Heddon Greta to the southeast, Weston to the southwest and Gillieston Heights to the northeast. Parks and reserves in the surrounding area, meanwhile, include the Werakata National Park to the west and southwest, Cessnock State Forest to the west, the Lower Hunter National Park to the south and the Heddon Greta Reserve to the southeast.

The landscape of the Project area can be broadly characterised as flat to undulating, with flat, low-lying swampy terrain in the north-central portion of the Project area giving way, to the south, west and east into low undulating hills dissected by numerous ephemeral drainages. Several elevated flats, some of which could be described as 'plateaus', are also present within the Project area, with the largest and most prominent of these housing Hydro's Kurri Kurri smelter complex towards its southern end. Low undulating hills in easternmost portion of the Project area form part of a larger, north-north-easterly trending belt of elevated undulating terrain that forms the watershed between the Swamp Creek and Wallis Creek catchments. Elevations within the Project area range from 2 to 47 m AHD providing a total local relief of 45 m. Slopes are predominantly very gently (1-3%) to gently (3-10%) inclined. Named watercourses and water bodies within the Project area include Swamp and Black Waterholes Creeks as well as a sizeable portion of the regionally significant Wentworth Swamp, a permanent freshwater wetland system that covers an area of approximately 1,300 ha downstream of Kurri Kurri.

Reference to the NSW Geographical Names Register indicates that the Project area is situated within the Parish of Heddon in the County of Northumberland. Land within the Project area has been registered as Lot 1224828 on DP1082569, Lot 1201503 on DP 1082775, Lot 1215090 on DP 1102156, Lot 1425480 on DP1158546, Lot 1420807 on DP1159325, Lot 1427421 on DP1160801, Lot 1424043 on DP1161547, Lot 444259 on DP166625, Lot 209443 on DP233125, Lot 421359 on DP39701, Lot140801 on DP456769, Lot 554442 on DP456946, Lot 444265 on DP502196, Lot 3872 on DP543057, Lot 558653 on DP547715, Lot 150780 on DP553542, Lot 3622432 on DP589169, Lot 121073 on DP62332, Lot 127974 on DP654206, Lot 238178 on DP71130, Lot

397964 on DP728982, Lot 209444 on DP73597, Lot 362386 on DP755231, Lot 319804 on DP975995, Lot 201888 on DP976895, Lot 147507 on DP976896 and Lot 82659 on DP998540.

1.4 Project Team

The project team for this assessment included personnel from AECOM and 32 Registered Aboriginal Parties (RAPs). Dr Andrew McLaren (Archaeologist, AECOM) managed and participated in all aspects of the assessment detailed in this report. Andrew holds a Bachelor of Arts (1st Class Honours) degree from the University of Queensland in Brisbane, a Master of Cultural Heritage from Deakin University in Melbourne and a PhD in archaeology from the University of Cambridge in England. In addition, he has a total of over 5 years of Australian Aboriginal cultural heritage management experience and thus satisfies the minimum qualifications stipulated in Section 1.6 of the Code of Practice. Andrew was the primary author of this report. Luke Atkinson (Geoarchaeologist, AECOM) contributed to **Section 6.0**.

Other AECOM staff involved in this assessment included Geordie Oakes (Archaeologist, AECOM), Rochelle Coxon (Graduate Archaeologist, AECOM), Sharmin Lubonski (Associate Director, AECOM) and Tim Osborne (Designer, AECOM). Geordie participated in the survey and undertook a technical review of this report. AHIMS site cards for newly identified sites within the Project area were prepared by Rochelle. Unless otherwise specified, all figures within this report were created by Tim. Overarching QA review of this report was provided by Sharmin.

Aboriginal community consultation for this assessment was undertaken in accordance with OEH's Consultation Requirements (DECCW 2010b). Full details of the consultation process undertaken are provided in **Section 3.0**. Aboriginal persons and organisations consulted as part of this assessment are listed in **Table 1**.

Table 1 Registered Aboriginal Parties (RAPs) for the current assessment

Registered Aboriginal Party (RAP)	Primary contact person
Aboriginal Native Title Elders Consultants	Margaret Matthews
Cacatua General Services	Donna Sampson
AGA Services	Adam Sampson
Culturally Aware	Tracey Skene
EMT Cultural & Heritage	Esther Tighe & Mervyn Leslie
Gidawaa Walang Cultural Heritage Consultancy	Annie Hickey
Giwirri Consultants	Rodney Matthews
HSB Heritage Consultants	Patricia Hampton
Hunter Valley Cultural Consultants	Christine Archbold
Jarban & Mugrebea	Les Atkinson
Crimson Rosie	Jeff Matthews
Kauma Pondee Inc	Jill Green
Lower Hunter Aboriginal Incorporated	David ahoy
Mindaribba Local Aboriginal Land Council	Steven Talbott
Ungooroo Aboriginal Corporation	Jessi Garland
Upper Hunter Heritage Consultants	Darrel Matthews
Upper Hunter Wonnarua Council Inc	Rhoda Perry
Wallangan Cultural Services	Maree Waugh
Wanaruah Local Aboriginal Land Council	Noel Downs
Widescope Indigenous Group	Steven Hickey
Kauwul Wonn1 Contracting	Arthur Fletcher

Registered Aboriginal Party (RAP)	Primary contact person
Tocomwall Pty Ltd	Scott Franks
Yinarr Cultural Services	Kathie Kinchela
Amanda Heard	Adam Heard
Lower Hunter Wonnarua Cultural Services	Tom Miller
Gomeroi Namoi	Greg Heard
Amanda Hickey Cultural Services	Amanda Hickey
A1 Indigenous Services	Carolyn Hickey
Kawul Cultural Services	Vicky Slater
HTO Environmental Management Services	Paulette Ryan
HECMO Consultants	Kerren Boyd
Wurrumay Consultants	Kerrie Slater

1.5 The Proponent

The proponent for this assessment is Hydro Aluminium Kurri Kurri Pty Ltd (Hydro), a subsidiary of the global aluminium company Norsk Hydro ASA. Hydro is a registered Australian company (ACN: 093 266 221; ABN: 55 093 266 221) based in Kurri Kurri, NSW.

1.6 Report Structure

This report contains eleven sections. This section - **Section 1.0** - has provided background information on the assessment undertaken. The remainder of the report is structured as follows:

- **Section 2.0** outlines the statutory framework within which this assessment has been undertaken;
- **Section 3.0** details the Aboriginal community consultation program undertaken for this assessment;
- **Section 4.0** describes the existing environment of the Project area and its associated archaeological implications.
- **Section 5.0** describes the archaeological context of the Project area on a regional and local scale. Predictions regarding the nature of the Project area's Aboriginal archaeological record are also provided.
- **Section 6.0** summarises relevant ethnographic information for the Project area.
- **Section 7.0** describes the archaeological survey component of the assessment.
- **Section 8.0** outlines the significance of identified Aboriginal archaeological sites within the Project area.
- **Section 9.0** provides an assessment of the suitability of the Preliminary Masterplan in relation to Aboriginal heritage.
- **Section 10.0** details appropriate management recommendations for the identified Aboriginal heritage values of the Project area; and
- **Section 11.0** lists the references cited in-text.

1.7 Acknowledgements

AECOM gratefully acknowledges the assistance of the following individuals during fieldwork and/or the completion of this report:

- Shannon Sullivan (Planning Manager, ESS Australia)
- Leanne Pringle (Commercial Manager, Hydro);
- Kerry McNaughton (Environment Officer/Buffer Zone Supervisor, Hydro); and

- Ben Fuller (Special Counsel, Gilbert & Tobin Lawyers).

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AECOM

REGIONAL CONTEXT

Aboriginal Cultural Heritage Assessment
Hydro Aluminium Smelter Site & Associated Buffer Land
Kurri Kurri, New South Wales

FIGURE 1

G:\ENVGIS\Projects\60316\60312210 Hydro Aboriginal\FIGURES\60312210 F2 Project Area 28 08 2014 TO

AECOM

PROJECT AREA

Aboriginal Cultural Heritage Assessment
Hydro Aluminium Smelter Site & Associated Buffer Land
Kurri Kurri, New South Wales

FIGURE 2

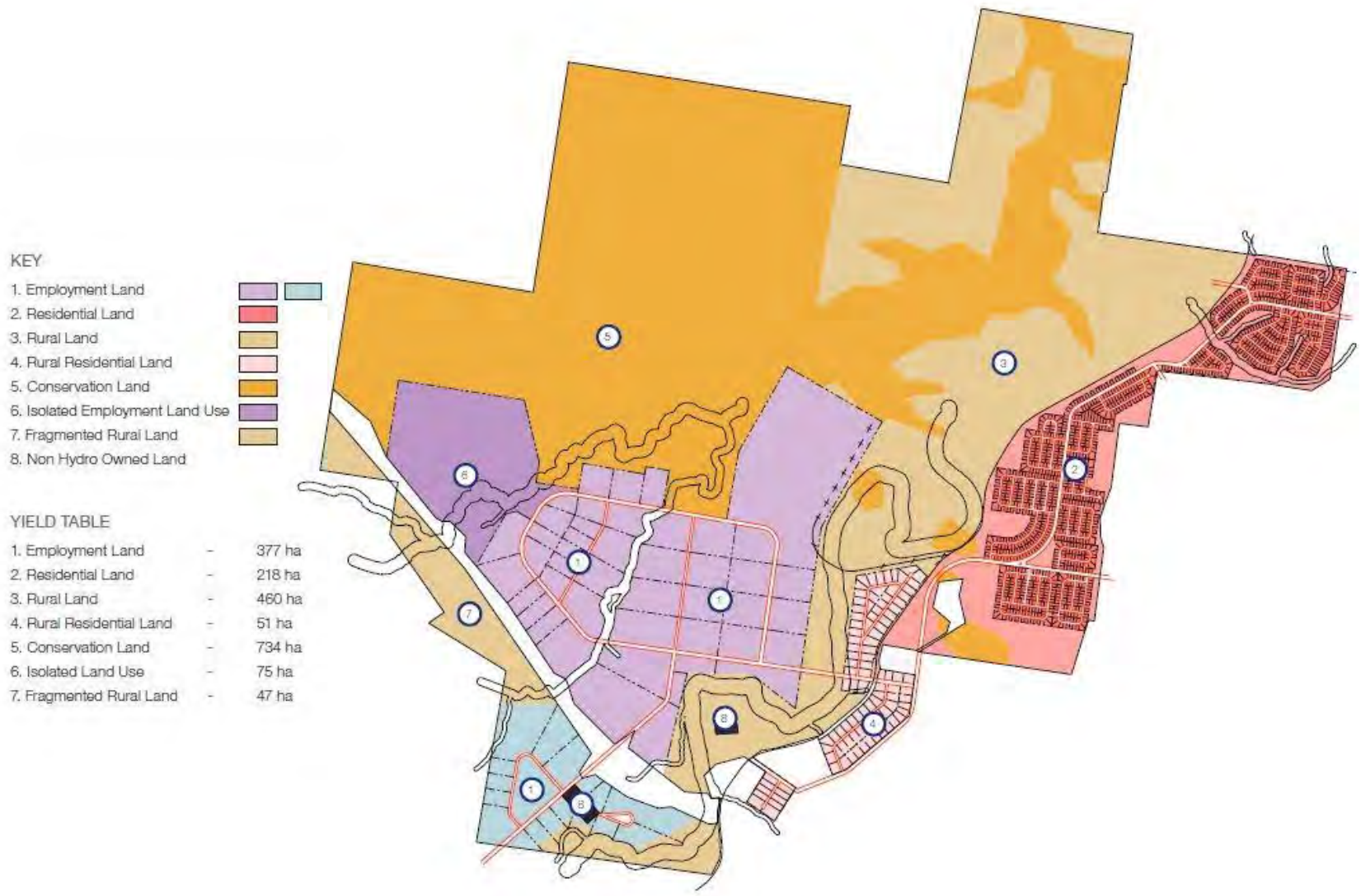


Figure 3 Preliminary Masterplan (Source: Hydro)

2.0 Applicable Policy & Legislation

2.1 Commonwealth Legislation

2.1.1 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (the ATSIHP Act) provides for the preservation and protection of places, areas and objects of particular significance to Indigenous Australians. The stated purpose of the ATSIHP Act is the *"preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition"* (Part I, Section 4).

Under the Act, '*Aboriginal tradition*' is defined as *"the body of traditions, observances, customs and beliefs of Aboriginals generally or of a particular community or group of Aboriginals, and includes any such traditions, observances, customs or beliefs relating to particular persons, areas, objects or relationships"* (Part I, Section 3). A '*significant Aboriginal area*' is an area of land or water in Australia that is of *"particular significance to Aboriginals in accordance with Aboriginal tradition"* (Part I, Section 3). A '*significant Aboriginal object*', on the other hand, refers to an object (including Aboriginal remains) of like significance.

For the purposes of the Act, an area or object is considered to have been be injured or desecrated if:

a) In the case of an area:

   i. it is used or treated in a manner inconsistent with Aboriginal tradition;

   ii. the use or significance of the area in accordance with Aboriginal tradition is adversely affected; and

   iii. passage through, or over, or entry upon, the area by any person occurs in a manner inconsistent with Aboriginal tradition

b) in the case of an object:

   i. it is used or treated in a manner inconsistent with Aboriginal tradition.

The ATSIHP Act can override state and territory laws in situations where a state or territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an area or object. However, the Minister can only make a decision after receiving a legally valid application under the ATSIHP Act and, in the case of long term protection, after considering a report on the matter. Before making a declaration to protect an area or object in a state or territory, the Commonwealth Minister must consult the appropriate minister of that state or territory (Part 2, Section 13).

2.1.2 Environment Protection and Biodiversity Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) took effect on 16 July 2000. Under Part 9 of the EPBC Act, any action that is likely to have a significant impact on a matter of National Environmental Significance may only progress with approval of the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPAC). An action is defined as a project, development, undertaking, activity, series of activities, or alteration. An action will also require approval if:

- It is undertaken on Commonwealth land and will have or is likely to have a significant impact;
- It is undertaken outside Commonwealth land and will have or is likely to have a significant impact on the environment on Commonwealth land; and
- It is undertaken by the Commonwealth and will have or is likely to have a significant impact.

The EPBC Act defines 'environment' as incorporating both natural and cultural environments and therefore includes Aboriginal heritage items. Under the Act, protected heritage items are listed on the National Heritage List (items of significance to the nation) or the Commonwealth Heritage List (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE). Statutory references to the RNE in the EPBC Act were removed on 19 February 2012. However, the RNE remains an archive of over 13,000 heritage places throughout Australia.

The heritage registers mandated by the EPBC Act have been consulted and there are no Aboriginal heritage items located within or directly adjacent to the Project area.

2.2 State Legislation & Policies

2.2.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act), administered by OEH, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Director General of OEH responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as follows:

- an *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).
- an *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010* (NPW Regulation), and the demonstration of due diligence.

An Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened. Consultation with Aboriginal communities is required under OEH policy when an application for an AHIP is considered and is an integral part of the process. AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons. Section 89A of the NPW Act requires notification of the location of Aboriginal sites within a reasonable time, with penalties for non-notification.

2.2.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act), administered by the NSW Department of Planning and Environment, requires that consideration be given to environmental impacts as part of the land use planning process in NSW. In NSW, environmental impacts are interpreted as including impacts to Aboriginal and non-Aboriginal cultural heritage.

Developments that require development consent from a local council or the Minister for Planning are assessed under Part 4 of the EP&A Act.

2.2.3 Lower Hunter Regional Strategy (LHRS) & Regional Conservation Plan (RCP)

The Lower Hunter Regional Strategy (LHRS), finalised in 2006, details the New South Wales Government's planning priorities for the Lower Hunter Valley and identifies proposed areas of growth. The Regional Conservation Plan (RCP) is a partner document to the LHRS and outlines a 25 year program to direct and drive conservation planning and efforts within the Lower Hunter.

Both individually and in combination, the LHRS & RCP recognise the importance of Aboriginal objects and places to contemporary Aboriginal people, as well as the landscapes associated with them. However, both documents also acknowledge that the continued growth of the Lower Hunter's population and industries will raise challenges for their long-term protection. In recognition of these challenges, the LHRS has identified the following key actions for the long-term protection and management of the Aboriginal and Historic (non-Indigenous) heritage resource of the Lower Hunter Valley:

- Councils are to ensure that Aboriginal cultural and community values are considered in the future planning and management of the local government area;
- The Department of Planning and Environment and Councils will review the scope and quality of the existing statutory lists of heritage items and ensure that all places of significance are included in the heritage schedules of local environmental plans; and
- The cultural heritage values of major regional centres and major towns that will be the focus of urban renewal projects will be reviewed, with the aim of protecting cultural heritage.

The RCP proposes a number of mechanisms to ensure that high value conservation lands in the Lower Hunter Valley are identified, protected and managed for their biodiversity values as well as their Aboriginal cultural heritage values. Stage 1 of the RCP, implemented in 2006, involved the transfer of *c*.20,000 hectares of public high value conservation land into conservation reserves. The transfer of an additional 12,000 hectares of private land into the reserve system is expected to occur under the RCP over the next few years.

2.3 Local Government

As indicated in **Section 1.3**, the Project area cross-cuts the Cessnock and Maitland LGAs. Relevant Environmental Planning Instruments (EPIs) for these LGAs are the Maitland Local Environmental Plan 2011 (Maitland LEP 2011) and Cessnock Local Environmental Plan 2011 (Cessnock LEP 2011).

2.3.1 Cessnock LEP 2011

Clause 5.10 of the Cessnock LEP 2011 provides specific provisions for the protection of heritage items, heritage conservation areas, Aboriginal objects and Aboriginal places of heritage significance within the Cessnock LGA, defined in the LEP as follows:

- A *heritage item* means a building, work, place, relic, tree, object or archaeological site, the location and nature of which is described in Schedule 5 of the LEP;
- A *heritage conservation area* means an area of land of heritage significance:

  (a) shown on the Heritage Map as a heritage conservation area, and

  (b) the location and nature of which is described in Schedule 5 of the LEP,

  and includes any heritage items situated on or within that area.
- An *Aboriginal object* means any deposit, object or other material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of an area of 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.
- An *Aboriginal place of heritage significance* means an area of land, the general location of which is identified in an Aboriginal heritage study adopted by the Council after public exhibition and that may be shown on the Heritage Map, that is:

  (a) the site of one or more Aboriginal objects or a place that has the physical remains of pre-European occupation by, or is of contemporary significance to, the Aboriginal people. It may (but need not) include items and remnants of the occupation of the land by Aboriginal people, such as burial places, engraving sites, rock art, midden deposits, scarred and sacred trees and sharpening grooves, or

  (b) a natural Aboriginal sacred site or other sacred feature. It includes natural features such as creeks or mountains of long-standing cultural significance, as well as initiation, ceremonial or story places or areas of more contemporary cultural significance.

Under the Cessnock LEP 2011, development consent is required for any of the following:

(a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

(i) a heritage item,

(ii) an Aboriginal object,

(iii) a building, work, relic or tree within a heritage conservation area,

(b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,

(c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,

(d) disturbing or excavating an Aboriginal place of heritage significance,

(e) erecting a building on land:

(i) on which a heritage item is located or that is within a heritage conservation area, or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,

(f) subdividing land:

(i) on which a heritage item is located or that is within a heritage conservation area, or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Schedule 5 of the Cessnock LEP 2011 provides a list of heritage items and conservation areas within the Cessnock LGA. There are no Aboriginal heritage items listed in this schedule that fall within the Project area.

2.3.2 Maitland LEP 2011

Clause 5.10 of the Maitland LEP 2011 provides specific provisions for the protection of heritage items, heritage conservation areas, Aboriginal objects and Aboriginal places of heritage significance within the Maitland LGA, defined in the LEP as follows:

- A *heritage item* means a building, work, place, relic, tree, object or archaeological site, the location and nature of which is described in Schedule 5 of the LEP;
- A *heritage conservation area* means an area of land of heritage significance:

  (a) shown on the Heritage Map as a heritage conservation area, and

  (b) the location and nature of which is described in Schedule 5 of the LEP,

  and includes any heritage items situated on or within that area.
- An *Aboriginal object* means any deposit, object or other material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of an area of 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.
- An *Aboriginal place of heritage significance* means an area of land, the general location of which is identified in an Aboriginal heritage study adopted by the Council after public exhibition and that may be shown on the Heritage Map, that is:

  (a) the site of one or more Aboriginal objects or a place that has the physical remains of pre-European occupation by, or is of contemporary significance to, the Aboriginal people. It may (but need not) include items and remnants of the occupation of the land by Aboriginal people, such as burial places, engraving sites, rock art, midden deposits, scarred and sacred trees and sharpening grooves, or

  (b) a natural Aboriginal sacred site or other sacred feature. It includes natural features such as creeks or mountains of long-standing cultural significance, as well as initiation, ceremonial or story places or areas of more contemporary cultural significance.

Under the Maitland LEP, development consent is required for any of the following:

(a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

(i) a heritage item,

(ii) an Aboriginal object,

(iii) a building, work, relic or tree within a heritage conservation area,

(b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,

(c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,

(d) disturbing or excavating an Aboriginal place of heritage significance,

(e) erecting a building on land:

(i) on which a heritage item is located or that is within a heritage conservation area, or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,

(f) subdividing land:

(i) on which a heritage item is located or that is within a heritage conservation area, or

(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Schedule 5 of the Maitland LEP 2011 provides a list of heritage items and conservation areas within the Cessnock LGA. There are no Aboriginal heritage items listed in this schedule that fall within the Project area.

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.

As indicated in **Section 1.4**, Aboriginal community consultation for the current assessment was undertaken in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010b) (the 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 10 February 2014 requesting information on relevant Aboriginal persons and organisations:

- OEH - Hunter Central Coast Region Office;
- Mindaribba Local Aboriginal Land Council (Mindaribba LALC);
- Office of the Registrar, *Aboriginal Land Rights Act 1983* (NSW);
- The National Native Title Tribunal (NNTT);
- NTSCORP Limited;
- Maitland Shire Council;
- Cessnock Shire Council; and
- Hunter-Central Rivers Catchment Management Authority (HCR CMA).

Responses were received from four agencies and are attached as **Appendix B**:

- The Office of the Registrar responded on 22 February 2014 advising that the Project area does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act*

1983 (NSW). They also advised that the Mindaribba LALC may be able to assist in the identification of relevant Aboriginal stakeholders.

- The NNTT responded on 11 February 2014 advising that, as the submitted search request relates to areas of freehold land, native title has been extinguished over these areas.
- Mindaribba LALC responded on 19 February 2014 advising that they would like to register their interest in the Project and would like to be involved in all phases of fieldwork and salvage should any be required; and
- OEH responded on 6 March 2014 providing the details of 75 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 Maitland Mercury on 11 March 2014 (**Appendix C**). The closing date for registration via this notice was 25 March 2014, 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 11 March 2014, 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 75 Aboriginal stakeholders were invited to register an interest in being consulted. The closing date for expressions of interest was 25 March 2014, which provided the necessary *minimum* 14 day period for expressions of interest.

By the closing date for expressions of interest, 27 parties had registered an interest in the assessment. An additional five parties registered an interest after this date and were included in the consultation process. Summary information on all RAPs, including registration dates, is provided in **Table 2**.

Table 2 Registered Aboriginal Parties

Registered Aboriginal Party (RAP)	Date of registration	Method of registration	Primary contact person
Aboriginal Native Title Elders Consultants	24-02-14	Email	Margaret Matthews
Cacatua General Services	16-03-14	Email	Donna Sampson
AGA Services	16-03-14	Email	Adam Sampson
Culturally Aware	19-03-14	Email	Tracey Skene
EMT Cultural & Heritage	13-03-14	Phone	Mervyn Leslie
Gidawaa Walang Cultural Heritage Consultancy	14-03-14	Fax	Annie Hickey
Giwirri Consultants	24-02-14	Email & phone	Rodney Matthews
HSB Heritage Consultants	19-03-14	Email	Patricia Hampton
Hunter Valley Cultural Consultants	24-02-14	Email	Christine Archbold
Jarban & Mugrebea	12-03-14	Email	Les Atkinson

Registered Aboriginal Party (RAP)	Date of registration	Method of registration	Primary contact person
Crimson Rosie	23-03-14	Letter	Jeff Matthews
Kauma Pondee Inc	22-03-14	Email	Jill Green
Lower Hunter Aboriginal Incorporated	26-03-14	Email	David Ahoy
Mindaribba Local Aboriginal Land Council	19-02-14	Email	Steven Talbott
Ungooroo Aboriginal Corporation	19-02-14	Email	Jessi Garland
Upper Hunter Heritage Consultants	24-02-14	Email	Darrel Matthews
Upper Hunter Wonnarua Council Inc	20-03-14	Phone	Rhoda Perry
Wallangan Cultural Services	18-03-14	Email	Maree Waugh
Wanaruah Local Aboriginal Land Council	19-03-14	Email	Noel Downs
Widescope Indigenous Group	17-03-14	Email	Steven Hickey
Kauwul Wonn1 Contracting	19-03-14	Email	Arthur Fletcher
Tocomwall Pty Ltd	13-02-14	Phone	Scott Franks
Yinarr Cultural Services	18-03-14	Email	Kathie Kinchela
Amanda Heard	20-02-14	Email	Adam Heard
Lower Hunter Wonnarua Cultural Services	18-02-14	Email	Tom Miller
Gomeroi Namoi	20-02-14	Email	Greg Heard
Amanda Hickey Cultural Services	17-03-14	Email	Amanda Hickey
A1 Indigenous Services	17-02-14	Email	Carolyn Hickey
Kawul Cultural Services	31-03-14	Email	Vicky Slater
HTO Environmental Management Services	07-04-14	Phone	Paulette Ryan
HECMO Consultants	04-04-14	Email	Kerren Boyd
Wurrumay Consultants	07-07-14	Email	Kerrie Slater

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 within 28 days of the closing date for EOIs. 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 28 April 2014, a list of the 29 Aboriginal organisations that had registered an interest in the assessment and had not requested their details be withheld, as well as a copy of the EOI letter sent out on 11 March 2014, was forwarded to the relevant OEH regional office (i.e., Hunter Central Coast) and the Mindaribba LALC.

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 Hydro's planning proposal was provided to RAPs as part of the registration of interest process detailed in **Section 3.1.3**. Basic information on the proponent and planning proposal was included in the EOI letter mailed on 11 March 2014.

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 15 April 2014, all RAPs were sent a draft of AECOM's proposed methodology for this cultural heritage assessment. A request for any initial comments or thoughts regarding the cultural values was also made in the covering letter accompanying the methodology. The specified closing date for comments was 14 May 2014.

Six written and nine verbal responses to the draft methodology were received from RAPs. These responses are summarised in **Table 3**. Where appropriate, AECOM's responses are also provided. Written RAP responses to the draft methodology are attached as **Appendix D**.

Table 3 RAP responses to draft methodology

Registered Aboriginal Party (RAP)	Date of response	Method of response	Summary of response	AECOM response to RAP comments
Aboriginal Native Title Elders Consultants	14.05.14	Verbal	Aboriginal Native Title Elders Consultants agree with the methodology and advise that they have extensive survey and excavation experience in the Kurri Kurri area	None required
Cacatua General Services	15.05.14	Verbal	Cacatua General Services agree with the methodology	None required
AGA Services	14.05.14	Verbal	AGA Services agree with methodology	None required
EMT Cultural & Heritage	14.05.14	Verbal	EMT Cultural & Heritage agree with the methodology	None required
Gidawaa Walang Cultural Heritage Consultancy	05.05.14	Email	Gidawaa Walang Cultural Heritage Consultancy agree with the methodology	None required
Lower Hunter Aboriginal Incorporated	06.05.14	Email with letter	Lower Hunter Aboriginal Incorporated agree with the methodology and believe that all consultation has been undertaken in a proper manner with respect to Aboriginal culture and values. Mr Ahoy (Senior Sites Manager) advises that his family has lived in the Heddon Greta and Kurri Kurri area for many generations and that, while the Project area has stories of hunting camps, no sacred sites are known. The Project area, Mr Ahoy advises, is culturally significant and is known to contain stone artefact sites. In addition, there is high potential for the identification of additional artefacts and camping areas.	None required
Mindaribba Local Aboriginal Land Council		Email with letter	Mindaribba LALC support the rezoning application provided a full assessment is conducted and that any resulting management recommendations are adhered to. In addition, Mindaribba LALC believes that the draft methodology provided is more of a background to the project.	Noted. This Aboriginal cultural heritage assessment report is to form part of a planning proposal to Maitland and Cessnock Shire Councils to rezone land within the Project area. As no ground surface impacts are proposed as part of Hydro's Planning Proposal, the current assessment will not be used to support applications for AHIPs under Section 90A of the NPW Act 1974. Such applications will need to be supported by standalone Aboriginal Cultural

Registered Aboriginal Party (RAP)	Date of response	Method of response	Summary of response	AECOM response to RAP comments
				Heritage Assessment and Aboriginal Archaeological Reports prepared in accordance with OEH guidelines. A process of Aboriginal community consultation carried out accordance with the Consultation Requirements would also need to be demonstrated. AECOM's proposed methodology was outlined in detail in Section 1.6 of draft methodology document provided to RAPs. A brief review of environmental and archaeological data for the Project area and environs was included in the document to give context to this methodology.
Wallangan Cultural Services	14.05.14	Verbal	Wallangan Cultural Services agree with the methodology	None required
Wanaruah Local Aboriginal Land Council	14.05.14	Verbal	Wanaruah Local Aboriginal Land Council is happy for their involvement to be limited to receiving assessment reports.	None required
Kauwul Wonn1 Contracting	13.05.14	Email with letter	Kauwul Wonn1 Contracting has reviewed the draft methodology and find the process of assessment acceptable.	None required
Tocomwall Pty Ltd	15.05.14	Verbal	Tocomwall Pty Ltd agree with the methodology	None required
Lower Hunter Wonnarua Cultural Services	14.05.14	Email with letter	Lower Hunter Wonnarua Cultural Services have reviewed the methodology and believe that it is not a methodology but rather just background information.	Noted. AECOM's proposed methodology was outlined in detail in Section 1.6 of draft methodology document provided to RAPs. A brief review of environmental and archaeological data for the Project area and environs was included in the document to give context to this methodology.
Gomeroi Namoi	15.05.14	Email	Gomeroi Namoi support the rezoning application provided a full assessment is completed over entire Project area and that any associated management recommendations are implemented or addressed prior to fieldwork.	Noted. This Aboriginal cultural heritage assessment report is to form part of a planning proposal to Maitland and Cessnock Shire Councils to rezone land within the Project area. As no ground surface impacts are proposed as part of Hydro's Planning

Registered Aboriginal Party (RAP)	Date of response	Method of response	Summary of response	AECOM response to RAP comments
				Proposal, the current assessment will not be used to support applications for AHIPs under Section 90A of the NPW Act 1974. Such applications will need to be supported by standalone Aboriginal Cultural Heritage Assessment and Aboriginal Archaeological Reports prepared in accordance with OEH guidelines. A process of Aboriginal community consultation carried out accordance with the Consultation Requirements would also need to be demonstrated.
HTO Environmental Management Services	14.05.14	Verbal	HTO Environmental Management Services agree with the methodology	None required
HECMO Consultants	14.05.14	Verbal	HECMO Consultants agree with the methodology	None required

As indicated in **Table 3**, information regarding the cultural values of the Project area was provided by one RAP (i.e., Lower Hunter Aboriginal Incorporated) in their response to the draft methodology.

Mr David Ahoy, Senior Sites Manager for Lower Hunter Aboriginal Incorporated advised that his family has lived in the Heddon Greta and Kurri Kurri area for many generations and that, while the Project area has stories of hunting camps, no sacred sites are known. The Project area, Mr Ahoy advised, is culturally significant and is known to contain stone artefact sites. In addition, Mr Ahoy advised that there is high potential for the identification of additional artefacts and camping areas.

No other specific cultural heritage values relating to the Project area were identified by RAP respondents.

3.3.2 Archaeological Survey

With the exception of the Wonnarua LALC, who had indicated as part of the registration process that they did not wish to participate in the fieldwork component of this assessment, all RAPs who had registered an interest in this assessment prior to the commencement of fieldwork on 23 June 2014 were provided the opportunity to participate in an archaeological survey of the Project area. Owing to the large number of RAPs involved, a fieldwork roster was developed to facilitate equitable RAP involvement.

Notification of the field survey, including insurance requirements, was provided in writing to all relevant RAPs on 13 June 2014 (**Appendix E**). In the end, a total of 26 RAPs provided representatives for survey. RAP field representatives are listed by organisation in **Table 4**.

Table 4 RAP field representatives by organisation

Registered Aboriginal Party (RAP)	Field representative(s)	Field date(s)
Aboriginal Native Title Elders Consultants	Margaret Matthews	01.07.14
Cacatua General Services	Kelly Griffiths	23.06.14
AGA Services	Ashley Sampson	23.06.14
EMT Cultural & Heritage	Lionel Washington	25.06.14
Gidawaa Walang Cultural Heritage Consultancy	Annie Hickey	23.06.14
Giwirri Consultants	Michele Stair	27.06.14
HSB Heritage Consultants	Patricia Hampton	24.06.14
Hunter Valley Cultural Consultants	John Matthews	01.07.14
Jarban & Mugrebea	Les Atkinson	24.06.14
Crimson Rosie	Colleen Stair	01.07.14
Kauma Pondee Inc	David Ahoy	24.06.14
Lower Hunter Aboriginal Incorporated	David Ahoy	25.06.14
Mindaribba LALC	Matthews Yates & Steve Crawford	24.06.14-26.06.14; 30.06.14-02.07.14
Upper Hunter Heritage Consultants	Darrel Matthews	01.07.14
Wallangan Cultural Services	Maree Waugh	25.06.14
Widescope Indigenous Group	Steven Hickey	25.06.14
Kauwul Wonn1 Contracting	Maree Waugh	27.06.14
Tocomwall Pty Ltd	Mary Franks	27.06.14 & 02.07.14
Yinarr Cultural Services	Kathie Kinchela & Kenneth Brown	26.06.14
Amanda Heard	J. Sinclair	30.06.14
A1 Indigenous Services	Steven Hickey	26.06.14

Registered Aboriginal Party (RAP)	Field representative(s)	Field date(s)
Lower Hunter Wonnarua Cultural Services	David Johnson	26.06.14
Amanda Hickey Cultural Services	Paulette Ryan	27.06.14
Kawul Cultural Services	Rod Hickey	30.06.14 & 01.07.14
HTO Environmental Management Services	Paulette Ryan	30.06.14
HECMO Consultants	Maree Waugh	26.06.14

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

- Wentworth Swamp would have been a focal resource feature for Aboriginal people camping within and passing through the Project area owing to it being a virtual 'supermarket' of floral and faunal resources.
- Mount Tomalpin, which is clearly visible from various parts of the Project area, would have been an important local landmark for Aboriginal people camping within and passing through the Project area and was likely only accessible to selected individuals;
- The concentration of sites around Wentworth Swamp and along Black Waterholes creeks shows that both areas were important hunting and gathering areas;
- The Project area contains a large number of edible and otherwise useful plants;
- The presence of sites in eroded areas shows that the Project area contains a large subsurface archaeological resource;
- All Aboriginal archaeological sites within the Project area are culturally significant as they attest to the use of the site by Aboriginal people in the past;
- The stone artefact assemblages identified during survey are typical of those found locally in terms of being dominated by silcrete artefacts and containing backed artefacts; and
- Stones used for flaked stone artefact manufacture within the Project area were likely sourced from the nearby Hunter River gravels.

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, on7 November 2014, all RAPs were sent a draft of the Aboriginal cultural heritage assessment for review and comment. The specified closing date for comments was 8 December 2014, which provided the necessary minimum 28 day review period.

Two responses to the draft report were received from RAPs: one written and one verbal. Both responses are summarised in **Table 5**. Written RAP responses to the draft report are attached as **Appendix F**.

Table 5 RAP Reponses to draft report

Registered Aboriginal Party (RAP)	Date of response	Response to draft report	AECOM Response
Aboriginal Native Title Elders Consultants	N/A	No response provided	None required
Cacatua General Services	N/A	No response provided	None required
AGA Services	N/A	No response provided	None required
Culturally Aware	N/A	No response provided	None required
EMT Cultural & Heritage	N/A	No response provided	None required
Gidawaa Walang Cultural Heritage Consultancy	11-12-14	Gidawaa Walang Cultural Heritage Consultancy support	None required

Registered Aboriginal Party (RAP)	Date of response	Response to draft report	AECOM Response
		the management recommendations in the draft report.	
Giwirri Consultants	N/A	No response provided	None required
HSB Heritage Consultants	N/A	No response provided	None required
Hunter Valley Cultural Consultants	N/A	No response provided	None required
Jarban & Mugrebea	N/A	No response provided	None required
Crimson Rosie	N/A	No response provided	None required
Kauma Pondee Inc	N/A	No response provided	None required
Lower Hunter Aboriginal Incorporated	N/A	No response provided	None required
Mindaribba Local Aboriginal Land Council	N/A	No response provided	None required
Ungooroo Aboriginal Corporation	N/A	No response provided	None required
Upper Hunter Heritage Consultants	N/A	No response provided	None required
Upper Hunter Wonnarua Council Inc	N/A	No response provided	None required
Wallangan Cultural Services	N/A	No response provided	None required
Wanaruah Local Aboriginal Land Council	11-11-14	Suzie Worth, on behalf of the Wanaruah LALC, advises that the LALC is happy with the report overall but request that the development control triggering due diligence be modified to state that an Aboriginal persons should be present for these assessments.	Noted. AECOM has inserted the following provision into the control in question: “Visual inspections undertaken for the purposes of a due diligence assessment should include an Aboriginal community representative”.
Widescope Indigenous Group	N/A	No response provided	None required
Kauwul Wonn1 Contracting	N/A	No response provided	None required
Tocomwall Pty Ltd	N/A	No response provided	None required
Yinarr Cultural Services	N/A	No response provided	None required
Amanda Heard	N/A	No response provided	None required
Lower Hunter Wonnarua Cultural Services	N/A	No response provided	None required
Gomeroi Namoi	N/A	No response provided	None required
Amanda Hickey Cultural Services	N/A	No response provided	None required
A1 Indigenous Services	N/A	No response provided	None required
Kawul Cultural Services	N/A	No response provided	None required
HTO Environmental Management Services	N/A	No response provided	None required
HECMO Consultants	N/A	No response provided	None required
Wurrumay Consultants	N/A	No response provided	None required

4.0 Existing Environment

The nature and distribution of Aboriginal archaeological materials are closely linked to the environments in which they occur. Environmental variables such as topography, geology, hydrology and vegetation will have played a critical role in influencing how Aboriginal people moved within and utilised their respective Country. Amongst other things, these variables affected the availability of suitable campsites, drinking water, plant and animal resources and raw materials for the production of stone and organic implements. Accordingly, any attempt to predict or interpret the character and distribution of Aboriginal sites in a given landscape must take such environmental factors into account. At the same time, an assessment of historical land use activities and geomorphic processes, both contemporary and historic, allows predictions to be made concerning the survival, visibility and integrity of Aboriginal archaeological materials within the same landscape.

4.1 Physical Setting

As indicated in **Section 1.3**, the Project area is located to the immediate north of the township of Kurri Kurri, approximately 29 km northwest of Newcastle and 5 km southwest of Maitland in the Lower Hunter Valley of NSW. Reference to the Cessnock 1:100,000 Topographic Map Sheet (9132-2N) indicates that the Project area, which covers an area of approximately 1,964 hectares across the Cessnock and Maitland LGAs, is situated between MGA grid coordinates 355400 and 362000 east and 6369400 and 6374900 north (Zone 56).

Surrounding townships and hamlets include Abermain to the west-southwest, Heddon Greta to the southeast, Weston to the southwest and Gillieston Heights to the northeast. Parks and reserves in the surrounding area, meanwhile, include the Werakata National Park to the west and southwest, Cessnock State Forest to the west, the Lower Hunter National Park to the south and the Heddon Greta Reserve to the southeast.

Reference to the NSW Geographical Names Register indicates that the Project area is situated within the Parish of Heddon in the County of Northumberland. Land within the Project area has been registered as Lot 1224828 on DP1082569, Lot 1201503 on DP 1082775, Lot 1215090 on DP 1102156, Lot 1425480 on DP1158546, Lot 1420807 on DP1159325, Lot 1427421 on DP1160801, Lot 1424043 on DP1161547, Lot 444259 on DP166625, Lot 209443 on DP233125, Lot 421359 on DP39701, Lot140801 on DP456769, Lot 554442 on DP456946, Lot 444265 on DP502196, Lot 3872 on DP543057, Lot 558653 on DP547715, Lot 150780 on DP553542, Lot 3622432 on DP589169, Lot 121073 on DP62332, Lot 127974 on DP654206, Lot 238178 on DP71130, Lot 397964 on DP728982, Lot 209444 on DP73597, Lot 362386 on DP755231, Lot 319804 on DP975995, Lot 201888 on DP976895, Lot 147507 on DP976896 and Lot 82659 on DP998540.

4.2 Topography

The Project area is located within the Central Lowlands subregion of the Hunter Valley (after Galloway, 1963) and crosscuts the 'Lower Hunter Plain' and 'East Maitland Hills' physiographic regions defined by Matthei (1995) (see **Figure 4** and **Figure 5**). The topography of the Project area can be broadly characterised as flat to undulating, with level, low-lying swampy terrain in the north-central portion of the site giving way, to the south, west and east into low undulating hills dissected by numerous ephemeral drainage lines. Several elevated flats[1], some of which could be described as 'plateaus', are also present within the Project area, with the largest and most prominent of these housing Hydro's Kurri Kurri smelter complex towards its southern end. Terraces along Swamp Creek attest to the lateral and vertical migration of this locally significant watercourse over time.

Reference to Matthei (1995) indicates that the flat, low-lying terrain that dominates the north-central portion of the Project area forms part of an extensive swampy backplain of the nearby Hunter River. Islands of higher ground within this backplain can be classified as residual rises (*sensu* Speight, 2009). Undulating hills in the eastern half of the Project area, meanwhile, comprise part of a larger, north-northeasterly trending belt of elevated undulating terrain that comprises the watershed between the Wallis Creek and Swamp Creek catchments. In the southern half of the Project area, flood prone creek flats occur in association with Swamp and Black Waterholes Creeks, as well as two of their unnamed higher order tributaries.

Elevations within the Project area range from 2 to 47 m AHD providing a total local relief of up to 45 m. Slopes are predominantly very gently to gently (1-10%) inclined, with moderately (10-32%) inclined slopes also present but comparatively rare. Following Speight (2009), a breakdown of the relative representation of morphological landform units within the Project area is provided in **Table 6**. Identified landform units are shown on **Figure 6**.

[1] A degree of morphological overlap between some of the Project's area 'elevated flats' and 'spur crests' is acknowledged.

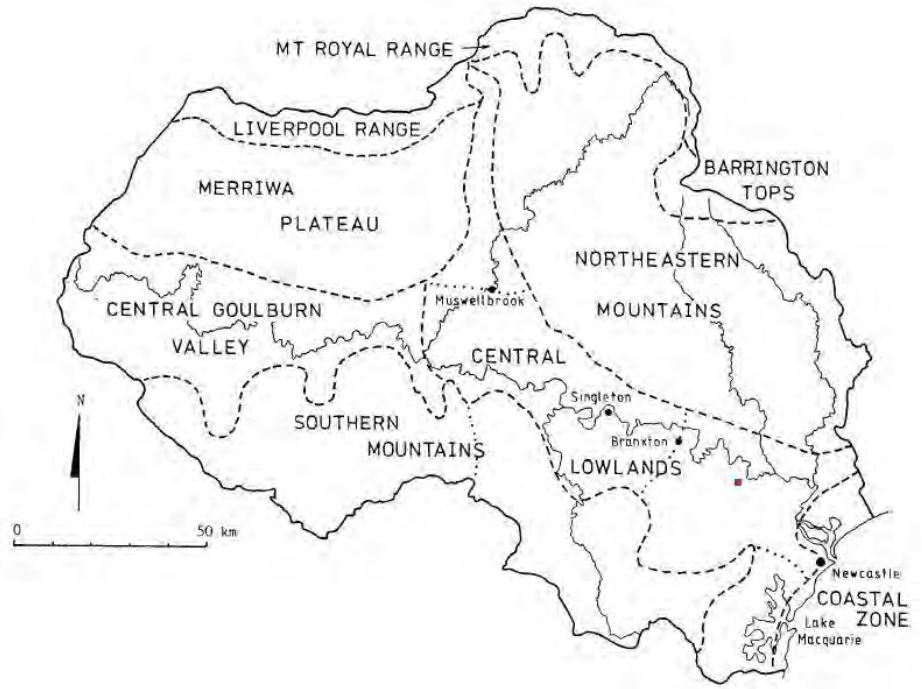


Figure 4 **Subregions of the Hunter Valley (from Hughes, 1984: 4, Fig. 4, after Galloway, 1963). Approximate location of Project area marked with red square.**

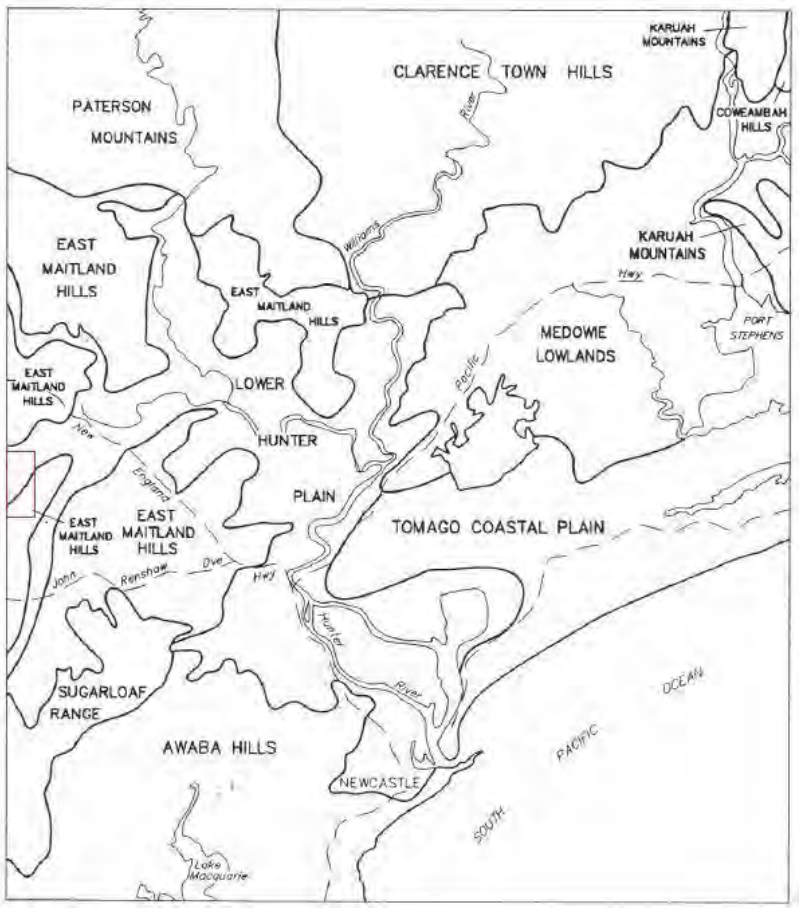


Figure 5 **Physiographic regions of the Newcastle 1:100 000 Map Sheet (from Matthei, 1995). Approximate location of Project area marked in red. Note Project area extends outside of mapped area.**

Table 6 Morphological landform units within the Project area

Landform unit	Area (ha)	%
Simple slope	993	50.6
Swamp	224.7	11.4
Elevated flat	158.1	8.1
Disturbed	142.3	7.2
Spur crest	139.9	7.1
Drainage depression	138.8	7
Crest	73.4	3.7
Flat	63.7	3.2
Residual rise	20	1
Creek terrace	10.8	0.6
Total	**1,964**	**100**

4.3 Hydrology

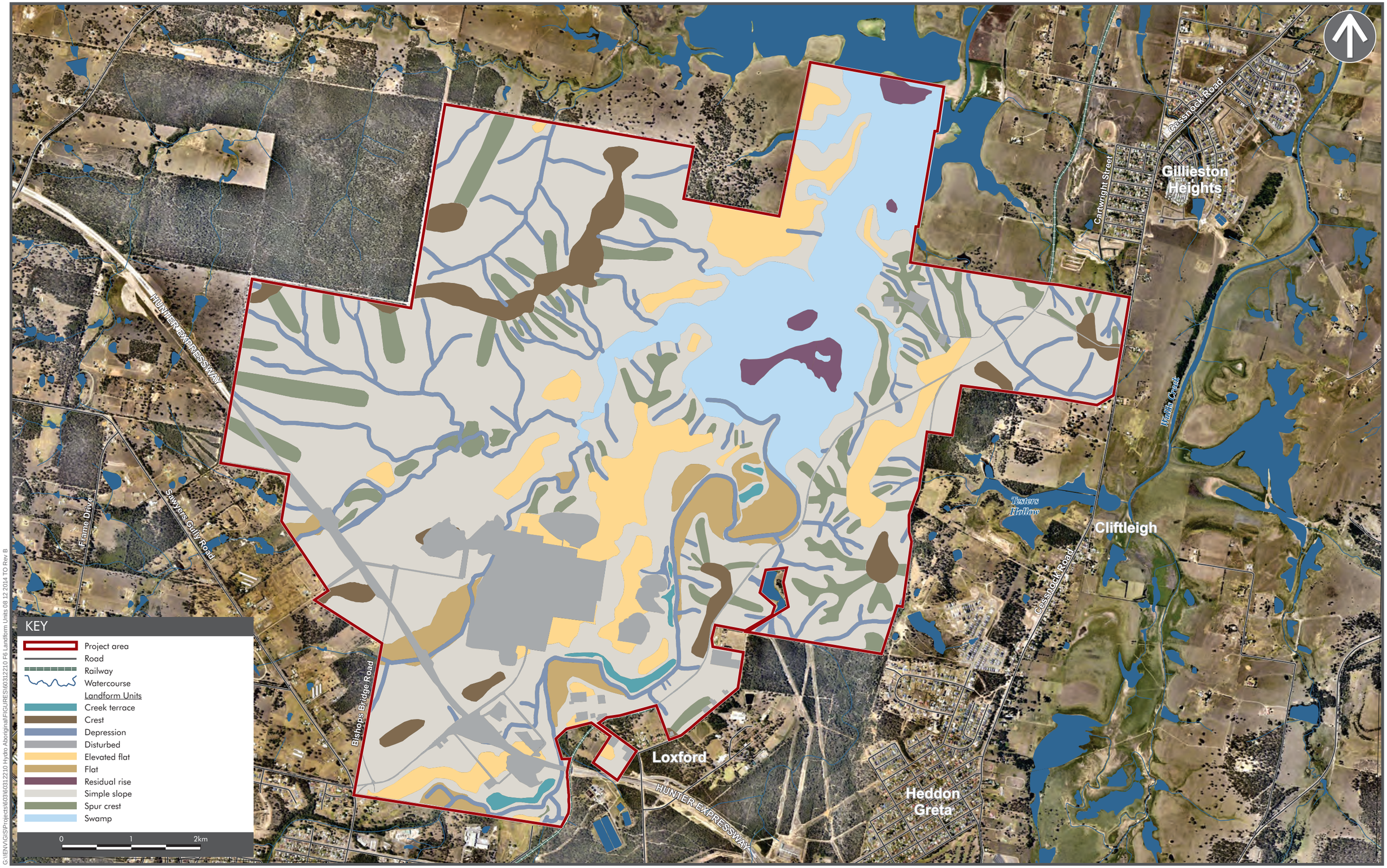
The Project area crosscuts the Swamp Creek and Wallis Creek sub-catchments of the broader Hunter River catchment and contains a sizeable portion of the regionally significant Wentworth Swamp, a permanent wetland system that covers an area of approximately 1,300 hectares downstream of Kurri Kurri and was known historically as Lake Lachlan, after Governor Macquarie's son (Hunter, 2012:19).

Today, Wentworth Swamp comprises a freshwater wetland and is one several Lower Hunter wetland systems that has been incorporated into the NSW Scientific Committee's *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Endangered Ecological Community*. However, prior to the construction of the Wallis Creek Floodgates[2] and the implementation of other Lower Hunter Valley Flood Mitigation Scheme measures, the swamp would have consisted of an estuarine environment subject to the daily tidal cycle of the Pacific Ocean[3], albeit one characterised by a complex mosaic of brackish and freshwater micro-environments (see also **Section 4.5.1** below).

Named watercourses within the Project area include Black Waterholes Creek and Swamp Creek[4], both of which discharge into Wentworth Swamp within the site. Black Waterholes Creek enters the Project area to the west of the existing Hydro smelter complex as a 3rd order stream, while Swamp Creek enters it to the southeast of the complex as a >4th order stream. Terraces along the latter attest to its lateral and vertical migration over time. Swamp Creek joins Wallis Creek at Louth Park *c*.3.4 km northeast of the Project area which, in turn, discharges into the Hunter River at Horseshoe Bend approximately 6 km northeast of the site. Both creeks are susceptible to flooding from the Hunter River, particularly in their lower reaches.

Remaining mapped drainage lines within the Project area consist principally of ephemeral 1st to 2nd order streams that are best described as drainage depressions. Notable exceptions include the unnamed 2nd order stream that borders the Hydro smelter complex to the west, the unnamed 2nd order tributary of Bishops Creek in the northwestern portion of the Project area and the unnamed 2nd order stream that discharges into Wentworth Swamp in the easternmost portion of the site. Other significant watercourses in the vicinity of the Project area include Bishops Creek to the north and Wallis Creek to the east.

[2] First constructed in 1870, the Wallis Creek Floodgates were reconstructed in 1876 and again in 1941
[3] The tidal limit in the Hunter River occurs in the vicinity of Oakhampton, approximately 64 km from the Pacific Ocean.
[4] Downstream of Wentworth Swamp, Swamp Creek is also known as Fishery Creek.



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AECOM

LANDFORM UNITS

Aboriginal Cultural Heritage Assessment
Hydro Aluminium Smelter Site & Associated Buffer Land
Kurri Kurri, New South Wales

FIGURE 6

Wentworth Swamp
Gillieston Heights
Gillieston Road
Cartwright Street
Wallis Creek
Testers Hollow
Cliftleigh
Cessnock Road
Heddon Greta
Loxford
HUNTER EXPRESSWAY
Dickson Road
Swamp Creek
Black Waratahs Creek
Frame Drive
Sawyers Gully Road
Metcalfe Lane
Bishops Bridge Road
Hart Road
Horton Road
Scales Road

KEY

- Project area
- Road
- Railway
- Watercourse

Stream Order

- 1st
- 2nd
- 3rd
- 4th
- > 4th

0 1 2km

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AECOM

HYDROLOGY

Aboriginal Cultural Heritage Assessment
Hydro Aluminium Smelter Site & Associated Buffer Land
Kurri Kurri, New South Wales

FIGURE 7

4.4 Surface Geology

Examination of the Newcastle and Singleton 1:250 000 Geological Map Sheets indicates that the surface geology of the Project area consists principally of rocks belonging to the Rutherford Formation (Pdr) of the Early Permian Dalwood Group, with Quaternary Alluvium (Qa) also well represented.

Rocks of the Rutherford Formation, specifically, lithic sandstone, micaceous siltstone, mudstone, shale and erratics, mantle the majority of the elevated flat to undulating terrain surrounding Wentworth Swamp while unconsolidated flood plain alluvium (i.e., clay, silt and sand) of Holocene antiquity blankets the low-lying terrain associated with the swamp and lower reaches of Swamp and Black Waterholes Creeks. Although unconfirmed, reference to Roy et al. (1995)) suggests that Holocene flood plain alluvium within the Project area overlies, at least in places, estuarine muds belonging to the Hunter Valley's now largely infilled palaeoestuary. At Maitland, *c*.5 km northeast of the Project area, up to 8 m of unconsolidated flood plain alluvium overlies estuarine muds that have a total thickness of around 17 m (Roy et al. 1995: 77). A similar if reduced cover of flood plain alluvium is inferred for the Project area given its location relative to the Hunter River.

Other mapped geological formations within the Project area include the Farley Formation of the Dalwood Group, the Greta Coal Measures and the Branxton Formation of the Early Permian Maitland Group. Rocks of the Farley Formation have been mapped as mantling the undulating terrain to the east of Wentworth Swamp and include sandstone, mudstone, siltstone and shale erratics. In the easternmost portion of the Project area, available geological mapping indicates the presence of a narrow belt of rocks belonging to the Greta Coal Measures. These measures are bordered to the east by rocks of the Branxton Formation.

As far as is possible to determine from available documentary sources, no naturally-occurring deposits or outcrops of stone suitable for the production of flaked and/or edge-ground stone tools have been previously identified within or directly adjacent to the Project area. Nonetheless, given that suitable materials are known to occur within some of the geological formations present within and surrounding the Project area, the presence of such features remains a possibility. Outside of the Project area, gravel deposits associated with nearby Hunter River have been identified as a regionally significant source of lithic raw materials for flaked and edge-ground stone tool manufacture (Hiscock, 1986a; Moore, 2000; White, 2012). These deposits, which occur in the form of point and mid-channel gravel bars, as well as 'stranded' terrace and ridge gravels, are known to contain a variety of flakeable rock types including silcrete, silicified tuff (also known as indurated mudstone), quartz, quartzite, chert, petrified wood and various fine-grained volcanic rocks (e.g., White, 1998).

As with flakeable stone, available environmental and archaeological reference materials for the Project area indicate that sandstone outcrops suitable for the grinding of stone hatchet-heads and wooden spears have not been previously identified within it. Regardless, the known presence of sandstone in the Branxton, Farley and Rutherford Formations, as well as the Greta Coal Measures, raises the possibility that such outcrops may, in fact, exist. The presence of grinding groove sites in the surrounding district is similarly suggestive. If present, existing archaeological data for grinding groove sites in the Lower Hunter Valley suggest that flat or relatively flat, low-lying outcrops of fine-grained sandstone near water will have preferentially selected for this task. Alongside food preparation and other tasks (e.g., the grinding of ochre), smaller, portable sandstone blocks may also have been used in this capacity.

4.5 Soils & Geomorphology

4.5.1 The Hunter 'Delta'

As shown on **Figure 8**, the Project area is located at the western extremity of the Hunter "delta", a term first used by David and Etheridge (1890) to describe the broad expanse of floodplains, swamps and channels extending some 35 km inland from the coast at Newcastle. More recently, this same region has been described by Chappell (1993) as a coastal or fluvio-deltaic lowland, the boundaries of which correspond to those portions of bedrock palaeovalleys occupied by Pleistocene and Holocene estuaries now infilled with a "complex assemblage of fluvial, estuarine and coastal-marine sediments of various ages" (Roy et al., 1995: 70). The present day floodplains, swamps and channels of the lower Hunter, Patterson and Williams Rivers define a large infilled estuary whose upper reaches were just west of Maitland (Roy et al., 1995: 70) (**Figure 9**). In common with other southeastern Australian coastal river valleys, formation of the Hunter delta's former Pleistocene and Holocene estuaries was closely tied to glacio-eustatic fluctuations in sea level, the last major cycle of which commenced around 130,000 years ago with the Last Interglacial phase of high sea levels and warm temperatures (Roy et al., 1995: 61) (**Figure 10**).

During the Last Interglacial, *c*.130,000 to 115,000 years ago, conditions in the Hunter delta are believed to have been similar to the present day with an extensive deltaic floodplain blanketing the Lower Hunter Valley (Roy et al., 1995: 70). Raised estuarine shell beds in the greater Maitland area, investigated by David and Etheridge (1890) and others (e.g., Thom & Murray-Wallace, 1988), have been assigned to this phase of sedimentation and are indicative of a sea level around 5 m higher than that of today (Roy et al., 1995: 70). Associated terrace deposits, the modern distribution of which has been mapped by Roy et al. (1995) (**Figure 8**), are remnants of the Last Interglacial floodplain that once covered the lower Hunter valley. The 'Inner Barrier' of the Newcastle Bight Sand Barrier System was also deposited at this time (Roy et al., 1995: 70).

Incision of the present day rivers of the Hunter delta into their respective valleys commenced with the onset of glacial cooling and its attendant (progressive) reduction in sea levels. Erosion and transportation of much of the Last Interglacial floodplain in the millennia leading up to and comprising the Last Glacial Maximum (LGM) (*c*.24,000 to 17,000 years ago) have been attributed to prolonged sub-aerial weathering and the lateral migration of river channels across this low gradient floodplain (Roy et al., 1995: 71). During the LGM, the coastline of the Hunter River 'delta' was on the continental shelf around 25km east of its present position. A zone of gravelly sands on the inner shelf marks the course of the Hunter palaeo channel (Roy & Crawford, 1980). Rising sea levels associated with the Post-glacial marine transgression (*c*.20-6.5ka) subsequently inundated the inner shelf and much of the Lower Hunter Valley, resulting, at the end of the transgression, in an estuary extending approximately 35 km inland from present coastline (**Figure 11**). Initiation of the Outer Barrier of the Newcastle Bight Sand Dune System can also be traced to this period, with sandy shelf deposits reworked landward from *c*.18,000 years ago (Dean-Jones, 1990: 24). Progradation of the Outer Barrier followed the cessation of sea level rise *c*.6,500-6,000 years ago and marked the commencement of "a new cycle of estuarine and deltaic sedimentation" in the Lower Hunter Valley (Roy et al., 1995: 71).

Mid-to-late Holocene sedimentation in the Hunter delta has been discussed in detail by Roy et al. (1995) who describe a dual infilling process involving the building of tidal delta marine sand into the estuary mouth from the open ocean and the deposition of land-supplied fluvial-estuarine sediments through rivers and creeks. Estuarine environments were most common during the mid-Holocene (*c*.6-4 ka) but have progressively decreased in size through estuary infilling. In the case of Wentworth Swamp, progressive infilling associated with a prograding Hunter River delta and sediment influx from local creeks will have slowly transformed what was a shallow estuarine water body into the terrestrial swamp system of today. Alongside changes in the distribution of potable water sources, accompanying changes in the floral and faunal regime of the area occupied by the former estuary are of relevance to understanding past Aboriginal land use within the Project area.

Estuarine muds associated with the Hunter palaeoestuary vary laterally in response to existing environmental conditions. Towards the coast, where salinity levels are relatively stable and the estuary is marine-dominated, the muds are shell-rich. However, further inland, organic-rich muds with less shell predominate, a product of significantly higher freshwater inflows (Roy et al., 1995: 76). At Maitland, *c*.5 km northeast of the Project area, estuarine muds are up to 17 m thick and contain fluvial deltaic sand units. These muds are overlain by up to 8 m of Holocene flood plain alluvium, with well-developed levees present (Roy et al., 1995: 77). Flood plain deposits in this and other portions of the Hunter palaeoestuary have been described as consisting of "complexly interbedded muddy sands and sandy muds with minor organics" (Roy et al., 1995: 71). Sand levels are highest in levees adjacent to the Hunter River and decrease towards backswamps such as Wentworth Swamp. Although site-specific data are lacking, Holocene muds within the current Project area are anticipated to be finer-grained than those closer to modern Hunter River channel.

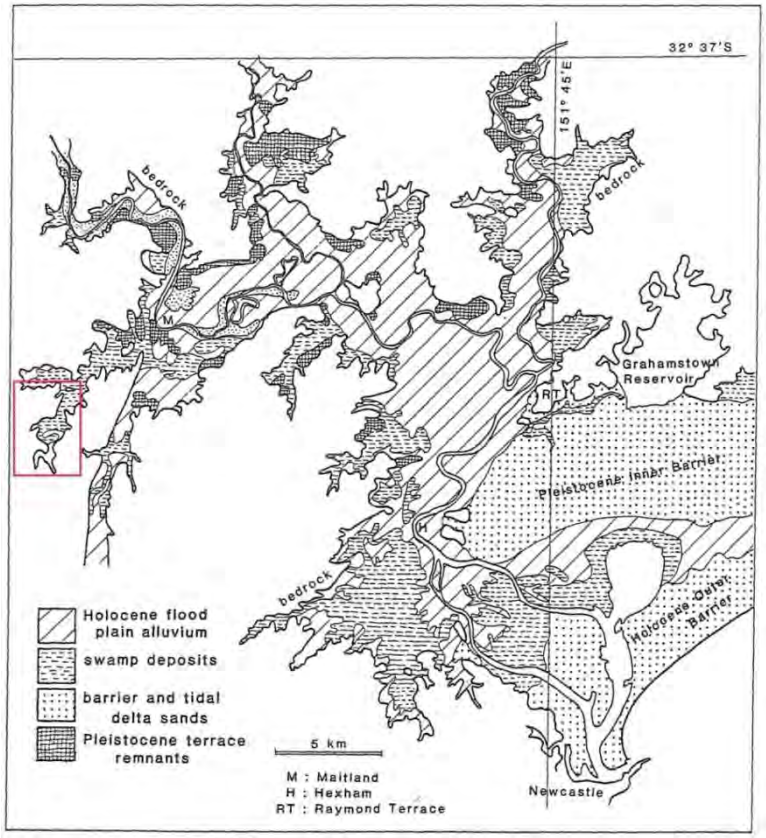

Figure 8 **Map of the Hunter "delta" showing the floodplain and backswamps of the lower Hunter, Williams and Patterson Rivers as well as remnant Pleistocene terrace deposits and the coastal sand barriers of the Newcastle Bight Sand Dune System (from Roy et al., 1995: 66, Fig. 2). Approximate location of Project area marked in red.**

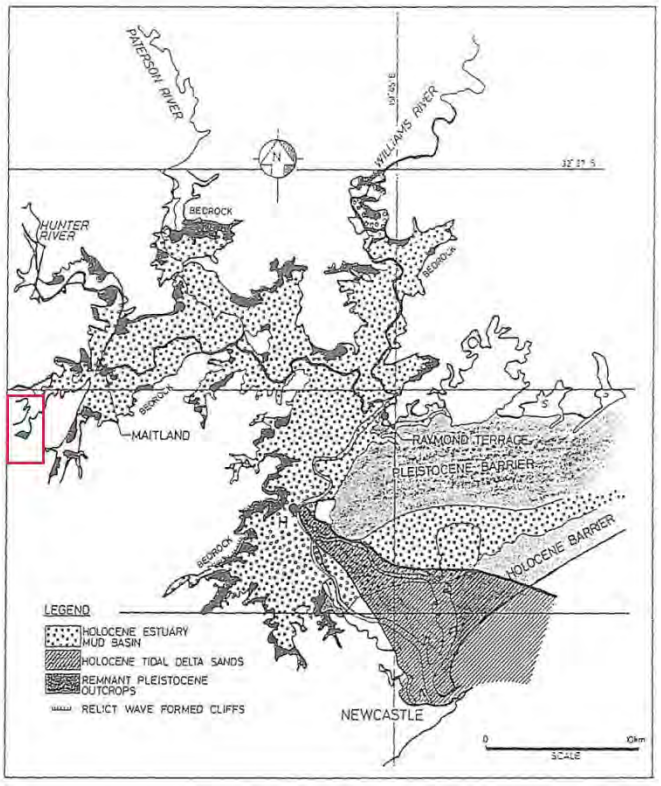

Figure 9 **Map showing the aerial extent of the main Holocene valley fill lithofacies of the Hunter "delta" (from Roy et al., 1995: 72, Fig. 6). Approximate location of Project area marked in red. Note Project area extends outside of mapped area.**

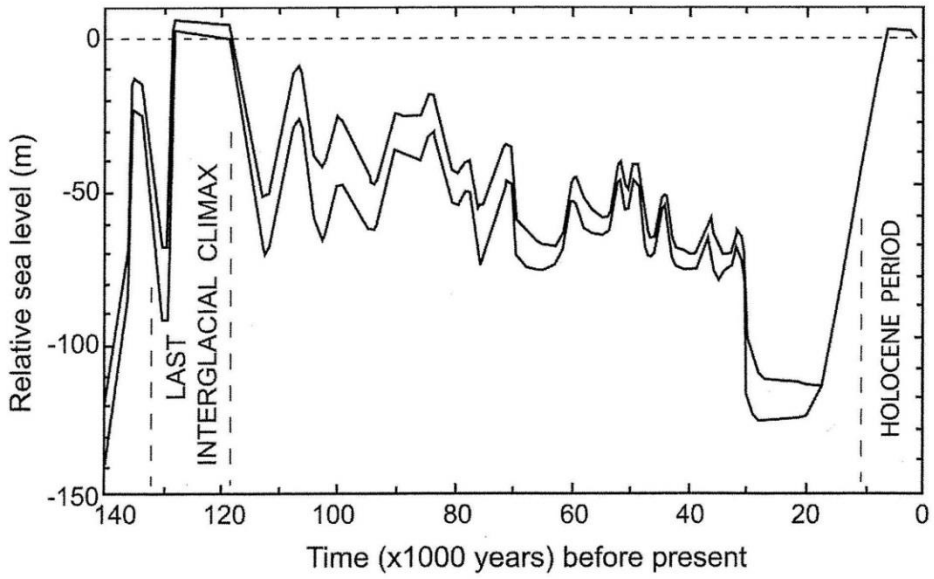

Figure 10 Sea-level changes since the last Inter-glacial period (from Lambeck & Chappell, 2001)

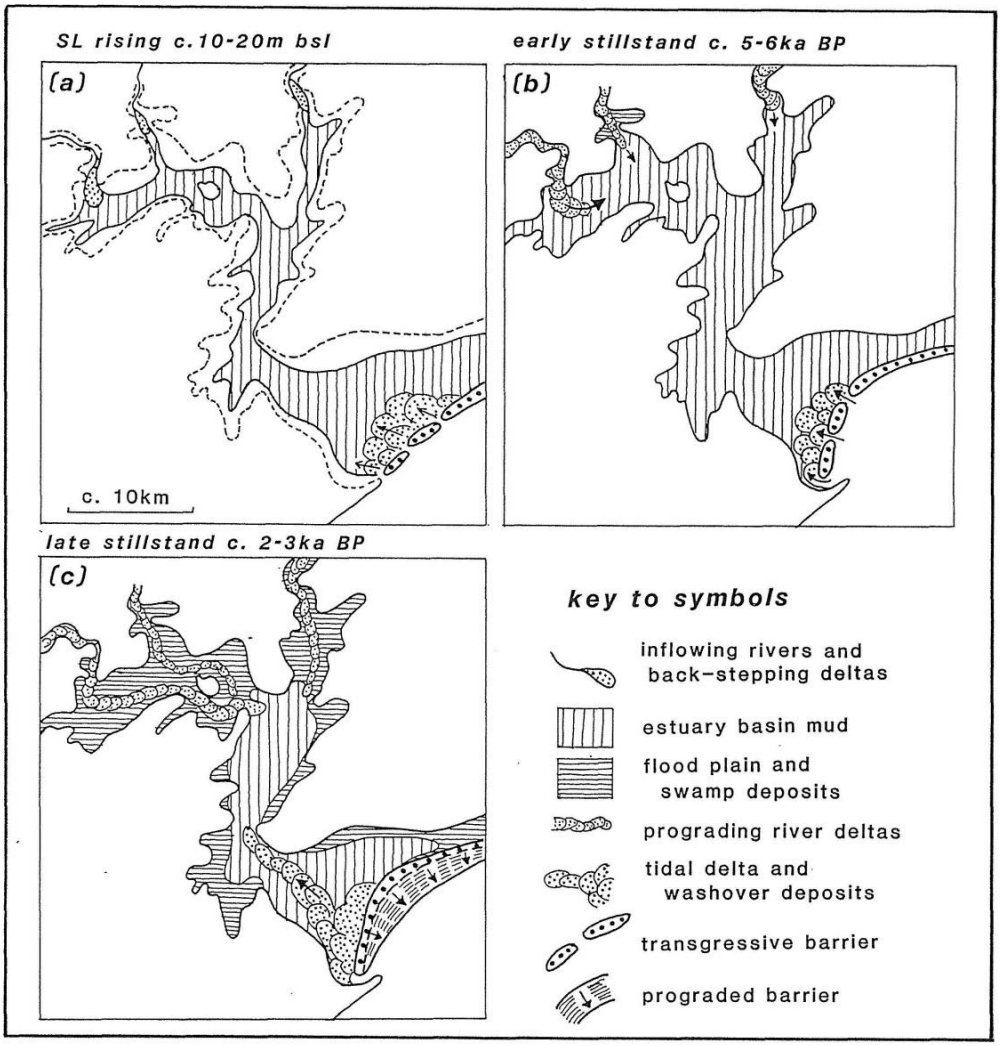

Figure 11 Evolutionary model of the Hunter "delta" (from Roy et al., 1995: 75, Fig. 9).

4.5.2 Soils & Soil Landscapes

Reference to the soil landscape maps produced for the Singleton 1:250,000 Map Sheet (Kovac & Lawrie, 1991) and Newcastle 1:100,000 Map Sheet (Matthei, 1995) indicates that soils within the Project have been mapped as belonging to the Hunter (hu & hua), Branxton (bx), Neath (nh) and Bolwarra Heights (bh & bha) Soil Landscapes. **Table 7** summarises the key characteristics of these landscapes and their dominant soil materials.

Available soils data for the Project area suggest a strong spatial correlation between extant soils and underlying geological units, described in **Section 4.4** above. In floodplain and swampy backplain contexts, A horizon soils consisting of weakly to well-structured clays and pedal loams are inferred from type locations and are expected to overlie medium clays (B Horizons) (Matthei, 1995: 172). Outside of these contexts, texture contrast soil profiles with gravelly loam, sandy loam, sandy clay loam and loamy sand A horizons and clay B Horizons are anticipated (after Kovac & Lawrie, 1991; Matthei 1995), as are deep (>1m) but relatively localised fluvial sand deposits. The latter are expected to be concentrated on landform elements associated with Swamp and Black Waterholes Creeks (e.g., low bordering spur crests and terraces).

Aeolian sand deposits associated with Story et al.'s (1963) Warkworth Land System may also occur within the Project area, with the valley housing Black Waterholes Creek, in particular, retaining significant potential for the presence of such features in view of available land systems mapping (**Figure 12**). These deposits are principally Pleistocene in age but contain loose surface layers that were likely remobilised and reworked during the Holocene. Previous geomorphological investigations of an aeolian sand sheet identified along the western side of Chinamans Hollow Creek to the southwest of the Project area concluded that A horizon sands in that feature were likely of Holocene antiquity on the basis of their looseness and lack of weathering (Hughes, 2002b in ERM, 2003). The typological characteristics of the flaked stone assemblage recovered from these sands were likewise deemed consistent with a Holocene date (ERM, 2003: 51). No stone artefacts were recovered from, or observed within, the coarser, more compact and variably weathered B Horizon sands of the Chinamans Hollow Creek sand sheet, which were assigned, by analogy with other Hunter Valley aeolian sand deposits, a Pleistocene date (Hughes, 2002b in ERM, 2003).

As in other parts of the Hunter Valley, existing archaeological, environmental and historic reference materials for the Project area suggest that a range of geomorphic processes are likely to have affected the Aboriginal archaeological record of the site. Potentially significant phenomena from an archaeological perspective include bioturbation, erosion, alluvial/colluvial aggradation and aeolian processes. Possible effects of these processes include:

- Increased archaeological site visibility in eroded areas;
- Reduced archaeological site visibility in areas of sediment deposition;
- Horizontal and vertical translocation of artefacts;
- Stratigraphic mixing;
- Truncation of archaeological deposits; and
- Creation of thicker (potentially stratified) archaeological deposits in floodplain, slope base and fluvial/aeolian sand deposit contexts.

Table 7 Soil landscapes of the Project area and their dominant soil materials. Soil and landscape data from Kovac & Lawrie (1991) and Matthei (1995).

Soil Landscape & Associated Codes	Geological Unit(s)	Topography	Dominant soils (horizon)	Soil pH	Erodibility[1]	Permeability	Occurrence & Relationships
Hunter (hu, hua & hub)	Quaternary alluvium	Extensive alluvial plains on recent alluvium. Slope gradients <1%. Elevation 2-11m. Local relief to 2m. *Landscape variant hua*: swampy backplains *Landscape variant hub*: ox-bows, recent overbank deposits, crevasse splays and broad levees	hu1 - Friable brown pedal loam (A Horizon)	6.0-7.5	NC: moderate C: moderate W: very low	Moderate	*On floodplains:* Typically, 10-80 cm of hu1 overlies >150 cm of hu5. *On backplains & backswamps*: 10-65 cm of hu2 overlies >80 cm of hu5
			hu2 - Brownish black well-structured clay (A Horizon)	5.5-7.0	NC: moderate C: moderate W: very low	Moderate to low	
			hu3 - Weakly structured brown sand clay loam (A Horizon)	6.0-7.5	NC: moderate C: moderate W: low	Moderate	
			hu4 - Loose dark brown sand (A_1 Horizon)	6.0-6.5	NC: very low C: high W: moderate	High	
			hu5 - Pedal brownish black silty clay to medium clay (B horizon)	6.0-7.5	NC: moderate C: high W: very low	Slow	
			hu6 - Brown well-structured loam (B horizon)	7.0-7.5	NC: very low C: high W: moderate	Moderate	
Bolwarra Heights (bh & bha)	Branxton Formation, Muree Sandstone, Greta Coal Measures and Farley Formation	Rolling low hills. Slope gradients 5-20%. Elevation up to 100 m. Local relief to 80 m. *Landscape variant bha*: shallow (<50 cm) soils	bh1 – Brownish black gravelly loam (A_1 Horizon)	5.5-6.0	NC: moderate C: high W: very low	Moderate to high	*Generally*: Up to 25 cm of bh1 overlies 15-20 cm of bh2, which in turn overlies 75-103 cm of bh3. *Some well drained upper slopes and crests*: up to 25 cm of bh1 overlies 15-30 cm of bh2, which in turn overlies 30-45 cm of bh4. Occasionally, up to 35 cm of bh1 directly overlies bh4. *Poorly drained slopes*: up to 25 cm of bh1 overlies up to 20 cm of bh2, which in turn overlies up to 30 cm of bh3
			bh2 – Earthy gravelly sandy clay loam (A_2 Horizon)	5.0-6.5	NC: high C: high W: very low	Moderate	
			Yellowish brown pedal clay (B_2 Horizon)	4.5-5.5	NC: moderate C: moderate W: very low	Moderate to slow	
			Reddish brown pedal mottled clay (B Horizon)	5.5-6.0	NC: moderate C: moderate W: very low	Moderate to slow	

Soil Landscape & Associated Codes	Geological Unit(s)	Topography	Dominant soils (horizon)	Soil pH	Erodibility[1]	Permeability	Occurrence & Relationships
							In drainage lines: >100 cm of bh1
Branxton (bx)	Farley Formation, Rutherford Formation, Mulbring siltstone, Muree Sandstone, Branxton Formation and Singleton Coal Measures	Undulating rises to low hills and creek flats. Slope gradients 3-5%. Elevations from 50 to 80m. Local relief is 10-40m.	Yellow Podzolic Soils *Topsoil*: Sandy loams to loamy sands *Subsoil:* medium clays	5.5-6.5 5.5	*Topsoil*: Moderate *Subsoil:* Low	*Topsoil & Subsoil*: Slow	Midslopes *Topsoil:* Depth to 20 cm *Depth to bedrock:* +100 cm
			Red Podzolic Soils *Topsoil*: Fine sandy loams to sandy loams *Subsoil:* medium clays	5.5-6.0 6.0	*Topsoil*: Moderate *Subsoil:* Low to Moderate	*Topsoil & Subsoil*: Moderate	Crests and upper slopes *Topsoil:* Depth to 25 cm *Depth to bedrock:* +65 cm
			Yellow Soloths *Topsoil*: Loamy sands to fine sandy loams *Subsoil:* medium clay	6.0-6.5 5.5	*Topsoil*: Moderate *Subsoil:* High	*Topsoil & Subsoil*: Moderate	Lower slopes and drainage lines *Topsoil:* Depth to 25 cm *Depth to bedrock:* +140 cm
			Alluvial Soils (Sands) *Topsoil*: Loamy sands	6.0	*Topsoil*: Low *Subsoil:* Low	*Topsoil & Subsoil*: High	Creek flats and slopes *Topsoil:* Depth to 20 cm *Depth to bedrock:* +60 cm
			Siliceous Sands *Topsoil*: Sandy loams *Subsoil:* Loamy sand	6.0-7.0 5.5	*Topsoil*: Moderate *Subsoil:* Moderate	*Topsoil & Subsoil*: High	Large valley flats *Topsoil:* Depth to 70 cm *Depth to bedrock:* +100 cm

Soil Landscape & Associated Codes	Geological Unit(s)	Topography	Dominant soils (horizon)	Soil pH	Erodibility[1]	Permeability	Occurrence & Relationships
Neath (nh)	Branxton Formation	Undulating low rises and swamps. Slope gradients up to 3%. Elevations from 40 to 80m. Local relief under 30m.	Grey Solodic Soils *Topsoil*: Clayey sands to loamy sands *Subsoil:* Sandy clay	 9.0 8.5	*Topsoil*: Low *Subsoil:* High	*Topsoil & Subsoil*: High	Melaleuca flats *Topsoil:* Depth to 35 cm *Depth to bedrock:* +50 cm
			Yellow Solodic Soils	N/A	N/A	N/A	N/A

[1] NC = Non-concentrated flows; C = Concentrated flows; and W = Wind

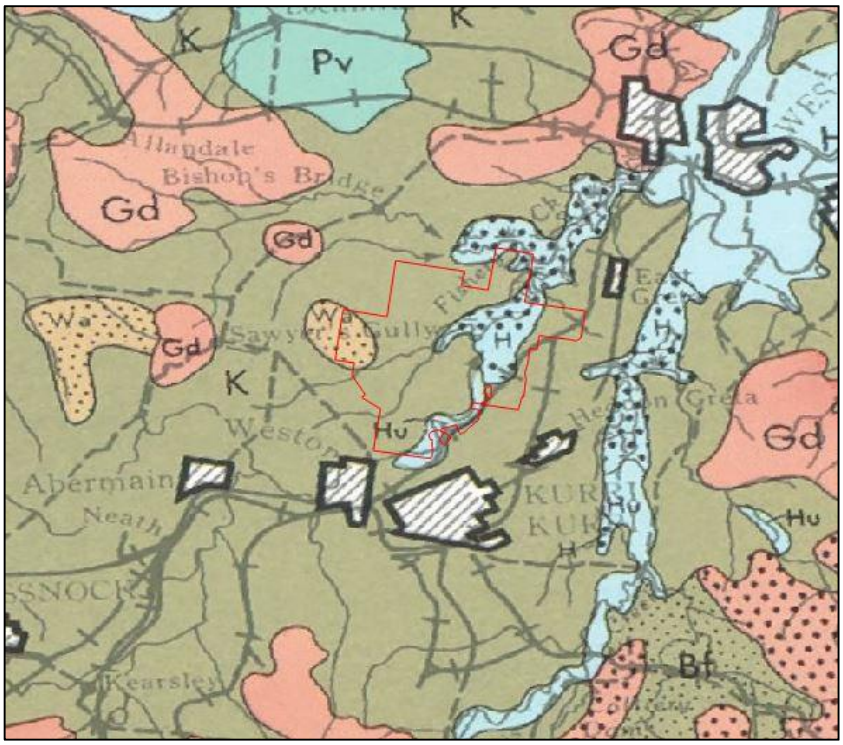

Figure 12 **Georeferenced excerpt from Galloway et al.'s (1963) Land Systems of the Hunter Valley Area Map Sheet showing the location and extent of the Warkworth Land System within the Project area. Other mapped land systems within the Project area include the Killarney (K), Hunter (Hu) and Hexham (H) Land Systems. Project area boundary approximate.**

4.6 Flora & Fauna

Native vegetation within the Project area has been significantly modified as a result of historic European land use practices, with no 'Old Growth' forest remaining and the original wetland vegetation of Wentworth Swamp now highly degraded (FloraSearch, 2004, 2008). Nonetheless, areas of regenerating native vegetation, as well as scattered paddock trees, provide insight into the pre-European settlement floral regime of the site.

In general, the Project area supports a diverse range of natural vegetation communities, with different communities occupying different landscape positions. As previously noted, the Project area contains a sizeable portion of the regionally significant Wentworth Swamp. Permanent and ephemeral wetlands within the Project area support a characteristic suite of freshwater wetland vegetation, albeit one that varies across the site in relation to water permanency and depth. Wetland-bordering forest communities, now almost completely cleared, would have included species such as Forest Redgum (*Eucalyptus tereticornis*), Swamp Oak (*Casuarina glauca*), Snow-in-Summer (*Melaleuca linariifolia*) and Cabbage Gum (*Eucalyptus amplifolia*). For the most part, existing wetlands are surrounded by cleared pasture land characterised by introduced pasture grasses, legumes and weeds. Where clearance has not occurred, slopes above the Project area's wetlands support a clear succession of Redgum and Grey Gum sub-communities which give way, on poorly drained soils, to low heathy woodlands. Woodland composition changes upslope becoming more open and grassy. Upper slopes and crests within the Project area support tall dry forests Ironbark and Spotted Gum. Riparian forest communities of variable floristic composition are also present along watercourses and on adjoining lower slopes.

Although available historical records provide only limited insight into Aboriginal exploitation of plants within the Hunter Valley (Brayshaw, 1987: 74), it can be confidently asserted that the original vegetation communities of the Project area will have supplied Aboriginal people camping within or passing through the site with an extensive array of edible and otherwise useful plant species (**Table 8**). Recorded native vegetation communities and locally occurring aquatic features (e.g., Wentworth Swamp) will likewise have supported a large and diverse range of economic terrestrial, aquatic and avian fauna. Historical evidence for the Aboriginal exploitation of faunal and floral resources within the Lower Hunter Valley is discussed in further detail in **Section 6.4**.

Table 8 Selection of economic plant species identified within the Project area

Botanical name	Common name	Potential Use(s)	Reference(s)
Acacia spp.	Acacia	Seeds & gum edible; wood suitable for making range of implements; bark & gum have medicinal properties	Stewart & Percival, 1997
Eucalypt spp.	Eucalypts	Bark has multiple uses (e.g., shelter, shields, baskets, fish nets); wood suitable for making range of implements (e.g., spears, clubs); leaves, gum & bark have medicinal properties	Stewart & Percival, 1997; Isaacs, 2002
Banksia spp.	Banksia	Nectar can be sucked from flowers or flowers soaked in water to make sweet liquid	Stewart & Percival 1997; Isaacs, 2002: 218
Lambertia formosa	Mountain Devil	As above	Stewart & Percival, 1997
Grevillea spp.	Grevillea	As above	Isaacs, 2002: 224
Hypoxis hygrometrica	Golden Weather-grass	Tubers edible	Isaacs, 2002: 224
Dianella revoluta	Blue Flax Lily	Fruits and seeds edible; roots also edible after pounding and roasting; leaf fibres can be used for string	Stewart & Percival, 1997
Eleocharis sphacelata	Tall Spike-rush	Onion-shaped tubers edible fresh (young) or roasted (older)	Stewart & Percival, 1997
Bursaria spinosa	Blackthorn	Nectar can be sucked from flowers	Isaacs, 2002: 219
Gahnia radula	Thatch Saw-sedge	Seeds can be pounded to produce flour; leaf bases are edible	Stewart & Percival, 1997
Lomandra longifolia	Spiny-headed Matrush	Leaf bases and flowers edible; leaves can be used to make baskets	Stewart & Percival, 1997
Marsilea spp.	Nardoo	Roots can be pounded, meal mixed with water and resulting dough baked	Isaacs, 2002: 225
Melaleuca spp.	Paperbark & Honeymyrtle	Nectar-filled flowers can be soaked in water to sweeten it; bark has multiple uses; (e.g., shelter, dressing for wounds, wrapping)	Stewart & Percival, 1997
Callistemon spp.	Bottlebrush	Flowers can be sucked for nectar	Isaacs, 2002: 219
Persoonia linearis	Narrow-leaved Geebung	Fruits edible	Stewart & Percival, 1997
Portulaca oleracea	Pigweed	Leaves, stems and seeds edible	Stewart & Percival 1997
Cassytha spp.	Devil's Twine	Fruits edible	Low, 1988

Botanical name	Common name	Potential Use(s)	Reference(s)
Pteridium esculentum	Bracken Fern	Rhizomes and fronds edible; rhizomes must be baked or roasted to destroy toxins; young stems can be rubbed on insect bites to relieve stinging/itching	Stewart & Percival, 1997
Typha orientalis	Cumbungi	Rhizomes edible after roasting; fibres can be used to make string; young shoots can be eaten raw; flower spikes can be steamed and eaten	Stewart & Percival, 1997
Xanthorrhoea glauca	Grass Tree	Leaves produce hard waterproof resin that melts when warmed as can be used as binding agent; flowers can be sucked or soaked in water to make sweet drink; leaf bases and growing points edible	Stewart & Percival, 1997
Phragmites australis	Common Reed	Roots edible; Straight flowering stems can be used as spear shafts; leaves can be twisted into rope	Zola & Gott, 1992: 12
Triglochin procerum	Water Ribbons	Tubers edible	Zola & Gott, 1992: 12
Bolboschoenus fluviatilis	Marsh Clubrush	Round corms can be roasted, pounded and made into edible starchy cakes	Zola & Gott, 1992: 13
Arthropodium minus	Small Vanilla Lily	Tubers edible	Zola & Gott, 1992: 25
Clematis glycinoides	Headache Vine	Roots edible; crushed leaves can be inhaled to relieve headache	Zola & Gott, 1992: 25
Eustrephus latifolius	Wombat Berry	Tuberous roots edible	Cribb & Cribb, 1974: 174
Exocarpus strictus	Dwarf Cherry	Fruits edible	Zola & Gott, 1992: 39
Burchardia umbellata	Milkmaids	Roots edible after cooking	Zola & Gott, 1992: 43
Caesia parviflora	Pale Grass-lily	Tubers edible	Zola & Gott, 1992: 44
Thysanotus tuberosus	Fringed Lily	Tubers edible	Zola & Gott, 1992: 44
Diuris sulphurea	Tiger Orchid	Tubers edible	Zola & Gott, 1992: 45
Exocarpus cupressiformis	Native Cherry	Fruits edible	Cribb & Cribb, 1974: 34
Angophora floribunda	Rough-barked Apple	Sap has medicinal properties	Lassak & McCarthy, 2001
Pterostylis spp.	Greenhood orchids	Tubers edible	Zola & Gott,1992: 46
Thelymitra spp.	Sun orchids	Tubers edible	Zola & Gott, 1992: 46
Geranium spp.	Native Geranium	Tubers edible	Zola & Gott, 1992: 47
Rubus parvifolius	Native raspberry	Fruits edible	Zola & Gott, 1992: 49
Billardiera scandens	Apple-berry	Fruits edible	Zola & Gott, 1992: 49

Botanical name	Common name	Potential Use(s)	Reference(s)
Astroloma humifusum	Cranberry heath	Fruits edible	Zola & Gott, 1992: 50
Centipeda cunninghamii	Common Sneezeweed	Plant can be soaked/boiled and resulting liquid used as a tonic for colds and chest complaints	Zola & Gott, 1992: 53
Amyema guadichaudii	Mistletoe	Fruits edible	Zola & Gott, 1992: 53
Themeda australis	Kangaroo Grass	Seeds edible (ground and baked as cakes); leaves and stems contain fibre that can be used to produce string	Zola & Gott, 1992: 58
Poa sp.	Tussock grass	Fibre from grass can be used to make string nets for nets, baskets and mats.	Zola & Gott, 1992: 58
Panicum effusum	Hairy panic grass	Seeds edible (ground and baked)	Issacs, 2002: 226

4.7 European Settlement

Formal European settlement of the greater Kurri Kurri area can be traced to the first half of the 19th century, with John Howe's pioneering expeditions to the Hunter Valley in 1819 and 1820 prompting the construction of the Great North Road (1826-1836) and opening up the Swamp and Wallis Creek valleys for free settlement (Pike et al., 1994). With the access afforded by the Great North Road and Hunter River at nearby Maitland, the 1820s and 30s saw numerous land grants made and taken up in the greater Kurri Kurri area. The earliest of these grants, dated 21 February 1821, was made to one Benjamin Blackburn. Blackburn was granted a 400 acre parcel of land on the banks of Wallis Creek at Richmond Vale. To the northwest of Blackburn's grant, around present day Kurri Kurri, available historic records (including parish maps) indicate that for most, if not all, of the 19th century, land within the Project area comprised part of properties granted to, or purchased by, the following individuals:

- Seth Hawker (50 acres), convict and Sydney saw pit owner;
- Emanuel Hungerford (2,000 acres, 'Lochdon'), Captain in the South Cork Militia;
- Samuel Clift (1,280 acres in two 640 acre lots), grazier;
- Edward D. Day (1,165 acres), police magistrate at Maitland;
- John Callaghan (1,280 acres, in two 640 acre lots), servant of Captain Hungerford;
- Isabella Barbara Campbell[5] (1,280 acres), wife of surveyor Peter Grant Ogilvie; and
- D.Meffan (50 acres), profession and background unknown.

As shown on **Figure 13**, portions of the Project area were also originally reserved as Village Reserve (V.R.) and Travelling Stock Route (T.S.R. 37). Regarding the use(s) of the land owned by the above-named individuals, available historic reference materials suggest an emphasis on beef cattle rearing / grazing, which appears to have comprised the surrounding district's dominant industry until the development of the South Maitland Coalfields in the early 1900s. Unlike areas further to the west, local soils were reportedly unfavourable for crop farming (i.e., principally wheat, but also maize, potatoes and tobacco) (Pike et al., 1994: 6).

The full potential of the South Maitland Coalfields was not realised until Professor T. W. Edgeworth David's detailed survey of 1886. David's discovery of the Greta Coal Measures prompted the then Department of Mines to reserve almost 12,000 hectares of land for coal mining purposes. By 1907, the year in which David's survey report was made public, ten collieries were operating or under development on the South Maitland Coalfields (Pike et al., 1994: 7). Prominent early mines around Kurri Kurri included the Heddon Greta (1900), Stanford Methyr (1900), Pelaw Main (1901) and Hebburn No. 1 (1902) collieries. These were easily sunk tunnel or incline mines. As mining of the seam became increasingly difficult, the 1910s and 20s saw a second generation of predominantly

[5] Note that Isabella Campbell's grant is listed on available parish maps under her trustees' names: C.J and D. Campbell.

deep, high-cost shaft mines commence operation. Alongside the 1st generation collieries, these second generation collieries were served by an extensive network of privately-owned railway lines, known collectively as the South Maitland Railway. Within the current Project area, this historically significant rail system is represented by the Aberdare Railway, which traverses the eastern third of the Project area in a general north-south direction. Constructed between 1901 and 1904, the Aberdare Railway was opened in stages, with the section between Aberdare Junction and Weston completed in 1902, and the remaining section to Cessnock completed in 1904.

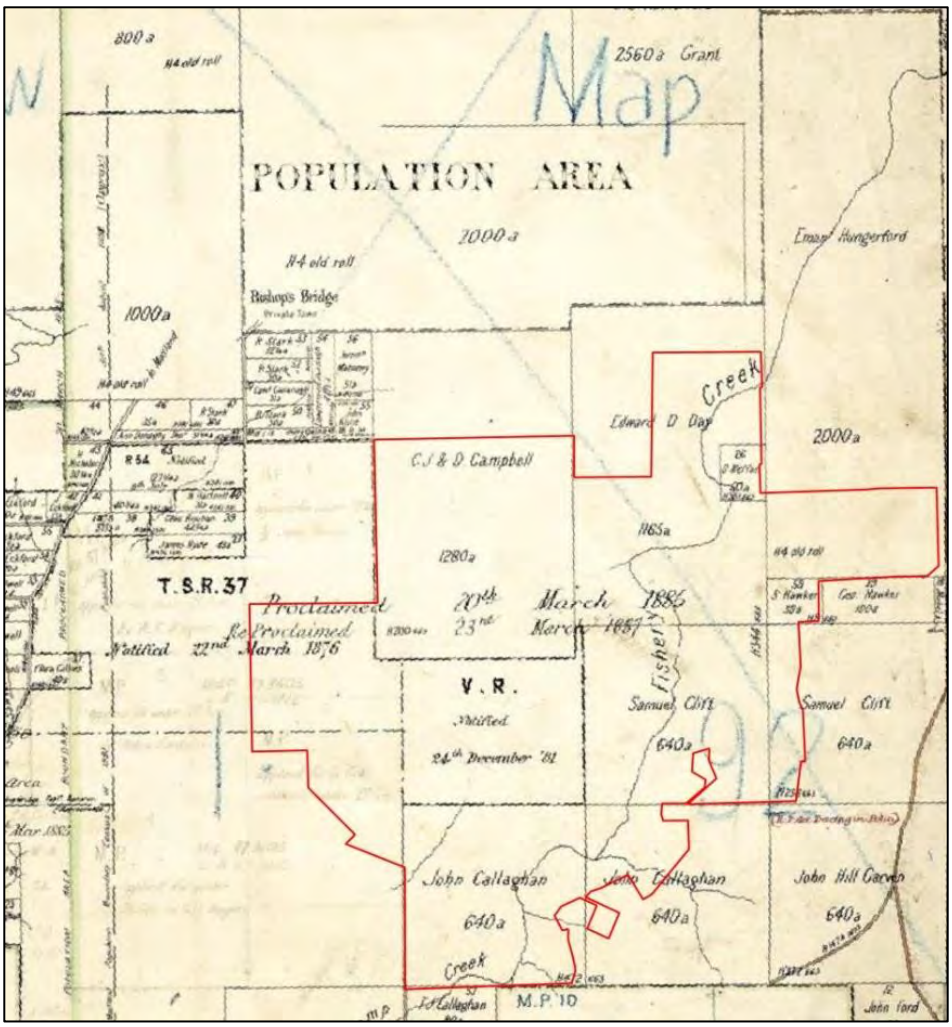

Figure 13 Georeferenced excerpt of 1885 Parish map for the Parish of Heddon (County of Northumberland) with Project area boundary overlaid.

The growth of the coal mining industry resulted in a marked increase in the population of the greater Kurri Kurri area. By the early 1900s, the small villages that had been established around the major collieries like Stanford Methyr and Pelaw Main were no longer able to adequately accommodate the increasing number of workers and their families. Consequently, in 1902, a proposal for the establishment of the town of Kurri Kurri was approved by the Executive Council (Smith, 1979: 4). Land sales commenced the following year and the town of Kurri Kurri grew rapidly. The Kurri Kurri electoral roll of 1903 recorded a population of 1,200 persons, and by February of 1904, the town was being supplied with water (Smith, 1979: 5).

The coal mining industry continued to act as the 'economic base' of the Kurri Kurri area until the 1950s, at which time a large number of collieries began to close due to deepening seams, difficult ground conditions and a general reduction in coal markets. Given that the economy of the area had been largely dependent on the success of the coal mining industry, its decline had a devastating impact on the local economy. Widespread unemployment prompted many locals to move away from the area to pursue work elsewhere, resulting in a decline in the local population. At the same time, demand for local goods and services reduced, small business began to fail, real estate prices dropped and both private and public incomes were reduced (James B. Croft & Associates, 1980: 31).

It was in this depressed economic climate that Alcan Australia Limited (Alcan) made its decision in 1965 to build an aluminium smelter at Kurri Kurri. Establishment at Kurri Kurri was part of a State Government initiative to restore economic stability to the area (James B. Croft & Associates, 1980: 31). Construction works began less than two years later, with metal production commencing in 1969. An initial capacity of less than 25,000 tonnes of aluminium per annum was raised, through two expansion projects, to 150,000 tonnes per annum by 1985, with an associated workforce at this time of around 900 employees (Alcan Australia Limited, 1988: 2). Under Alcan's ownership, approximately half of the aluminium metal from the Kurri Kurri smelter was sent to the company's fabrication plants in Sydney, Melbourne and Brisbane, with the remaining half exported to Japan, Southeast Asia and the USA (Alcan Australia Limited, 1988: 3). In mid-2000, the Kurri Kurri smelter was acquired by the German company VAW Aluminium AG, with the current owner - Norsk Hydro ASA - assuming ownership in 2002.

Alongside the production activities of the Kurri Kurri smelter, recent decades have seen land within the Project area used for a variety of purposes including recreational activities (e.g., Loxford Park Speedway), cattle rearing / grazing, dairying, horse rearing / training / grazing, hobby farming, turf cutting, rural residential development, environmental conservation and public/private transportation (e.g., the Hunter Expressway). The 'Wangara' property, which makes up a significant portion of the buffer zone surrounding the smelter complex, is currently agisted by Hydro for the grazing of cattle. Under Hydro's ownership, Wentworth Swamp and areas of regenerating native vegetation within the buffer land have been fenced to exclude livestock and are monitored annually as part of Hydro's annual environmental management program.

4.8 Land Disturbance

Together with available literary records, historical aerial photographs for the Project area provide a framework for assessing the nature and extent of past ground disturbances within it. Examination of aerials from 1952 (**Figure 14**), 1961, 1975, 1980 (**Figure 15**), 1984, 1998 (**Figure 16**) and 2013, for example, indicate a range of land use activities and associated ground surface impacts across the site. These include:

- Extensive native vegetation clearance;
- The construction and expansion of the Kurri Kurri aluminium smelter;
- Pastoral activities including livestock grazing, fencing, the construction of multiple farm dams and the construction of contour banks for erosion control;
- Hobby farming & ploughing;
- The construction of recreational sporting fields and race tracks;
- The construction of residential dwellings and associated structures and driveways;
- Fluvial erosion activity, particularly along creeklines and on cleared hillslopes; and
- The construction of essential services including power lines and roads (e.g., the Hunter Expressway);

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 assessment include:

- The likely destruction, in areas of grossly modified terrain, of any pre-existing sites and deposit(s);
- The disturbance of pre-existing archaeological deposits through both direct (e.g., ploughing, bulldozing) and indirect (e.g., erosion) means, resulting in a loss of archaeological integrity;
- The likely removal of any culturally scarred trees that once existed within the Project area; and
- An increase, in areas affected by erosion, of archaeological site visibility.

Figure 17 comprises a land disturbance map for the Project area. Two basic levels of disturbance are recognised: minimal to moderate and high. Areas of highly disturbed terrain within the Project area are unlikely to retain evidence of past Aboriginal occupation in surface and subsurface contexts owing the severity of past ground surface disturbances that have occurred within them.

Figure 14 1952 aerial photograph of the Project area and environs (Source: Land & Property Information NSW)

Figure 15 1980 aerial photograph of the Project area and environs (Source: Land & Property Information NSW)

Figure 16 1998 aerial photograph of the Project area and environs (Source: Land & Property Information NSW)

4.9 Key Observations

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

- Prior to European settlement, the floral and faunal resources of the Project area will have been sufficient to facilitate intensive and/or repeated occupation by Aboriginal people;
- Wentworth Swamp, Swamp Creek and Black Waterholes Creek will have been focal resource features for Aboriginal people camping within and passing through the Project area;
- Elevated, low gradient land surfaces in the vicinity of Wentworth Swamp and higher order watercourses are likely to have been favoured for sustained/intensive occupation;
- The Project area is located at the western extremity of what is known as the Hunter 'Delta', a term first used by David and Etheridge (1890) to describe the broad expanse of floodplains, swamps and channels extending some 35 km inland from the coast at Newcastle. More recently, this same region has been described by Chappell (1993) as a coastal or fluvio-deltaic lowland, the boundaries of which correspond to those portions of bedrock palaeovalleys occupied by Pleistocene and Holocene estuaries now infilled with fluvial, estuarine and coastal-marine sediments of various ages;
- Today, Wentworth Swamp comprises a freshwater wetland. However, prior to the construction to the Wallis Creek Floodgates and implementation of other Lower Hunter Valley Flood Mitigation Scheme measures, the swamp will have consisted of an estuarine environment subject to the daily tidal cycle of the Pacific Ocean, albeit one characterised by a complex mosaic of brackish and freshwater micro-environments;
- Outcrops and/or deposits of stone suitable for the production of flaked stone artefacts may be present within the Project area. However, none have been previously identified;
- Outside of the Project area, gravel deposits associated with the nearby Hunter River have been identified as a regionally significant source of lithic raw materials for flaked and edge-ground stone tool manufacture;

- If present, outcropping sandstone within the Project area has the potential to exhibit grooves associated with the sharpening of stone hatchet-heads and/or wooden spears. Grinding groove sites, if present, are most likely to occur along drainage lines;
- Aeolian sand deposits similar to those identified along the western side of Chinamans Hollow Creek to the southwest of the Project area may be present within the current Project area, with the valley housing Black Waterholes Creek, in particular, retaining the highest potential for such features; and
- Native vegetation within the Project area has been extensively modified as a result of European land use practices. Nonetheless, existing areas of regenerating native vegetation retain some, albeit limited, potential for mature trees with cultural scarring. Scattered mature paddock trees may likewise exhibit cultural scars.