# Extension of Warkworth Coal Mine

environmental impact statement


# PART E

## Aboriginal Heritage Study

by Australian Museum Business Services

# Extension of Warkworth Coal Mine
# Archaeological Assessment of Aboriginal Heritage

## Report to Coal & Allied

Report

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## Acknowledgments

AMBS would like to thank the following people who provided advice and assistance in the preparation of this report:

Victor Perry and Tracey Skene, representing the Upper Hunter Wonnarua Council, who participated in the survey and test excavations and provided comments on impacts and site management issues.

Barry French and John Matthews (both members of the Wanaruah Local Aboriginal Land Council), who were also employed by the Upper Hunter Wonnarua Council to be involved in the field survey.

Barry Anderson and John Waters, representing the Lower Wonnarua Tribal Council, who were involved in the test excavations.

Wanaruah Local Aboriginal Land Council representative Rodney Matthews, who participated in the test excavation.

Luke Hickey, representing the Wonnarua Nation Aboriginal Corporation, who participated in the test excavations and provided advice on the significance and recommendations for the study area.

Tanya Koeneman, Aboriginal Heritage Officer, and Margrit Koettig, Archaeologist, from the National Parks and Wildlife Service, who were available to discuss any issues as they arose.

Mick Lovely, Dianne Markham, Jenny Eldridge and Leah Watson of Coal & Allied, who provided information regarding the proposed development and joined us in field survey and test excavations.

## Summary

Coal & Allied propose to extend mining operations in their Warkworth Mine Lease, west of the current development consent boundary. An archaeological investigation was undertaken by the Australian Museum Business Services (AMBS) to locate archaeological sites and assess the impacts of extending mining operations in this area. The present assessment contributes to the Environmental Impact Statement (EIS) for the extension of current mining operations into this area.

The study was undertaken in conjunction with Dr Philip Hughes of Huonbrook Environment and Heritage Pty Ltd.

The project commenced in October 2001 and at that stage Coal & Allied had an existing relationship with the Upper Hunter Wonnarua Council (UHWC) and Wonnarua Nation Aboriginal Corporation (WNAC), which were identified as appropriate Aboriginal community organisations to be consulted. The UHWC conducted survey of the study area in November 2001, with members from other groups being employed by the UHWC. Following completion of the survey, the Lower Wonnarua Tribal Council (LWTC) sent a letter to the National Parks and Wildlife Service (NPWS) wanting to be acknowledged as an independent Aboriginal community group to be consulted on Aboriginal heritage issues in this area, as did the Wanaruah Local Aboriginal Land Council (WLALC). As a result, Coal & Allied discussed with NPWS the necessary steps required to complete the cultural heritage assessment. NPWS stated that any further work required as part of this project should invite participation of the four local Aboriginal groups. As a result, the subsequent test excavation involved members from all four groups. Following completion of the test excavation, a cultural heritage assessment report was prepared by UHWC and endorsed by WNAC. This report was forwarded to LWTC and WLALC for comment and responses have been made by these two groups.

Archaeological survey of this land identified over 100 Aboriginal sites, mostly stone artefact scatters and isolated finds. Two grinding groove sites also occur within the study area. In addition, one area (a sand sheet adjacent to Sandy Hollow Creek) was identified as warranting test excavation to allow for a comprehensive archaeological assessment. As the Warkworth western extension development application triggered the Integrated Development Assessment (IDA) process, test excavation was carried out as part of the impact assessment.

The results have indicated that there was extensive and varied use of the area. The highest artefact densities were associated with drainage lines suggesting more intensive use within these landforms. There was also a high density of surface artefacts on the sand sheet adjacent to Sandy Hollow Creek. Test excavations also revealed artefacts within the sand sheet, including a small number at depth. This indicates that the sand sheet may have been a favoured location or focus of activity throughout time.

The Upper Hunter Wonnarua Council cultural heritage assessment identified the cultural values as not only being Aboriginal sites, but also the physical landscape and the visual connections to the land. The hill top locations and the grinding groove sites were identified as being culturally significant. The landscape including the area

proposed to be mined has been identified as being important. The impact of the development on cultural heritage is significant within the proposed mining area, however the areas of greatest significance, including the hilltop locations and the southern grinding groove sites, have been avoided through modifications to the original mine plan. The recommendations made in the UHWC report have been included in the EIS.

The Lower Wonnarua Tribal Council and Wanaruah LALC oppose the destruction of any of the Aboriginal sites through the proposed mine extension. A response received from the LWTC expresses disapproval of the project commencing. The WLALC letter outlines their standard response opposing destruction of sites. Given the LWTC and WLALC responses do not provided specific recommendations or options for mitigation, Coal & Allied will continue to demonstrate due diligence and provide these groups with the opportunity to expand on their reasons for not wanting the project to go ahead on the basis of cultural heritage issues. If provided, these responses will be forwarded to PlanningNSW and NPWS.

In terms of archaeological significance, the majority of sites in the Warkworth West extension area were open artefact scatters which comprised low numbers of artefacts, and many in already disturbed contexts. These sites are generally of low archaeological significance. They do not have the potential to contribute appreciable additional information to that already obtained, during the survey stage and previous salvage work, to current research questions on antiquity, spatial patterning or inter-site variation.

There are a number of sites with higher numbers of artefacts. These were mostly found in the Landform Zones associated with the creeklines (Sandy Hollow Creek, Longford Creek and the unnamed tributary to Wollombi Brook). The sites along Sandy Hollow Creek, while being large and to some degree still having intact deposit with some research potential, are still assessed as currently having low archaeological significance, as this area has already been extensively salvaged and so much is already known about the stone artefact technology and use of this area. There is no evidence to suggest that further excavation and analysis of these stone artefacts would substantially add to existing knowledge about such sites or about Aboriginal activity in the past. The sites along Longford Creek conformed to what is known about Aboriginal sites along watercourses.

The grinding groove sites, PN10 on Longford Creek and Site M on the unnamed Wollombi Brook tributary, can be seen to have some archaeological significance, given they are a relatively rare (although not unexpected) site type. While such sites do not provide much research value, they can be seen to have social, educational and aesthetic values.

Sand sheets, however, may have some archaeological significance. Sand sheets are a relatively rare landscape feature. Test excavation of the sand sheet adjacent to Sandy Hollow Creek confirmed the presence of artefacts. The loss of this sand sheet through the proposed extension of mining may affect our ability to understand past occupation of this landform feature. Consequently, the sand sheet can be viewed as having moderate to high archaeological significance. It should be noted that other sand

sheets have been identified adjacent to the proposed mine extension area. Some of these sand sheets will be preserved as part of the proposed mine Offsets Strategy.

Extension of the mine west of the current development consent boundary will impact on the archaeological resource. There are a large number of Aboriginal sites that will be directly impacted by the extension of the mine. In addition, test excavation of the sand sheet has shown that it may hold older archaeological deposit (it appears that there are in situ artefacts in the lower $A_2$ horizon, probably of Holocene age). There are no options for conservation of this sand sheet as it is situated well within the proposed mine extension area. There are also a number of Aboriginal sites situated outside the mine extension area. While these will not be mined out, there is the risk that they could be affected by indirect impacts of mining operations.

A number of Landform Zones will also be completely removed or partially affected by the extension of mining into this area. The Landform Zones of Sandy Hollow Creek (Landform Zone 1), the adjacent sand sheet (Landform Zone 4), the Woodlands area (Landform Zone 7) and the undulating terrain both to the east and west of Sandy Hollow Creek (Landform Zones 8a and 8c) will be completely removed by mining. According to the proposed mine extension plan, the upper reaches of Longford Creek will be affected. This includes the axe grinding groove site at PN10. Other Landform Zones partially affected include the summit ridge (Landform Zone 6) and the unnamed tributary to Wollombi Brook (Landform Zone 3). The mine plan shows that the southern grinding grooves (Site M) are outside the impact area.

A number of recommendations have been made by UHWC and AMBS in relation to the proposed mine extension. These particularly relate to salvage in areas that will be impacted and active management of areas that will not be affected by the mine extension.

In New South Wales, items of Aboriginal heritage are protected under the *National Parks and Wildlife Act 1974*. Sites that will be impacted by the proposed mine extension will require section 90 consent under the National Parks and Wildlife Act 1974.

# Contents

## Figures



## Tables

# 1 Introduction

Coal & Allied propose to extend mining operations in their Warkworth Mine Lease. The company proposes to extend the mine area west of the current development consent boundary. This extension will impact on archaeological resources. An archaeological investigation of the area of proposed extension was undertaken by the Australian Museum Business Services (AMBS) in order to locate archaeological resources and assess the impacts of extending mining operations in this area. The present assessment will contribute to the Environmental Impact Statement (EIS) for extension of current mining operations into this area.

The study area comprises land bounded by the existing development consent boundary adjacent to the current western high wall to the east; Wallaby Scrub Road to the west; The Putty Road to the south; and Jerrys Plains Road to the north. The location and extent of the study area is shown on Figures 1, 2a and 2b.

Warkworth is located in the Upper Hunter Valley of New South Wales, approximately 12 km south west of Singleton. Warkworth Mine is an existing open cut coal mine. The Warkworth Mining Lease covers approximately 4,200 ha, extending between the Wollombi Brook in the west, Jerry's Plain Road in the north and The Putty Road in the south and east. Current mining operations occur mostly in the central part of the lease, moving west towards Wallaby Scrub Road, and are approaching the western boundary of the mine's existing development consent. It is expected that the mine will intersect existing approval boundaries by April 2003.

As a result, Coal & Allied is seeking to obtain approval for an extension to the mine by this date to allow continuity of the operation.

The mine extension involves extending two pits (known as the North and West Pits) to the west and one pit (Woodlands Pit) to the south. Wallaby Scrub Road is the western boundary of the extension of the North and West Pit. The Putty Road and the lease boundary will form the extent of the extension of the Woodlands Pit.

In addition to the mine extension, the proposal includes the construction of bridges, by-pass roads and overland conveyor and the ability to consolidate administration and maintenance facilities at both Warkworth and Mount Thorley at Warkworth.

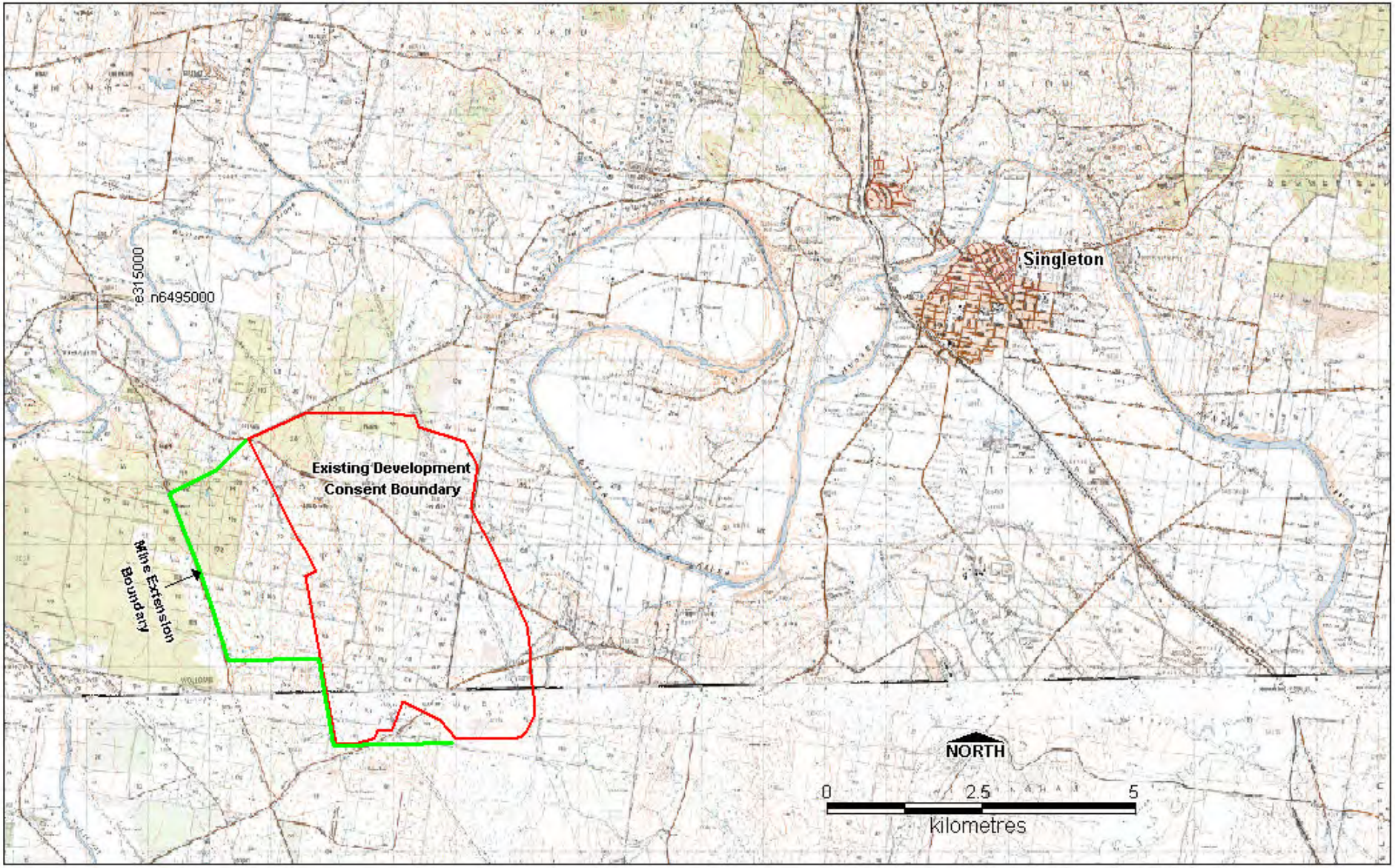


Figure 1. Location of the Study Area
(Based on Singleton 9132-IV-N and
Bulga 9132-IV-S 1:25k Topographic Maps)

AMBS

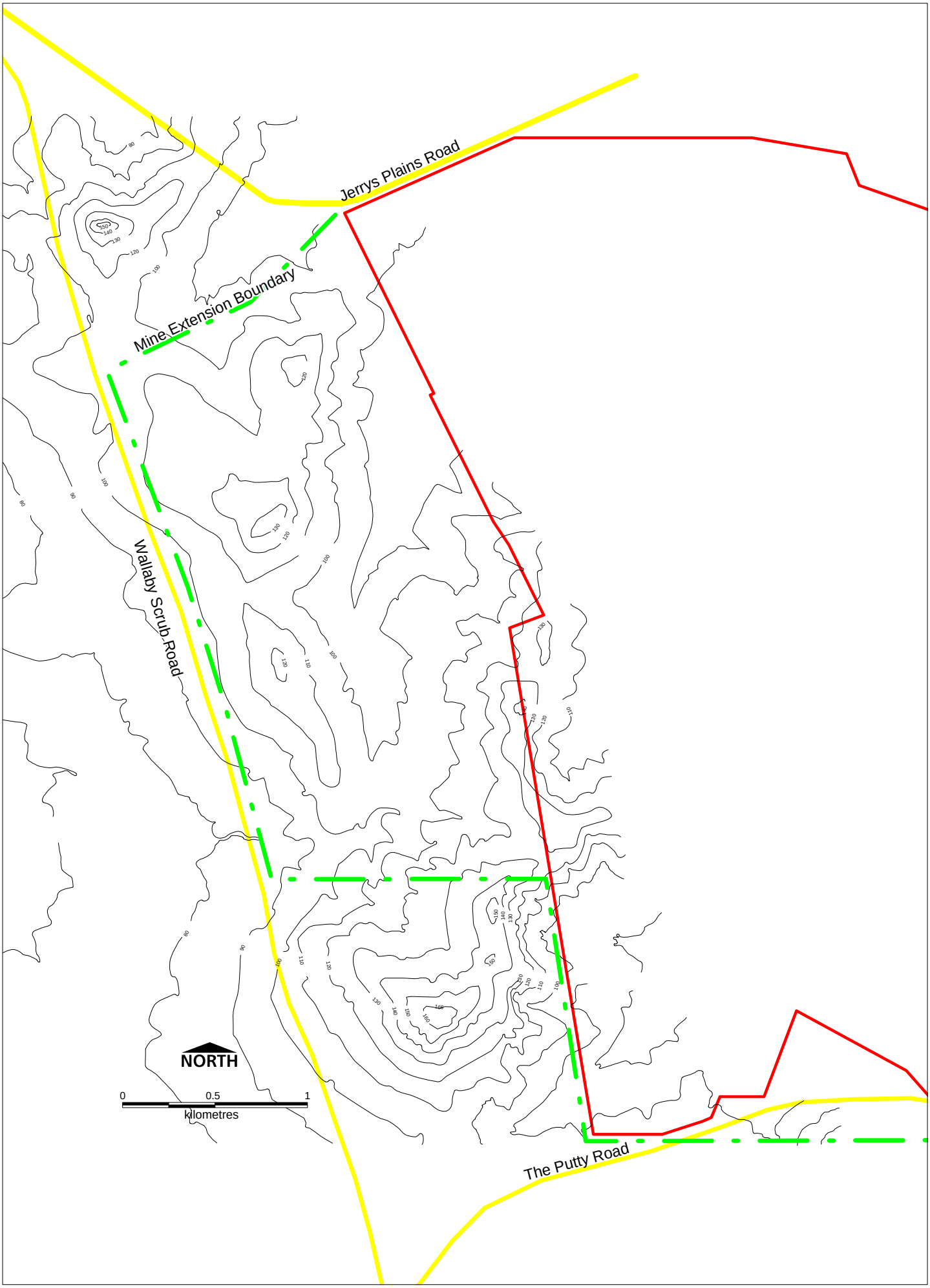


Figure 2a. Mine Development Boundary

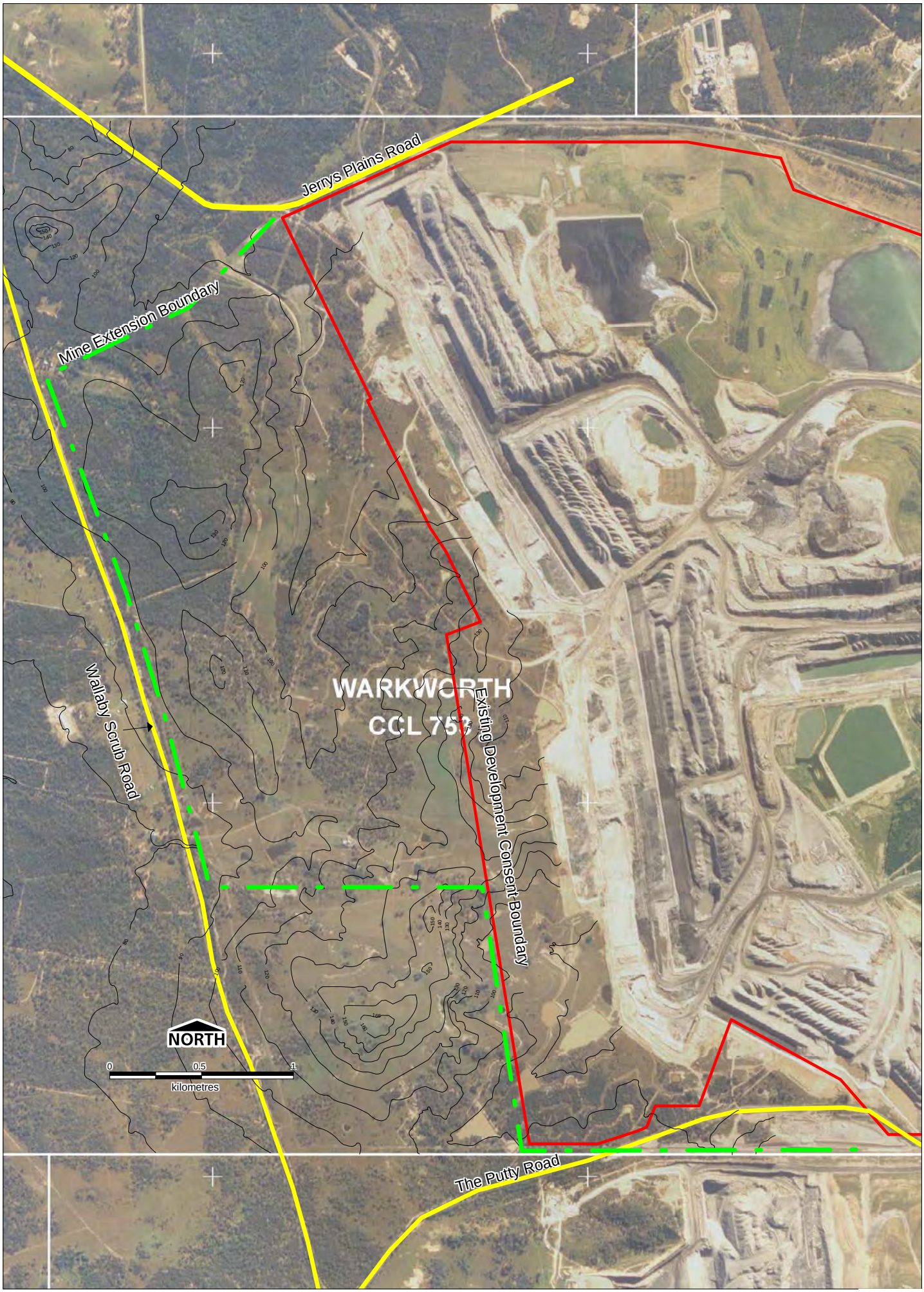


Figure 2b. Mine Development Boundary (1999 Aerial Photograph)

As part of the overall environmental impact assessment undertaken for the proposed mine extension, an archaeological and Aboriginal heritage assessment was required. During archaeological surface survey within the Warkworth western extension area, a number of Aboriginal archaeological sites were recorded and one area was identified as warranting test excavation in order to allow for an overall archaeological assessment for the EIS. As the Warkworth western extension development application triggers the Integrated Development Assessment (IDA) process, test excavation was required to be undertaken up-front. NPWS becomes an approval body in the IDA process when a development will impact on an Aboriginal object or declared Aboriginal Place, that is if a section 90 consent (i.e. Consent to Destroy issued by the Director-General of NPWS) is required. The basis of the IDA process involves applicants providing up-front the information required by the State agencies or approval bodies to determine if they will give the general terms of approval necessary for granting additional approvals.

This report details the results of this investigation and provides recommendations for management in accordance with the IDA process. The study was undertaken by Australian Museum Business Services archaeologists in conjunction with Dr Philip Hughes of Huonbrook Environment and Heritage Pty Ltd.

An associated Aboriginal Cultural Heritage Study was undertaken by the Upper Hunter Wonnarua Council (and endorsed by the Wonnarua Nation Aboriginal Corporation), whose members were involved in the surface survey as well as the test excavation component of this project. Following the surface survey, a number of other Aboriginal community groups expressed an interest in being involved in archaeological work in the Hunter Valley in general, and so participated in the subsequent test excavation and were given the opportunity to review and provide comment on the cultural heritage assessment. These additional groups included the Lower Wonnarua Tribal Council and the Wanaruah Local Aboriginal Land Council.

# 2 Description of Development Impact

The proposal involves extending the existing North and West Pits westwards and the southern pit (known as the Woodlands Pit) to the south. Wallaby Scrub Road will form the extent of the extension of the North and West Pit, while The Putty Road and the Lease boundary will form the extent of the extension of the Woodlands Pit.

The proposed mine extension boundary (refer to Figures 2a and 2b) was developed after consideration of a number of alternatives, including mining the entire area bounded by Putty Road, Jerrys Plains Road and Wallaby Scrub Road, other mine footprints and underground mining.

The proposed extension at Warkworth Mine will make efficient use of existing site facilities, minimising new infrastructure requirements and associated environmental impacts during construction. Therefore, the main impacts are associated with the actual mine footprint area (refer to Figures 2a and 2b).

Other impacts are the:

- construction of two new bridges over The Putty Road to allow for the heavy vehicle haulage of coal between Warkworth and Mount Thorley's Coal Preparation Plants, as well as the transfer of mining equipment between the mines;

- construction of a by-pass road adjacent to one of the bridges to allow for the relocation of heavy mining equipment, such as a dragline or shovel, that is unable to cross over one of the bridges;

- construction of a new overland conveyor between Warkworth and Mount Thorley's Operations and Mount Thorley Coal Lease, and

- upgrading of Warkworth Mine's administration and maintenance facilities to provide for the consolidation of Warkworth Mine and Mount Thorley facilities.

Extension of the mine west of the current development consent boundary will impact on the known and potential archaeological resource. There are a number of Aboriginal archaeological sites that will be directly impacted by the extension of the mine. In addition, test excavation of the sand sheet has shown that it may hold older archaeological deposit (it appears that there are *in situ* artefacts in the lower $A_2$ horizon, probably of Holocene age). There are no options for conservation of this sand sheet as it is situated well within the proposed mine extension area. There are also a number of sand sheets and Aboriginal sites situated outside the mine extension area. Through the course of this project, the original mine footprint was revised to avoid a number of the Aboriginal sites situated within the western extension area. Management strategies will be implemented to ensure that the risk of indirect impacts of mining operations is avoided.

Management recommendations have been made to address direct and potential indirect impacts of the proposed extension of mining operations at Warkworth Mine.

The mine design is influenced by the geology, recovery costs, out-of pit emplacement and rehabilitation requirements, ROM coal transport options, the capacity of the coal preparation plants and loading point, adjacent mine operations, road and utility locations and environmental factors relating to the final landform. In addition, the proposed mine extension boundary has been developed to avoid areas of high ecological/biodiversity as well as cultural heritage value identified in the Extension of the Warkworth Coal Mine Environmental Impact Statement and Species Impact Statement.

Mining will continue in a westerly direction from the existing development consent boundary. The western limit of mining, defined by Wallaby Scrub Road and the elevated ridges located on the southern and northern boundaries of the site, is due to be reached in year 18 of the mine plan.

# 3 Aims of the Study

The overall objective of this project was to determine whether the land subject to the development proposal contains Aboriginal sites ("Aboriginal objects" under the

*National Parks and Wildlife Act 1974*), therefore requiring section 90 consent under the Act and triggering the IDA process.

The study set out to achieve this through:

- consultation with the local Aboriginal community regarding Aboriginal sites;
- review of background documentation and previous archaeological assessments of the Warkworth mine;
- survey of the subject land to locate Aboriginal sites and recording the extent of the archaeological resource,
- assessment of the known Aboriginal sites;
- identifying areas of archaeological potential;
- test excavation to verify the location of Aboriginal sites. (Under IDA, test excavations are required to be undertaken before the DA is submitted);
- assessment of the site and determining whether the development proposal will impact on Aboriginal sites;
- preparing recommendations for management of the archaeological resource through assessment of Aboriginal sites based on archaeological significance assessment criteria;
- integrating the assessment of archaeological and Aboriginal heritage values to provide recommendations and management options;
- defining development constraints, identifying any conservation options, and identifying options for sites that will be impacted (e.g. salvage excavations, collection of artefacts); and
- liaison with the National Parks and Wildlife Service.

This study involved a detailed survey of the study area and subsequent subsurface testing of the sand sheet adjacent to Sandy Hollow Creek. The scope of the project was developed following meetings with NPWS. The surface survey employed a stratified sampling strategy and more intensive coverage than previous surveys of this part of the Warkworth Mine Lease. It focused on all landforms in order to provide a clearer picture of the distribution of sites and archaeological material across the landscape. The study also incorporated an investigation of the Warkworth West sand sheet. This investigation involved subsurface testing of the sand sheet to test the stratigraphic integrity of the deposit and its potential to contain pre-Bondaian, including Pleistocene material. Testing also provided information regarding use of the sand sheet. The results of the study provide an understanding of the archaeological sensitivity of particular landform units within the study area, enabling significance assessments of these units and sites within the study area.

# 4 Aboriginal Consultation

Consultation with the local Aboriginal community aimed to identify the cultural significance of the place and the impact that the development proposal would have on that cultural value. The Aboriginal community would also provide advice on appropriate management of the place with respect to its Aboriginal significance.

The cultural significance of a place is the cultural value that a place holds for the community, or for sections of the community. It may include the spiritual, social, aesthetic, historic or scientific value of the place for the present, past or future generations. According to the *NPW Act*, the criteria for establishing whether a place has Aboriginal significance for the purposes of declaring it an Aboriginal Place, is that it "is or was of special significance with respect to Aboriginal culture". Further assessment criteria are included in the *National Parks and Wildlife (Aboriginal Ownership) Amendment Act, 1996*, which recognises that "the land is of cultural significance to Aboriginals if the lands are significant in terms of the traditions, observances, customs, beliefs or the history of the Aboriginal people of the area".

Coal & Allied, as the applicant, has taken the lead role in consultation with the local Aboriginal community. The applicant contacted and arranged for the participation of the local Aboriginal community groups for both the surface survey and test excavation stages of this project.

The Aboriginal community in the Warkworth region is currently represented by four groups. Three of these are Traditional Owner / Native Title Claimant groups. The four groups are the:

- Upper Hunter Wonnarua Council (UHWC);
- Lower Wonnarua Tribal Council (LWTC);
- Wonnarua Nation Aboriginal Corporation (WNAC); and
- Wanaruah Local Aboriginal Land Council (WLALC).

While the proponent, Coal & Allied, took the lead role in Aboriginal consultation, AMBS worked with these groups throughout the project, through telephone conversations and representatives participating in fieldwork. All groups were consulted with regard to significance assessment and management recommendations.

At the time of the surface survey, in November 2001, the Aboriginal community was represented by the Upper Hunter Wonnarua Council. UHWC representatives Victor Perry and Tracey Skene were involved throughout the surface survey. Barry French and John Matthews were also employed by the UHWC for the survey fieldwork (it should be noted that while both are members of the WLALC, they did not represent the Land Council during this project). At that time, AMBS had been advised that Victor Perry also represented the interests of the Wonnarua Nation Aboriginal Corporation.

Following the survey, Coal & Allied and AMBS were advised by NPWS that the three other Aboriginal community groups were now active in the area and were to be consulted regarding the Warkworth proposal and invited to participate in the test

excavation stage of investigation and assessment. The work done to date and reasons for the test excavation were discussed with these groups.

All four local Aboriginal community groups were sent the research design for comment and input. Representatives from the Upper Hunter Wonnarua Council, Lower Wonnarua Tribal Council, Wonnarua Nation Aboriginal Corporation and Wanaruah Local Aboriginal Land Council were involved throughout the test excavation.

Comments were sought from each of the four groups on the Aboriginal significance of the Warkworth site and impact of the development proposal on the cultural heritage value. The cultural heritage assessment report prepared by the UHWC and endorsed by WNAC is attached in Appendix A. The statements on significance and impacts and the recommendations provided in the UHWC report have been incorporated into this report. Responses were invited from the two groups not directly involved in developing the cultural heritage assessment report, after being provided a complete copy of the archaeology and cultural heritage reports. The letters received from the LWTC and WLALC are also provided in Appendix A.

# 5 Environmental Setting and Survey Areas

## 5.1 Introduction

The survey area consists predominantly of gently undulating terrain formed on Permian sedimentary rocks of the Jerrys Plains Subgroup (Pswj). Parts of the western half of the area are draped with Cainozoic aeolian sand sheets (Czb) (shown on Figure 3). A high proportion of the area is drained by Sandy Hollow Creek, which flows to the north. The vegetation cover over much of the area is grassland (some of it improved pasture), either completely without trees or under very open Eucalyptus woodland. The remainder is covered with trees, ranging from open woodland to thick regrowth scrub.

In early November 2001, Hughes and Baker undertook a wide-ranging inspection of the Warkworth West area as part of the process of formulating a field survey strategy. On the basis of this reconnaissance, the study area was divided into a number of Landform Zones deemed likely to have different archaeological patterns. In the subsequent survey the study area was divided into a number of Survey Areas which equated with the Landform Zones defined during the reconnaissance. The larger Survey Areas were subdivided into two or more sub-areas. The location and extent of these Survey Areas (and Landform Zones) are shown in Figure 4.

Each Survey Area/Landform Zone was further subdivided into several smaller Survey Transects. The location and extent of the Survey Transects within each of the Landform Zones are shown in Figure 5 and described in detail in the table of characteristics of areas surveyed (refer to Table 4).

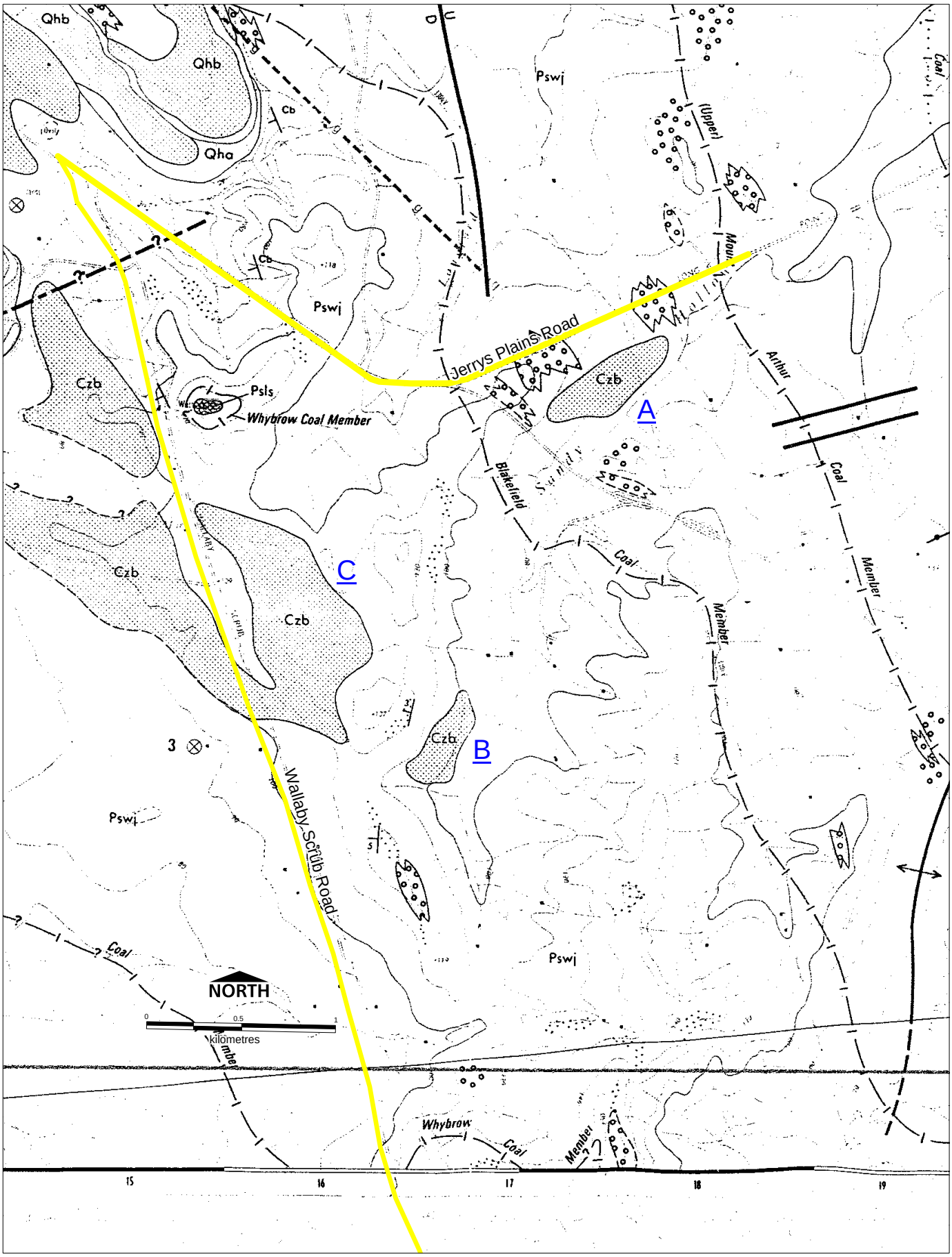


Figure 3. Geological map of teh study area, showing the mapped distribution of Cainozoic aeolian sands (Czb). The northern-most deposit (A) has been removed by mining. The excavations described in this report were undertaken in the southern deposit (B, Survey Area 4). The western deposit (C) occurred in Survey Area 8c. (Source: Geological Series Sheet 9132-IV-N, 1984).

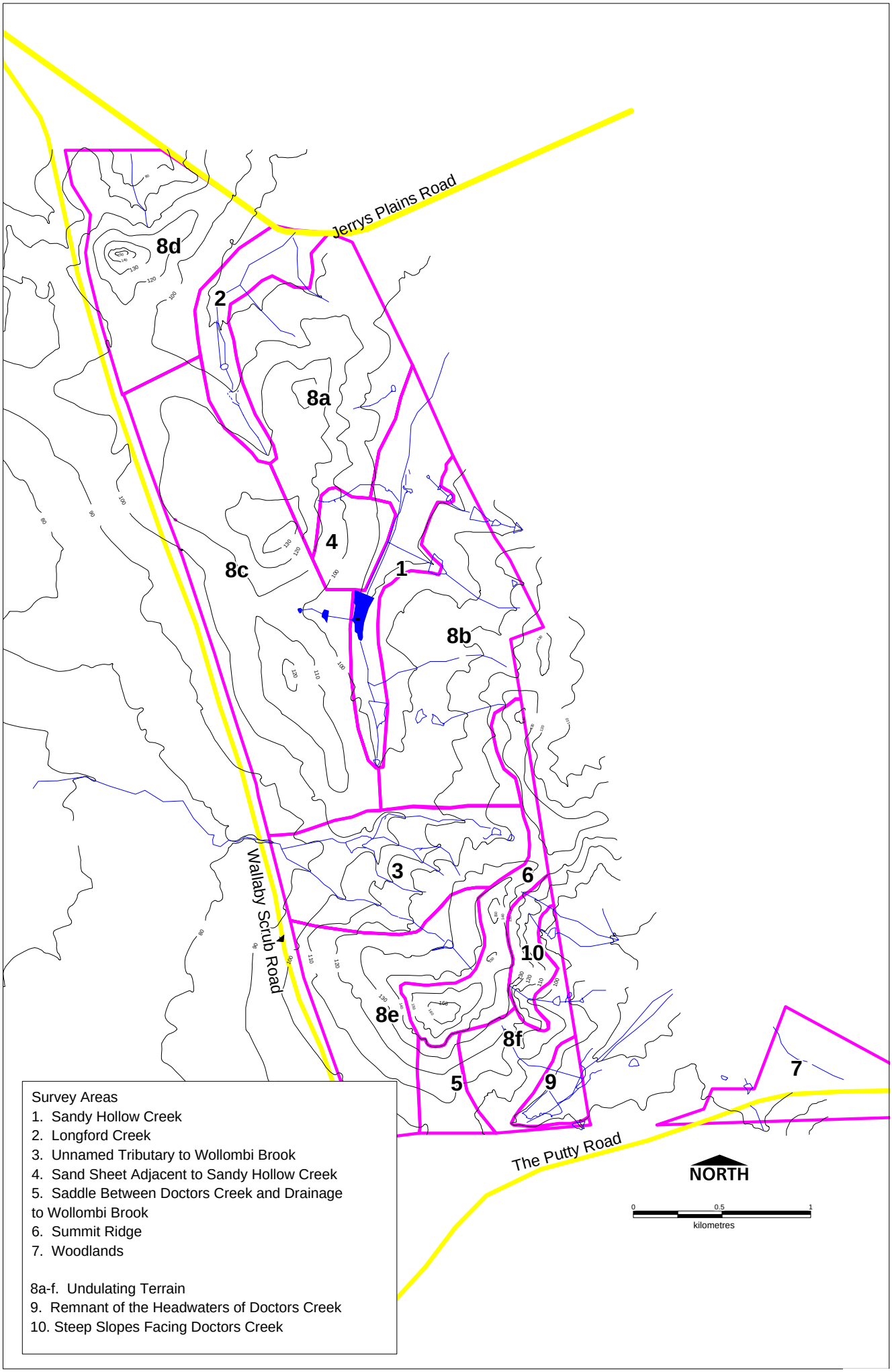


Figure 4. Survey Areas/Landform Zones

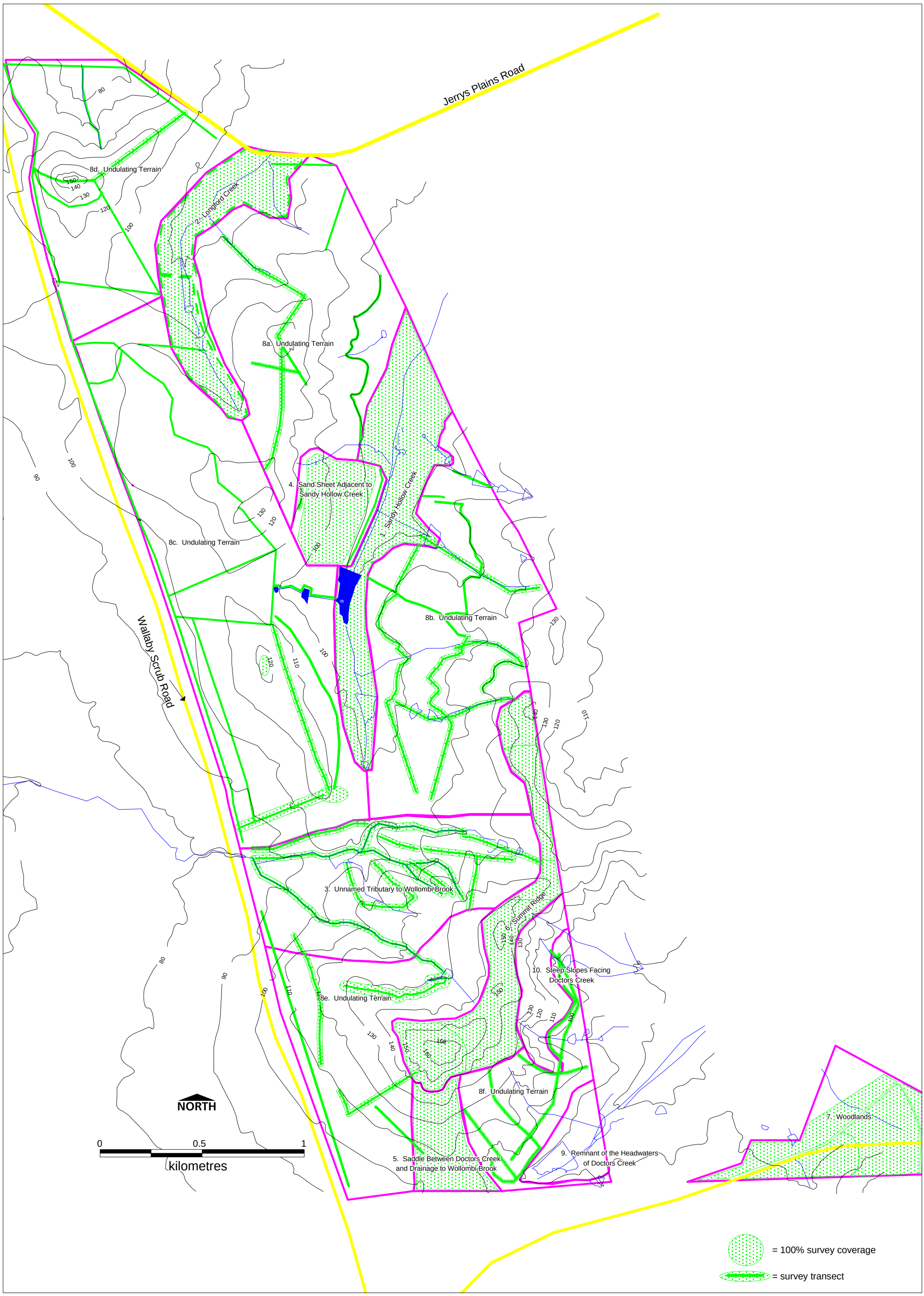


Figure 5. Survey Coverage Data

## 5.2 Survey Areas / Landform Zones

The physical characteristics of each of the eight Survey Areas/Landform Zones examined during the survey phase are described below. Two Landform Zones (9 and 10) identified during the reconnaissance phase were excluded from the survey phase. These two Landform Zones, and the reasons they were excluded, are described at the end of this section.

**Survey Area 1: Sandy Hollow Creek Valley**

*Landforms and geology*: Narrow valley floor of creek (20-50 m wide) and adjacent gentle footslopes for a distance of up to 100 m away from creekline. Includes small re-entrant valleys of tributary drainage lines joining the main creek. Valley filled with Quaternary colluvium and alluvium, the stratigraphy of which is very complex in the vicinity of Site W6 (see section 5.3.2 below). Creek channel incised discontinuously into the fill.

*Soils and vegetation*: The alluvial valley fill at the northern end of the survey area contained large amounts of sand (derived ultimately from aeolian sand) and had a complex stratigraphy, as described by Fahey (1994) (see below). Duplex soils have formed on colluvium on slopes immediately adjacent to the creekline. These had greyish fine sandy topsoils (Unit A) unconformably overlying weathered brown-red sandy clays and gravels, probably of Pleistocene age (Unit B). Most of the landscape was stable and well grassed or covered with regrowth woodland. Where the creek was incised, the banks tended to be eroded and there were extensive patches of bare ground, providing localised excellent 'archaeological visibility'. In a few places away from the creek channel there were similar extensive patches of eroded bare ground (e.g. where Site W11 was located).

**Survey Area 2: Longford Creek Valley**

*Landforms and geology*: Similar to but smaller than Sandy Hollow Creek. Narrow valley floor of creek (20-40 m wide) and adjacent gentle footslopes for a distance of up to 50 m away from creekline. Included small re-entrant valleys of tributary drainage lines joining the main creek. Valley filled with Quaternary colluvium, not alluvium. The main creek channel and several of the tributaries were deeply incised into the valley fill to form a network of vertical sided gullies.

*Soils and vegetation*: Classic duplex soils sequence with greyish fine sandy topsoils (Unit A) unconformably overlying weathered brown-red sandy clays and gravels, probably of Pleistocene age (Unit B). In many places the Unit A material was between 150 mm and 300 mm thick. Where the creek is incised, banks tend to be eroded and there were extensive patches of bare ground, providing localised excellent 'archaeological visibility'. Most of the area was covered with thick regrowth Eucalyptus woodland and scrub.

**Survey Area 3: Headwaters of Unnamed Tributary to Wollombi Brook**

*Landforms and geology*: Four headwater tributary creeks and associated minor tributaries forming a very broad undulating valley floor with adjacent gentle footslopes. Along the southern most and largest tributary creek quartzose sandstone cropped out extensively and in one area this contained a complex of axe grinding grooves. Where the tributary creeks merge just east of the Wallaby Scrub Road the valley was filled with Quaternary alluvium to a depth of at least 3 m.

*Soil and vegetation*: Very little exposure on hillslopes, but good exposures along creeklines where duplex soils with well developed Unit A/Unit B sequences occurred. On the hillslopes the soils were generally shallow (<200 mm) and sandy and stony. Most of the area was covered with grassland with small localised groves of regrowth Eucalyptus.

**Survey Area 4: Sand Sheet Adjacent to Sandy Hollow Creek**

*Landforms and geology*: A small sand sheet about 500 m long north-south by 200 m wide east-west on the western side and immediately adjacent to the channel of the creek (B on Figure 3). This sand sheet is described and discussed in greater detail below in the light of the results of the test excavations.

This sand sheet is the easternmost extension of a line of discontinuous sand sheets that extend west to northwest to Wollombi Brook about 3.5 km away (refer to Figure 3).

*Soils and vegetation:* The top 0.5-1.5 m of the sand sheet was loose to weakly friable. The 'topsoil' consisted of homogenous slightly organic sand up to 200 mm thick, and probably represents the ploughed zone, although the area has not been ploughed in at least the last eight years. The vegetation cover was improved grass pasture, with one small grove of large Eucalyptus trees. The loose sand unconformably overlay deeply weathered, mottled and cemented sandy clay.

**Survey Area 5: Saddle between Doctors Creek and Drainage to Wollombi Brook**

*Landforms and geology*: Broad saddle, the lowest point of which is at the southern edge of the Mining Lease. Steep, sometimes rocky upper slopes and gentle footslopes. Formed on Jerrys Plain Subgroup sandstones and siltstones.

*Soils and vegetation*: Little exposure, but appeared to be thin, poorly developed duplex soils formed on weathered bedrock, with some colluvium on higher slopes. Grassland.

**Survey Area 6: Summit Ridge**

*Landforms and geology*: Long, undulating ridge crest forming drainage divide between Wollombi Brook to the west and Hunter River to the northeast. Between 50 m and 200 m wide, with large areas of the crest flat to very gently sloping. Formed on sandstones and conglomerates of the Jerrys Plains Subgroup (Pswj). The southern-most flat topped knoll which forms the highest part of the ridge was capped with up to 300 mm of grey-brown loose to slightly compact windblown sand similar to the character of the aeolian sand deposits described for Survey Areas 4 and 8.

*Soils and vegetation*: Mainly thin, sandy and stony soils formed on weathered sandstone. Bedrock crops out on several of the knolls. Mostly grassland, but patches of open Eucalyptus woodland on the rocky knolls.

**Survey Area 7: Woodlands**

*Landforms and geology*: A narrow area of gently sloping terrain in the southeastern corner of the study area. Gently undulating hillslopes rising from Doctors Creek in the north towards a ridge crest which lies south of the lease boundary. Formed on siltstones, sandstones and conglomerates of the Jerrys Plains Subgroup (Pswj).

*Soils and vegetation*: Mainly thin, poorly developed stony duplex soils with skeletal soils on the upper slopes. Mainly regrowth scrub and woodland.

**Survey Area 8: Undulating Terrain**

*Landforms and geology*: This was the largest unit and consisted of gently undulating terrain with slopes of between $2^o$ and $10^o$ formed on rocks of the Jerrys Plain Subgroup. The slopes were mantled with weathered sandy and stony colluvium, the thickness of which increased downslope. This colluvium was capped with thin, sandy and usually mobile topsoils/sediments.

This Survey Area was further divided into a number of sub-units, on the basis of its location across the study area (i.e. where the undulating terrain is separated by other defined Survey Area/Landform Zones).

*Sub-Unit 8c:* This sub-unit, in the central western part of the surface area, had an extensive but patchy cover of loose windblown sand. An extensive Cainozoic sand sheet is mapped as occurring adjacent to the Wallaby Scrub Road in this area (C on Figure 3). Initially this mapped occurrence of sand was designated as a separate Landform Zone. However in the course of fieldwork it was found that this sand sheet was discontinuous, with large areas of the underlying bedrock and soils cropping out in areas mapped as being covered with sand. Conversely, extensive patches of loose sand up to 0.5 m thick were noted in areas to the north and south of the mapped occurrence of sand. The largest continuous extent of sand appeared to be in the vicinity of Site PN7 where a patch of loose white sand at least 0.5 m thick and covering more than 1 hectare had been cleared and planted out with a now abandoned grove of orange trees.

*Soil sand vegetation*: Both the soil and vegetation cover was highly variable. Duplex soils predominated, and these had discontinuous, thin (~100 mm) sandy topsoils overlying weathered clayey and stony subsoils. On the higher, steeper and sometimes rocky slopes formed on sandstone and conglomerate extensive areas of skeletal soils occur. Where windblown sand occurs, the topsoils were loose to slightly friable, slightly organic sands. The vegetation types encountered in each Survey Transect are described in Table 4. Briefly, there was a mosaic of types ranging from treeless grassland through very open woodland with a grass understorey to closed semi-mature woodland and forest to dense regrowth scrub. Most of the treed communities were dominated by Eucalyptus and (to a lesser extent) Casuarina species. On some of the patches of sand Callitris (native pine) predominated.

**Landform Zone 9: Remnant of the Headwaters of Doctors Creek**

*Landforms, geology and soils*: Moderately broad (about 50 m) valley floor of the creek and immediately adjacent footslopes. Valley filled with colluvium. Duplex soils formed on colluvium.

*Comment*: This was identified as a separate Zone during the reconnaissance phase. The creek had been surveyed previously by Haglund and Associates. At that time no sites were recorded in the section included in this study, however, several major sites recorded downstream to the east have since been destroyed by the mine operations. The valley floor has been extensively modified by major drainage control works (including two very large dams) and very little of the original ground surface and associated surficial deposits remain undisturbed. All such areas were examined during the reconnaissance inspection, but no artefacts were noted. Therefore there was no justification for further field investigation during the main survey phase.

**Landform Zone 10: Steep Slopes Facing Doctors Creek**

*Landforms, geology and soils*: Steep slopes (from >20$^{o}$ to near vertical) drained by several headwater tributaries of Doctors Creek. Formed in conglomeratic sandstone of the Jerrys Plain Subgroup. At the southern end there was a near vertical cliff about 100 m long in which several rock shelters have formed by cavernous weathering. Two of these shelters are large enough to have been potentially habitable. However, the floors consisted largely of bare rock with a patchy cover of thin, stony sediment (in conglomerate) that had been severely disturbed by animal scuffage (kangaroos and goats). These shelters have no excavation potential. On the steep slopes forming this Landform Zone, bare rock was exposed widely and elsewhere thin to skeletal soils formed on highly mobile sandy and gravelly colluvium occurred.

*Comment:* During the reconnaissance inspection all of the rock shelters were inspected for rock art, archaeological materials such as stone artefacts or potential archaeological deposits. None was found. None of these shelters have been recorded as sites previously, although it is likely that the archaeological teams undertaking previous work along Doctors Creek would have inspected them. This Zone was not inspected further during the main survey phase.

## 5.3 Review of Relevant Previous Geomorphological Investigations

### *5.3.1 The Sand Deposits on Warkworth West (Fahey 1994)*

Fahey (1994) undertook a geomorphological assessment of several archaeological sites along Sandy Hollow Creek in association with the archaeological investigations being undertaken by Haglund and Associates in 1993. The main aims of the study were to (a) provide an understanding of the geomorphological processes which may have affected the original distribution, and the subsequent redistribution of artefacts, (b) where possible, provide relative or absolute ages of the recent strata, and (c) provide some comment on the development of Sandy Hollow Creek and the local environment (Fahey 1994: 1).

Fahey (1994: 5-6) noted that two substantial sand rich deposits occur on the west flank of the valley. These are reported on the published geological sheet as aeolian dunes (A and B on Figure 3), however Fahey considered that there was evidence which indicates a substantial fluvial component to their formation. The northern-most deposit has since been destroyed by mining. A section cut through this northern deposit during mining showed that it was up to 20 m thick and filled a substantial palaeochannel cut into the Permian rocks. The top 3 m consisted of white, free flowing quartz sand which overlaid a thick layer of iron stained clayey sand, the sand fraction of which was also overwhelmingly quartz. Below the sand was a basal deposit of gravel several metres thick, the transition between the two indicating a rapid but not abrupt change in deposition. The rapid change from gravel to sand indicated a marked change in either provenance of the sediment or the depositional environment. He presented several scenarios, the most likely of which in the light of more recent evidence presented in this report is that a change in climate (he postulated to more arid conditions) resulted in aeolian sands derived from Wollombi Brook being blown over the intervening ridge and swamping the sedimentation within the Sandy Hollow catchment.

Although he did not study the southern sand sheet deposit specifically, he suggested it had a similar history.

### *5.3.2 Sedimentary History of the Alluvial Fill at Site W6 (Fahey 1994)*

Fahey (1994: 13-15, 21-39) mainly on the basis of a detailed stratigraphic record of the valley fill in the vicinity of Site W6 and associated thermoluminescent dates, reached the following conclusions:

1. Some areas of Sandy Hollow Creek have always been pre-disposed to scalding as a result of salinity associated with the sub-crop of coal seams. The latest episode of severe scalding occurred in the early to mid 20th century.

2. An episode of severe sheet erosion post-dated European settlement and disrupted the fluvial system of Sandy Hollow Creek by inundation with sediment. Severe

scalding and gullying post-dated this sheet erosion and gully erosion has cut through the deposited sediments and into earlier sediments.

3. During the Holocene, whether or not affected by scalding and gullying, the creek existed as a series of relatively shallow watercourses with chains of fresh water ponds in wet periods and saline seeps in drier times.

4. For at least the last 12,000 years this Sandy Hollow Creek fluvial system has been eroding older 'fluvially redeposited aeolian sand' deposit. This sand deposit has been superimposed on an earlier gravel dominated fluvial system and had filled the valley to a considerable degree.

5. The concentration of objects (such as artefacts and pebbles) near the base of the '$A_2$ horizon' is the result of a variety of processes including erosion/redeposition, bioturbation and pedogenic processes.

### *5.3.3 The Sand Dune at Cheshunt (Hughes and Shawcross 2001)*

In 2000 and 2001 archaeological and geomorphological investigations were undertaken at NPWS Site No. 37-5-166 on a sand dune adjacent to the Hunter River (Hughes and Shawcross 2001). The 3.6 m thick Cheshunt dune was located about 15 km to the northwest of Warkworth West. The surface layer (A horizon) consisted of soft sand, loamy sand and sandy loam 300 mm to 1,000 mm thick. This soft material unconformably overlaid a generally massive to blocky structured hard to very hard reddish clayey sand to sandy clay (B horizon) up to 600 mm thick. This in turn graded downwards into slightly weathered, friable to compact sand and clayey sand (C horizon), which is reddish at the top, but paler and yellowish at depth. A detailed description of the deposits is presented in the box below.

| | |
|---|---|
| $A_1$ horizon | Turf and humic topsoil, soft black to grey loamy sand to sandy loam. Usually about 100-150 mm thick but on the flank of the low spur up to 300 mm thick. Grades downwards over ~ 50 mm into: |
| $A_2$ horizon | Brown, reddish brown to brownish red soft sand to loamy sand 200 mm to 500 mm thick. Thickest on the flanks of the low spur. It is very weakly consistent and coherent with weak sub-angular blocky peds 20-100 mm in diameter with no cutans (i.e. clay skins coating the peds). A sharp, unconformable and generally undulating break to: |
| B horizon | Over most of the area a bright reddish brown slightly sticky clayey sand to sandy clay. It is very strongly consistent and coherent; moderately pedal with smooth-faced, dense, sub-angular blocky peds 50-100 mm, breaking to angular blocky peds 2-10 mm diameter, with many cutans and cracks <2 mm wide. In some areas the degree of pedogenesis is less pronounced and the material is less clayey and less coherent. Usually 250 mm to 600 mm thick. Grades down over 50 mm to 150 mm to: |
| C horizon | Sand with variable but small amounts of silt and clay. Highly variable in hardness, ranging from soft and friable (especially on the flanks of the dune) through compact (can be crushed by firm hand pressure) to very hard (can be crushed only with a hammer). Highly variable in colour; generally reddish below the B horizon, becoming paler and yellowish with depth, especially below about 1,300 mm to 1,500 mm. No visible sedimentary structures. Only slightly weathered and little mottling except where the sand rests on the underlying alluvial clay. |

High densities of stone artefacts (commonly more than 100/m$^2$) were recovered from throughout the soft A horizon sands, along with some European material. A few artefacts were found in the B horizon and a very small number (including one European object) in the C horizon. It was concluded that the A horizon sands had been completely disturbed by bioturbation (especially rabbits) and cultivation. The B horizon exhibited to varying degrees fissures (including desiccation cracks, tree root channels and insect burrows) extending down in cases into the underlying C horizon. Hughes and Shawcross (2001: 12) concluded the few artefacts in these horizons had moved down these fissures from the large reservoir of artefacts in the A horizon.

Hughes and Shawcross (2001: 11) concluded from the moderately intense degree of weathering/pedogenesis exhibited by the clay-rich pedal B horizon that the dune had formed during the late Pleistocene, not the Holocene. Subsequently two samples of quartz sand from the core of the dune were dated by OSL (optically stimulated luminescence) at the Australian National University. The upper sample, from 1.25 m below the surface dated to about 83,000 years ago and the lower sample, from 2.5 m below the surface, to about 88,000 years ago. This confirmed that the dune formed in the late Pleistocene before the human occupation of Australia, and that the artefacts in the core of the dune had been moved down the profile by bioturbation.

### *5.3.4 The Archaeological Potential of Duplex/Texture Contrast Soils*

Duplex/texture contrast soils occur widely across the Warkworth West survey area, but are especially well developed on the footslopes and valley fill of Sandy Hollow Creek where the largest archaeological sites occur. Throughout the Central Lowlands of the Hunter Valley well developed texture contrast soils occur along the footslopes and valley fills of creeklines and these commonly have archaeological sites with stone artefacts associated with them (see for example Hughes 1984). The degree of pedogenesis characteristic of these texture contrast soils can be equated with the 'high-contrast solum' stage of soil profile development described by Walker and Coventry (1976) for deposits which are Pleistocene in age. It is generally accepted that the alluvial or colluvial parent material for the B horizons of such soils must be at least 20,000 years old and can be very much older than this (see for example Erskine 1991, Dean-Jones and Mitchell 1993).

On texture contrast soils, with few exceptions stone artefacts have only been observed in the A horizon, and not in the B horizon. Part of the reason for this is that excavations are seldom extended down into the hard B horizon clays. Nevertheless, numerous excavations have been undertaken in these soils which have led to the recovery of many thousands of artefacts from the A horizon. In all but one case, where the excavations have been extended down into the B horizon either no artefacts have been found, or where the occasional artefact was recovered, it could be inferred reasonably that it have been originally derived from the A horizon by, for example, having fallen down a crack in the soil. The exception is the Pleistocene material recovered by Koettig (1986, 1987) from sites with duplex soils along Fal Brook.

Given the uncertainty concerning the pedogenic status of these soils some archaeologists have described them in sedimentological rather than pedological terms. Following the earlier work of Hughes (1981), Stern (1981) and Koettig and Hughes

(1985), Hughes has continued to divide the colluvial/alluvial deposits on which these texture contrast soils occur into two units. The Unit A is equivalent to the A soil horizon, and their Unit B equivalent to the B soil horizon. The description of a typical texture contrast or duplex soil is:

**Unit A** An upper grey to buff, sandy to silty unit, commonly containing gravel, generally less than 200 mm thick, and with very weakly developed soil profile. This unit can be equated with the 'cumulic' stage of soil development of Walker and Coventry (1976) and these deposits are generally modern to Holocene in age. This unit tends to be discontinuous, especially on hillslopes, and overlies Unit B, apparently unconformably.

**Unit B** A grey, brown to red clay and gravel-rich unit with evidence of deep weathering and with strongly differentiated soil horizons. The degree of pedogenesis characteristic of this unit can be equated with the 'high-contrast solum' stage of soil profile development described by Walker and Coventry (1976) for deposits which are Pleistocene in age.

Following on from the work of Mitchell and his colleagues on the origin of hillslope duplex soils in the Sydney Basin, Dean-Jones and Mitchell (1993: Section 4.1) consider that in the Hunter region duplex soils are the result of superposition of two unlike materials through the action of contemporary lateral movement of sediments down the slope. Fluvial hillslope processes create the discontinuity present between the A and B horizons which are in effect two distinct strata, which are time transgressive rather than genetic soil horizons.

Their research has demonstrated the importance of rainsplash (raindrop agitated surface flow) as the main sediment transport mechanism operating on slopes. However this alone is not enough to generate a texture contrast and such profiles only develop where slope transport combines with rapid rates of shallow bioturbation (especially by ants, termites and earthworms). Combined, these processes allow the winnowing of the fine fraction of the surface soil, which is then carried downslope as suspended sediment in the rainwash, thus effectively coarsening the A horizon relative to the B horizon (see also Humphreys and Mitchell 1983). These processes commonly lead to the formation of stone layers or lines between the A and B horizons, as stones larger than the diameters of the burrows of the bioturbating organisms 'sink' through the soil with time.

Dean-Jones and Mitchell (1993: Section 4.1.3) concluded that if the genesis model for duplex soils they outlined was accepted, the critical implications for archaeology were:

- Duplex soils (presumably especially the A horizons) do not necessarily indicate great age. 'Mature' texture contrast profiles can develop in a few centuries and they consider (1993: 76) that A horizon materials in duplex soils in the region are probably between 200 and 3,000 years old, rather than 20,000 to 30,000 years old.

- Open sites on duplex soils can never be truly stratified in a chronologically useful sense.

- Stone artefacts will behave in the same way as natural stones on a hillslope and will be subjected to surface dispersion, downslope movement and differential

burial or exposure by bioturbation. They may become incorporated into stone lines.

- Intact or relatively undisturbed hearths provide the best prospects for dating open sites in these contexts. All other dates, especially those based on detrital charcoal, are likely to be spurious.

### 5.3.5 Issues arising from the Review

Hughes generally supports the above interpretation of the genesis and age of the A horizon (i.e. Unit A) of the duplex soils and the implications for finding stratified sites in such soils. As discussed in the next section, it is unlikely that there has been widespread, severe denudation of hillslopes during the period people may have occupied the Hunter region, including during the height of the last glaciation. If episodes of major hillslope stripping occurred during the late Pleistocene, then they were probably before about 50,000 years ago. This is not to say that erosion and downslope movement of soil would not have been ongoing processes, influenced by climatic fluctuations as well as local factors such as high intensity rainfall events stripping soils from surfaces recently made bare by bushfires. However, the average rates of landscape lowering as a result of this ongoing erosion and transport would have been very slow.

The question arises, 'what archaeological signature may remain in these duplex soils?' Hughes considers that most if not all B horizon (i.e. Unit B) materials in these duplex soils have no or negligible archaeological potential, if only because of their inferred ancient age (i.e. pre-dating human occupation of the Hunter Valley). It is likely that from the beginning of occupation of the Hunter region artefacts would have been discarded on to A horizon soils essentially the same as those that occur today. Any stone artefacts of late Pleistocene to early Holocene age which were not completely transported from the slopes would have been left as a lag at or just above the junction between the A and B horizons. These would then have become incorporated in the basal levels of present A horizons, which are probably mid to late Holocene in age.

Dean-Jones and Mitchell (1993) argue that any stone artefacts contained in the evolving A horizons would have been dispersed vertically and laterally. A high degree of lateral dispersal is to be expected on steeper hillslopes, however in the Hunter Valley most sites are on gently inclined footslopes to flat terraces and benches where the lateral movement of artefacts would have been slight. Whatever degree of movement, Pleistocene assemblages are likely to have been affected more severely than Holocene assemblages by the cumulative effects of rainwash erosion and transport, and of bioturbation.

It follows that unless the A horizons are thick (at least 300 mm) and incorporate *in situ* older, dateable deposits in their basal levels, it will not be possible stratigraphically to distinguish older artefact assemblages from mid to late Holocene assemblages. In thin A horizons it is likely to be difficult to distinguish with certainty using artefact typology any early assemblages which might be present.

### 5.3.6 The Possible Age of Pre-European Landscape Instability Events

In discussing late Pleistocene geomorphic events in the Hunter region in relation to archaeology most researchers note that climatic conditions during the last glacial maximum between about 20,000 and 17,000 years ago would have been colder and drier than at present (see for example Sweller 2002). These colder and drier conditions may have been accompanied by wide spread landscape instability, reflected in the stripping of soils from hillslopes and major geomorphic events along stream valleys.

For example, Dean-Jones and Mitchell (1993: 31) discuss the presence at the base of gully sections throughout eastern Australia, including the Hunter region, of very coarse angular boulders and gravels as a basal layer of sediments over bedrock. They note that the geomorphic origin of these coarse deposits is not understood, but they state that it is possible that they represent a lag gravel surface from a previous extensive phase of erosion when it is conceivable that entire hillslopes were denuded. They acknowledge that the age of this hypothesised event is unknown, but state that a last glacial age of about 20,000 years is conceivable.

As discussed below, there probably was no widespread slope instability in the Hunter during the last glacial maximum. However, even if the basal gravels and boulders along these creeklines are of that age, changes in base level rather than climate might explain their occurrence. During the last glacial, when sea levels were as much as 130 m lower than at present, base levels along the Hunter River and its tributaries would have been lower and this would have triggered downcutting of the beds of streams such as Whites Creek at Mount Arthur North (as described in Dean-Jones and Mitchell 1993), even if only by a few metres. Any coarse gravels and boulders in the valley fills might have been concentrated as a lag over bedrock, to be covered with finer alluvium as base levels rose as a consequence of sea level rise.

It is simply not possible on present knowledge to determine the Pleistocene geomorphic history of the Hunter region in any detail at the regional level, nor with few exceptions at the local level.

In contrast, the geomorphic history of the lower Nepean River district near Sydney has been examined in much greater detail by Gerald Nanson and his colleagues (e.g. Nanson and Young 1988). Their investigations have yielded evidence of exceptional fluvial activity in lowland basins in southeastern coastal Australia well before the last glacial maximum. The most recent dating (as yet unpublished) indicates that this fluvial episode - the 'Cranebrook Pluvial' - commenced more than 100,000 years ago and may have been completed by 50,000 years ago. Nanson and Young (1988: 58) could find no alluvium that could be ascribed to the period of maximum glaciation (about 20,000 to 18,000 years BP).

Although not stated directly by these researchers, the implication is that any major stripping of unconsolidated hillslope deposits (including soils) to provide the massive amounts of sediment transported during this pluvial event must have occurred during or prior to the event, i.e. at least 50,000 years ago. Their conclusions are at odds with the proposal that the main period of alluvial deposition in coastal valleys in southeastern Australia was triggered by widespread slope instability during the last

glacial maximum. The data they presented suggests the glacial was a cool dry period of relatively little fluvial activity in basins not affected by glaciation.

Given their close proximity and similar environments, the Hunter Valley probably would have experienced similar climatic regimes through the late Pleistocene and Holocene as the lower Nepean region, with broadly similar geomorphic consequences. On balance, it would seem likely that the bulk of the gravel rich clayey sediments which form the creek valley alluvial/colluvial fills and the associated footslope colluvium (and which provided the parent material for the duplex soils B horizons) accumulated during this pluvial period before about 50,000 years ago. If so, the B horizon or Unit B material largely if not entirely predates human occupation of Australia.

It is commonly assumed that dune formation can only take place under arid conditions and therefore that the sand dunes and sand sheets in the Hunter Valley that comprise the Warkworth Land System (Galloway 1963, Story et al. 1963) are a signature of drier, more arid conditions than those that prevail today (Fahey 1994: 5-6). The Cheshunt dune, dated to about 88,000 years ago, formed during the fluvial episode described above, i.e. not at the glacial maximum. However, dune formation is also strongly influenced by, amongst other factors, abundant sediment supply, conditions that would have prevailed during the postulated pluvial period between 100,000 and 50,000 years ago when the Hunter River (and Wollombi Brook) would have been carrying vastly greater sediment loads than at present. Galloway (1963: 86, 97, 100) concluded that at various times of slope instability during the Quaternary when rivers had particularly wide, sandy beds, northwest winds piled up the sand dunes and sand sheets that comprise the Warkworth Land System along both Wollombi Brook and the Hunter River.

Foreshadowing the findings of the present study presented and discussed below, it is likely that the Sandy Hollow Creek sand sheets (derived from Wollombi Brook), also formed during this postulated pluvial period.

# 6 Archaeological Context

This section outlines the key archaeological issues in Hunter Valley archaeology, particularly relating to the immediate region and local level. This will provide the basis for defining the archaeological assessment and management context relevant to this study and the development of appropriate management options.

## 6.1 Archaeological Investigations in the Hunter Valley

Archaeological research has been conducted in the Upper Hunter Valley since the first half of the 20th Century (McCarthy and Davidson 1943, McCarthy 1943, Moore 1970, Moore 1981), initially by archaeologists from the Australian Museum (Fred McCarthy and David Moore). McCarthy and Moore located and collected artefact scatters adjacent to the Hunter River. The material occurred along the terrace and was particularly abundant at Gowrie (McCarthy and Davidson 1943). In the 1960s Moore carried out archaeological excavation of rock shelters at Sandy Hollow, Milbrodale and Bobadeen. An archaeological survey was undertaken by Moore from the

confluence of Wollombi Brook and the Hunter River, to Singleton (Moore 1970). Artefacts were found at the 200ft (60m) contour in eroded contexts, at several sites, particularly 'Gowrie terrace'.

From the late 1970s an increasing number of archaeological surveys and investigations have been carried out in the Hunter Valley for environmental impact studies and site management purposes. This has followed the introduction of the *Environmental Planning and Assessment Act 1979* (EPAA). The EPAA initiated pro-active archaeological survey and assessment, which tied in with the site protection and consent processes of the *National Parks and Wildlife Act 1974*. These studies differ in size and scale and are generally area specific, that is, concentrating on areas of land proposed for development, particularly areas proposed for coal mining.

Archaeological investigations for environmental impact assessment purposes were initially based largely on surface survey. In more recent times excavation has played a greater role, more so in mitigation of impacts through salvage than in assessment of sites. Both survey and excavations have revealed a rich archaeological record characterised by backed artefacts and the products from their manufacture in open archaeological deposits. Other implements such as portable grindstones and stone hatchet heads (axes) are present but are less common. The vast majority of sites are open archaeological deposits, with other site types such as grinding grooves and scarred trees also having been recorded.

## 6.2 Regional Issues

Archaeological interest has focused on stone technology, the chronology of Aboriginal occupation, and the distribution of Aboriginal sites within the landscape. Major technological studies have referenced Hiscock's important study of the Sandy Hollow rockshelter and sites on Mt Arthur North (Hiscock 1986). Hiscock distinguished between the technological systems employed from different levels of the Sandy Hollow rockshelter site excavated by Moore in the 1960s (Moore 1970). Hiscock's study attempted a chronological distinction between open sites through identification of technological features held in common with dated levels from the Sandy Hollow excavation. Hiscock's primary purpose in the study was as a response to the intensification debate in Australian archaeology in the 1980s and later studies have questioned the efficacy of Hiscock's methods (Baker 1992) or of technological attribute analysis in general (Koettig 1994).

Aboriginal site excavations have become more prolific in the Central Lowlands since the early 1990s when archaeological inquiry advanced beyond discovering the range of artefacts at sites and general location of archaeological evidence. The discovery of high spatial integrity of archaeological evidence in some areas led to an increasing interest in "intra-site" spatial patterning (Koettig 1994). There is a general trend of moving away from technological description to addressing prehistoric settlement patterns and other behavioural aspects (Baker 1992, Kuskie and Kamminga 2000).

This study focuses on two current issues: 1) settlement patterns as reflected in differential use of landform units within the study area, and 2) antiquity of occupation via the identification of open sites with stratified deposit.

### 6.2.1 Models of Aboriginal Land Use

One of the aims of this study is to attempt to define the nature of occupation over the local landscape. As a consequence, the nature of assemblage sampling has focused upon 'landform units' rather than particular 'sites' as is traditional in most archaeological consulting projects *(site remains the unit of recording archaeological material to comply with current legislation and NPWS recording requirements*). The intent of this strategy is to highlight variation between assemblages at a large scale, treating assemblages as a continuous scatter of material across the landscape. In doing this an attempt is being made to identify variation within artefact assemblages that correspond with variation in the general patterns of landscape use. It is not 'sites' *per se* that are the focus of attention, but the nature of activities that can be identified through the analysis of stone artefact distributions. Many of the surveys and salvage projects previously conducted at Warkworth, and throughout the Hunter Valley, have focused on exposed areas or areas where sites are thought to occur (along drainage lines). It is only recently that a clearer (less biased) picture of site and artefact distributions is beginning to emerge, which might enable the archaeology of the Hunter Valley to be understood within a behavioural framework.

#### 6.2.1.1 A Model of Forager Settlement

A forager settlement pattern may be an appropriate model for viewing the archaeology of the Upper Hunter Valley. This model suggests that the relative distribution of *residential base* sites and *activity location* sites should reflect the foraging radius associated with occupation in an area. A general model of foraging distinguishing the residential "home base" site with peripheral "activity locations" as presented by Foley (1981) is shown below. The right frame shows the archaeological outcome of the structured activities illustrated in the left frame.

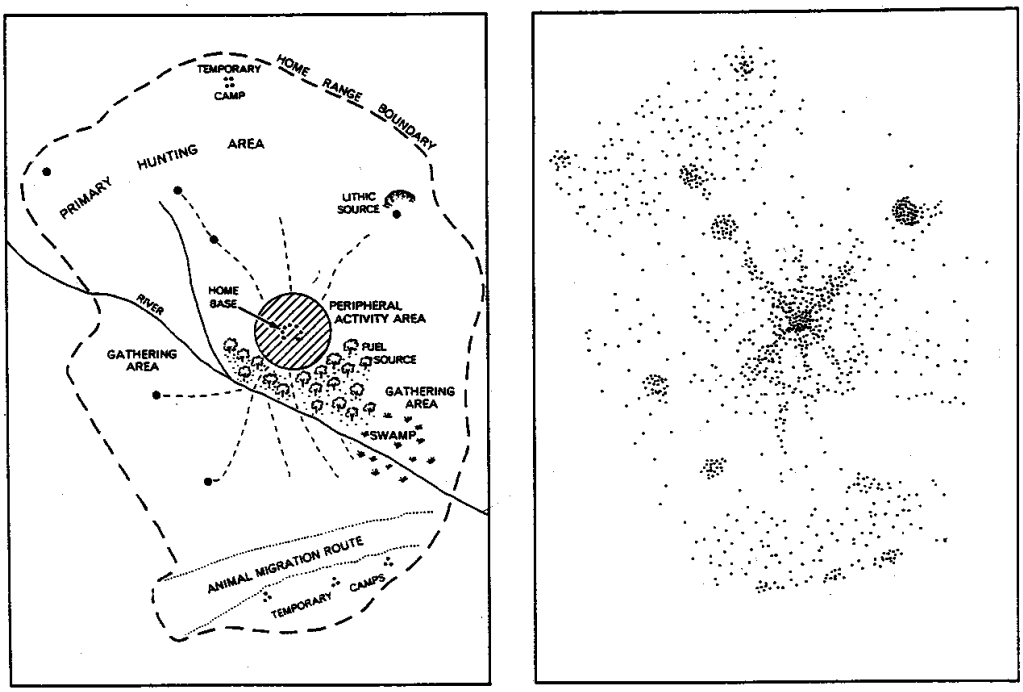


**Figure 6. Foraging Model from Foley 1981**

Tasks undertaken at activity location sites will vary and so the archaeological evidence associated with specific activities or tasks, for example resource extraction, will characterise individual *activity location* sites. *Activity locations* are not likely to contain features reflecting protracted camping, for example: hearths and in situ heat treatment of flaking stone are not anticipated. *Activity locations* occur within the foraging radius of a residential site.

*Residential sites* (also referred to as *residential bases* or *base camps*) are more likely to occur in parts of the landscape with good access to the widest range of subsistence resources, and with the greatest relative amenity for camping within the local area. Such locations will avoid cold air flow, favour protected sunlit locations and be close to reliable and renewable resources, principally fresh water. Creek valleys with reliable freshwater appear to offer such protected locations and are favoured over exposed floodplain and high riverbank locations for residential sites (the reverse may be true if access to resources is greater from a riverbank context). The degree of environmental reliability (e.g. permanent water as opposed to intermittent streams) may influence the rate of return to sites and hence the complexity of evidence. Higher order streams may have been a more reliable location attracting more frequent residential camping visits than an intermittent creek valley in extreme environmental conditions such as drought.

A foraging group, such as a family or extended family group, occupying a residential base for a typical stay of a few days will move regularly as subsistence resources are harvested and depleted within the foraging radius. Binford proposes a model of systematic movement by the foraging group in a leapfrog fashion, "leaping" beyond the previous foraging radius to establish a new residential base and new undepleted foraging radius. This “half-radius” pattern of residential mobility and landscape use is illustrated below (taken from Ebert 1992).

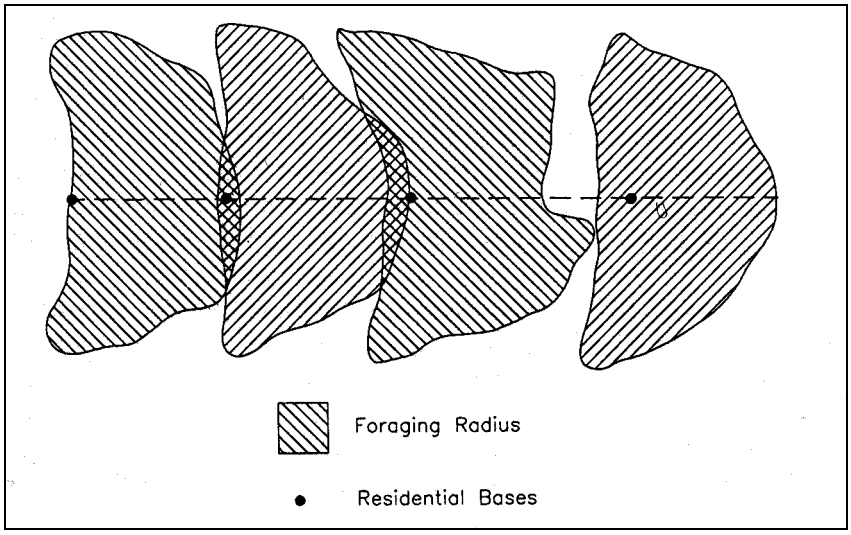


**Figure 7. Foraging Model from Ebert 1992**

An alternate view is a full radius pattern. The size of the foraging radius may be equated with the "site exploitation territory" estimated by Renfrew and Bahn after Higgs and Vita-Finzi (1972) to be around 10 km radius or the area within 2 hours walk (Renfrew and Bahn 1991).

Larger gatherings of clan or tribal groups would occur possibly once or twice a year at places used for ceremonies. There is some local evidence of these kinds of activities. The area around Baiame cave at Milbrodale, around 10 km south of the study area, has been referred to by the local Aboriginal community as one such location. A Bora ground is also located near Wollombi Brook, around 2 km west of the current study area.

It appears that, in the Upper Hunter Valley, the creek valley floors of the Central Lowlands formed the focus of *residential base* occupation. Sequential positioning of foraging radii along these creek valleys over several millennia would have resulted in a continuous archaeological distribution close to creeks reflecting domestic and maintenance activities in a *residential base* context. Archaeological evidence on the upper slopes, ridge lines and less domestically amenable areas up to several kilometres from the residential base would reflect resource gathering *activity locations*. The commonly reported pattern of archaeological evidence in the Upper Hunter whereby artefact distributions are concentrated close to creeks and highly dispersed away from the creek can be explained by this model. Apparent departures from the model present significant opportunities for research. Such departures occur for example where artefacts are sparsely distributed along a creek line and there are no concentrations. Such evidence challenges the notion of concentrated knapping floors along all creeks in the Hunter Valley. Concentrations of artefacts in areas of high environmental exposure (e.g. with negligible protection from prevailing winds) also deserve close scrutiny, for example Site 37-5-63 on Hunter Valley No.1 mine. It appears that the resource richness of the immediate area of this site, including a local stone source, a small meander cut-off rich in ribbon lily to the immediate north and immediate access to deep water holes in the Hunter River, may have resulted in an *activity location* with very highly concentrated artefactual material. Differences in the local environment of each site may influence the strategic use of each site. In addition, it was argued that the main reason for the concentration of artefacts at this location was that it was a sand dune (Hughes 1999), with the availability of local resources being secondary.

The mobility of prehistoric foragers as defined by Binford (1980) can be measured in many different ways (Kelly 1983, 1986). The most common way of gauging human mobility in foraging populations has been to investigate the diversity and richness of assemblages, in terms of the number and range of artefact types found both within, and between, sites (Shott 1986, Andrefsky 1998). In general, it is assumed that a site representing an activity location of foragers with high mobility will show a low diversity of artefact types (based on the premise that the site serves a few specific and focussed activities). A site representing extended stays or a residential function, however, will have a greater diversity (richness) of artefacts representing a greater range in activities performed on the site in the immediate area.

Nelson (1991) notes that “at residences, materials should include all stages of manufacture… and tools broken in manufacture”. Therefore, where group mobility is high and campsites are frequently shifted about the landscape, assemblages are not expected to contain facilities (such as heat treatment pits), and the wide array of implements discarded at places of extended occupation. Since the number of activities requiring the use of stone tools in any one location is likely to be restricted,

assemblages should reflect this and contain fewer implement classes. It may also be the case that the location of particular activities cannot be predicted, adding to the increased dispersal of material over the landscape. If individuals are opting to carry a number of stone tools during hunting and gathering forays into the landscape rather than manufacture tools at task locations, a high number of used tools should be recovered from these low density and dispersed assemblages.

#### 6.2.1.2 A General Model of Occupation in the Hunter Valley

In a recent study, Kuskie and Kamminga (2000) have established a general model of occupation strategies for the Central Lowlands and lower Hunter region primarily based upon ethnographic research (refer to Table 1). This model is useful as a starting point and makes a general set of predictions for the lower Hunter that is consistent with other studies (e.g. Nelson 1991, Thomas 1983). Primarily, the Kuskie and Kamminga (2000) model distinguishes between short-term or extended occupation and makes some predictions about the likely location of different foraging and settlement activities. Combining this information with a general review of assemblage contents from a sample of excavated sites within the Hunter Valley, a baseline of settlement activities may be determined (Barton 2001). While the model may be challenged in its detail it does provide a number of archaeological expectations that may be tested.

For example, the presence of features requiring a considerable labour investment such as stone-lined ovens or heat-treatment pits are likely to occur at places where occupation occurred for extended periods. The presence of grindstones is also a reliable indicator of low mobility and extended occupation. Seed-grinding requires a large investment of time and effort (Cane 1989). In most ethnographic examples, seed-grinding is an activity that takes places over an entire day to provide adequate energetic returns (Cane 1989, Edwards and O'Connell 1995).

Where group mobility was high and campsites were frequently shifted about the landscape, artefact assemblages are not expected to contain elements such as grindstones, heat-treatment pits, ovens and the diversity of implements frequently discarded at places of extended residential occupation. It may also have been the case that the location of particular activities could not be predicted by tool users, adding to the increased low density dispersal of artefacts over the landscape. Also, if individuals were opting to carry a number of stone tools during hunting and gathering forays into the landscape and maintain these tools rather than manufacture new tools at each task location, the ratio of used tools to unworn flakes in these assemblages should be high.

**Table 1. Occupation Model for the Central Lowlands and Lower Hunter Valley from Kuskie and Kamminga (2000)**

| Occupation pattern | Activity location | Proximity to water | Proximity to food resources | Archaeological expectations |
|---|---|---|---|---|
| Transitory movement | All landscape zones, but frequently on ridge and spur crests, watercourses and valley flats | Not important | Not important | Assemblages of low density and diversity<br>Evidence of tool maintenance and repair<br>Knapping |
| Hunting and/or gathering without camping | All landscape zones | Not important | Near food source | Assemblages of low density and diversity<br>Evidence of tool maintenance and repair<br>High frequency of used tools discarded<br>Knapping |
| Camping by small parties | Frequently associated with permanent or temporary water | Nearby | Near food source | Assemblages of low-moderate density and diversity<br>Evidence of tool maintenance and repair<br>Hearths |
| Nuclear family base camp | Level or gently undulating ground | Nearby reliable source | Near food source | Assemblages of high density and diversity<br>Evidence of tool manufacture and casual knapping<br>Facilities such as heat treatment pits and stone lined ovens<br>Grindstones present |
| Community base camp | Level or gently undulating ground | Nearby reliable source | Near food source | Assemblages of high density and diversity<br>Evidence of tool manufacture and casual knapping<br>Facilities such as hearths and stone lined ovens<br>Grindstones and ochre present<br>Evidence of heat treatment unlikely<br>Large area >100 $m^2$ with isolated campsites |

### 6.2.2 Antiquity of Archaeological Resources

The chronology of occupation and the antiquity of earliest archaeological material have always been areas of particular interest. Most sites, however, are surface scatters, or open deposits – subsurface material in duplex soils, which have little or no potential for investigating antiquity (refer to geomorphology section). A few stratified sites have been excavated and have provided some temporal frameworks for understanding variation in the stone artefacts (e.g. Moore 1970, Hiscock 1986), but very few sites contain pre-Bondaian Holocene or Pleistocene material (or have the potential to identify this material from more recently deposited material). Two sites in the Hunter Valley have been recorded as Pleistocene in age, Glennies Creek (Koettig 1987) and Moffat's Swamp (Baker 1994), which is actually on the coastal plain. Given that there can be little doubt of occupation in the Hunter Valley during the Pleistocene the paucity of archaeological material from this time represents a gap in the record.

Sand sheets and sand dunes are considered to be a likely location for Pleistocene and pre-Bondaian material to occur (refer to environmental background section). Dean-Jones and Mitchell (1993) briefly investigated sand dunes along Wollombi Brook and found stratigraphic sections with associated archaeological materials. In that report they state that the sand dunes warrant closer inspection. Recent excavations by Hughes and Shawcross (2001) at Site I on a Pleistocene source-bordering dune at Cheshunt have shown that rich, albeit highly disturbed in that instance, archaeological sites can occur on such dunes. However, no evidence of Pleistocene occupation was found in those excavations. The Cheshunt dune has been dated by OSL to about 88,000 years ago.

Within the western part of the study area, areas of aeolian sand sheets occur, of which the example along Sandy Hollow Creek (hereafter referred to as the Warkworth West sand sheet) is the most prominent example. Haglund (1999) noted a marked association between artefact occurrences and aeolian sands on the basis of her 1997 archaeological survey, but the potential of those sands to contain further archaeological deposits was not specifically assessed. The survey appears to have been undertaken without full consideration of the landforms and surficial geology. Previous studies in the Hunter Valley have not fully recognised the existence of aeolian sand deposits or their archaeological potential.

## 6.3 Archaeological Investigations at Warkworth

Numerous archaeological investigations for Aboriginal sites have previously been undertaken on the Warkworth Mine Lease over some time. Previous investigations are summarised below.

### *6.3.1 Surveys*

Details of previous surveys that have included parts of the Warkworth Mine Lease are provided in Table 2. Results of these surveys generally indicate that the occurrence of sites and patterns of archaeological distribution are consistent with other parts of the Hunter Valley. The location and type of all sites, including those recorded during this study are provided in a table in section 8.1 below. Sites are generally associated with drainage lines, but also occur on slopes and ridge tops. Site types include open sites, the largest of these always associated with eroded areas along creeklines, isolated artefacts and grinding grooves. Many of these surveys focused on creeklines and areas of high visibility.

A Bora ground (or ceremonial ground) has also been recorded in the Warkworth Mine Lease area. This site, recorded by Thorpe in 1918, was located in open woodland about two kilometres west of Wallaby Scrub Road and 500 metres east of Wollombi Brook. The site consisted of a number of carved trees and associated earth mounds (Thorpe 1918).

**Table 2. Summary of Previous Surveys**

| Survey | Description |
|---|---|
| Dyall 1979 | Collected stone artefacts from several sites. Dyall considered the material 'normal for the Liddell-Ravensworth-Mount Arthur-Mount Thorley region, and the material on them is of the usual types both in terms of the stone implements and of the rocks used in their manufacture. Most of the camp sites are very minor. Three of them….(including site A)….are sizeable but do not rank in size with other large open-air sites in the Singleton-Muswellbrook area' (Dyall 1979). |
| Brayshaw 1989 | Archaeological survey of a proposed 330kV transmission line route, crossing Warkworth. Crossed Sandy Hollow Creek, Doctors Creek and a tributary. One open site (scatter of stone artefacts) found on the south east side of Doctors Creek. |
| Haglund 1991 | Surveyed the eastern part of the Mine Lease that is now being mined (east of the current study area). Six stone artefact scatters and 31 isolated finds were recorded. The higher density scatters were on creek flats. A few stone artefacts were found on hillslopes and ridge tops. Large sites with many stone artefacts were found along the bigger creeks, Sandy Hollow, Doctors and Sullivans Creeks, confined mainly to the creek flats. Large sites all had evidence of backed artefact technology. |
| Brayshaw 1993 | Surveyed the south east portion of the Mine Lease area during a survey of the neighbouring Mt Thorley mine. One site (MT37) was located, which Haglund (1999) later found to extend into the Warkworth Mine Lease. The site was labelled by Haglund as PL1. |
| Haglund 1999 | Haglund (1999) surveyed land that includes the current study area, but also extended west of Wallaby Scrub Road. The survey revealed stone artefact scatters in 52 locations, which included three of Dyall's (1979) previously recorded sites. Grinding grooves were found in three locations. Haglund concluded that in the land east of Wallaby Scrub Road (the current study area) Aboriginal sites were generally associated with the drainage lines and/or level or gently sloping areas on crests, spurs and slopes. Three areas were identified by Haglund as 'complexes of Aboriginal sites' with associated areas of potential archaeological deposit.<br>The survey coverage is unclear, Haglund says that broad transects were walked and the locations of sites were flagged and then revisited with a WML surveyor to record the exact location and record artefacts in greater detail. (Most of these markers are still present at these site locations).<br>Fifty percent of sites were isolated finds. Dyall's sites B and J contained no artefacts at the time of Haglund's survey (in 1997). They had either been collected or eroded out since 1979. Site K (further separated into K1 and K2) was more exposed through erosion. Site K, Site M (M west and M east) as well as Haglund's sites PL10, PL12 and PL13 formed an almost continual scatter of artefacts, raising the question of site boundaries.<br>The higher density sites were located along the major water courses of Sandy Hollow Creek, Longford Creek, Wollombi Brook Tributary and Doctors Creek. Haglund also made the point that a very sparse scatter of stone artefacts is probable over most of the area, interpreted as 'background scatter'. The results of the current survey further support the fact that artefacts continue in lesser densities in almost all areas.<br>Haglund also noted that areas of aeolian sand appeared to be an attractive location as well. |

### 6.3.2 Salvage

Numerous salvage collections and excavations have been undertaken on the Warkworth Mine Lease, some of these from sites within the current study area. Table 3 provides some details of these salvage projects. Most of these sites are on or near creeklines. Analysis of the stone artefacts provides evidence for various activities. Large sites generally contained backed artefacts and indicate backed artefact manufacture. However, the potential for analysis is limited due to the lack of stratigraphic integrity of the duplex soils (refer to geomorphology section) and the disturbed context of artefacts collected from eroded surfaces.

**Table 3. Previous Salvage Projects at Warkworth**

| **Salvage work within the study area** | | | | |
|---|---|---|---|---|
| **Site Name** | **Report author and study date** | **Description** | **Excavated (E) and/or Collected (C)** | **Number of artefacts recovered** |
| Doctors Creek | Brayshaw and Haglund 1990 | Excavated either side of Doctors Creek, along the alignment of the above mentioned transmission line. Five artefacts were excavated from the area north of the creek, no artefacts were found on the southern side. | E | 5 |
| W6 | Haglund Salvage: 1993 Report: 2002 | Haglund excavated site W6, a relatively large site with suitable intact archaeological deposit to warrant subsurface excavation. W6 was located on the banks of Sandy Hollow Creek, which in this section was a broad fairly level creek, with extensive sheet erosion, which had exposed artefacts. W6 was about 950 m long and 120 m broad. Surface artefacts were collected from exposures, in some cases a shallow scrape removed redeposited material. Grader scrapes were also carried out, in 3-4 cm depths, the fresh surface examined and artefacts collected.<br>Analysis of stone artefacts (White 2001) indicated storage of raw material for future use. There is no evidence that stone was rationed. Possible time differences between knapping activities was raised. Backed artefacts were present. No usewear residue studies were undertaken.<br>It was concluded that a wide range of activities were undertaken at the site, evidenced by backed artefact technology, grindstones and mullers, and axes. The site appeared to have been used on and off over an undetermined period of time, with at least some activities being undertaken at the same time. | E and C | 2248 |
| W7 | Haglund Salvage: 1993 Report: 2002 | Confluence of Sandy Hollow Creek and tributary | E and C | 1127 |

| Site | Report author and study date | Description | Excavated (E) and/or Collected (C) | Number of artefacts recovered |
|---|---|---|---|---|
| W8 | Haglund Salvage: 1993 Report: 2002 | Exposure on drainage line 40 m from Sandy Hollow Creek | C | 41 |
| W10 | Haglund Salvage: 1993 Report: 2002 | Eroded areas on the banks of a tributary gully of Sandy Hollow Creek | C | 214 |
| Between W10 and W11 | Haglund Salvage: 1993 Report: 2002 | Footslopes adjacent to Sandy Hollow Creek | C | 76 |
| W11 | Haglund Salvage: 1993 Report: 2002 | Eroded areas on lower slopes, about 40 m from Sandy Hollow Creek | C | 1374 |
| **Salvage work within the broader Warkworth Mine Lease** | | | | |
| **Site** | **Report author and study date** | **Description** | **Excavated (E) and/or Collected (C)** | **Number of artefacts recovered** |
| W2 | Haglund 2001 White 1999a, b (study in 1996) | Deflated and eroded surfaces along Sullivans Creek | C and E | 4212 |
| W3 | White 1999a, b (study in 1996) | Artificial channel near Sullivans Creek | C | 189 |
| W5 | White 2001 (1996) Haglund 2001 | Along Dights Creek | C | 41 |
| WC | White 2001 | Along Dights Creek | C | 85 |
| WL | Haglund 1992 | Along Doctors Creek | C and E | 1542 |
| WH | Haglund 1992 | Along Doctors Creek | C and E | 3759 |
| WM | Haglund 1992 | Along Doctors Creek | C and E | 134 |

# 7 Methodology

## 7.1 Surface Survey

### 7.1.1 Introduction

Recent archaeological investigations for the extension of mining into the western part of the Warkworth Mine Lease (east of Wallaby Scrub Road) have been undertaken by Australian Museum Business Services (AMBS). Archaeological survey of the study area was carried out by four AMBS archaeologists in November 2001. Geomorphologist and archaeologist Philip Hughes was also involved in the field survey. The survey team also included four representatives of the local Aboriginal community.

### 7.1.2 Sampling Strategy

In early November 2001, Hughes and Baker undertook a wide-ranging inspection of the Warkworth West area as part of the process of formulating a field survey strategy. On the basis of this reconnaissance, the study area was divided into a number of Landform Zones deemed likely to have different archaeological patterns. These Landform Zones formed the basis of the Survey Areas covered during the surface survey. The location and extent of these Survey Areas are shown on Figure 4.

The entire area was subject to surface survey, with some areas selected for complete survey coverage (i.e. 100%). The latter included along Sandy Hollow Creek (Survey Area 1) and the adjacent sand sheet (Survey Area 4), Longford Creek (Survey Area 2), the saddle (between Doctors Creek to the east and drainage to Wollombi Brook to the west) (Survey Area 5) and the summit ridge along the eastern boundary of the study area (Survey Area 6). Only proportions of the other Survey Areas were covered, 25% in the case of the unnamed tributary to Wollombi Brook (Survey Area 3), 61% of the Woodlands Pit area (which was a discreet unit) (Survey Area 7) and 8% of the undulating terrain which comprised most of the study area (Survey Area 8).

The larger Survey Areas were subdivided into two or more sub-areas. Each Survey Area was further subdivided into several smaller Survey Transects. The location and extent of the Survey Transects within each of the Landform Zones are shown in Figure 5 and described in detail in Table 4.

### 7.1.3 Field Methods

Transects were located so that each of the landforms present in the study area were represented in the surveyed sample. Survey team members walked over each transect. Relevant information about each survey transect was recorded in the field. This included the amount of visibility and exposure as well as the landform elements present within transects. The locations of all previously recorded sites were inspected and a current assessment, including summary stone artefact recording, took place.

Table 4 describes transects walked through the study area. The table is set out according to the survey areas. Within each survey area the transects were based on landform units. These landform units are also described. The transects to be walked were drawn on maps prior to carrying out the field survey. During the survey these transects (labelled in the table as T1, T2, T3, etc) were sometimes slightly altered based on ground observations. Also during the field survey, exposures observed close to these transects were surveyed. These exposures are labelled as T1E2, T3E4 etc in the table. The dimensions for these exposures were estimated during the field survey. During the field survey an estimated percentage of Exposure (usually visible Unit B sediment) and Visibility (ground surface not obscured by vegetation) was given for each transect and exposure. After the field survey the annotated transects were re-drawn using Mapinfo software. This also allowed the dimensions and total area for each transect to be calculated. Effective survey area (ESA) was calculated by multiplying the total area of each transect or exposure by the percentage of visibility and exposure (Table 5).

### 7.1.4 Effective Survey Coverage

**Table 4. Characteristics of the Areas Surveyed**

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| **Survey Area 1 Sandy Hollow Creek** | | | | | | | | |
| Area 1 | Creek bank, alluvial flats and lower valley side slopes | 1,100x340 | 374,000 | 50 | 90 | 168,300 | W6, W7, W8, W9, W10, W11, W63, W66 | Lower half of valley previously surveyed in detail by Haglund. Complete area re-examined closely and sites as defined by Haglund re-located. No artefacts in areas between defined sites, but this is because there was no 'archaeological visibility' due to close grass cover and lack of erosion |
| Area 2 | Creek bank and lower valley side slopes upstream of W9 | 1,100x170 | 187,000 | 45 | 90 | 75,740 | W14, W15, W16, W17, W18, W19 | Both sides of creek. A mixture of grassland and open Eucalyptus woodland with numerous small to medium sized patches of eroded ground on which artefacts were visible |
| **Survey Area 2 Longford Creek** | | | | | | | | |
| *Area 1 - Upper catchment* | | | | | | | | |
| T1 | V shaped creek channel and gently sloping valley sides | c.710xc.170 | 120,600 | 10 | 20 | 2410 | PN10, PN11 | Area previously surveyed in detail by Haglund. Complete area re-examined closely and sites as defined by Haglund re-located. No artefacts in areas between defined sites, but this is because except along vehicle track (see next entry) there was no 'archaeological visibility' due to close grass cover and lack of erosion |
| T2 | | 300x3 | 900 | 70 | 90 | 570 | PN9 | Well formed vehicle track on east side of track, eroded into Unit A topsoil. Artefacts of PN9 and PN11 exposed along the track |
| *Area 2 - Lower catchment* | | | | | | | | |
| T1 | Alluvial flats with well developed Unit A/B sequence under Eucalyptus and Casuarina woodland | 2,000x2 | 4,000 | 90 | 50 | 1,800 | W25, W26, W27, W29, W30, W31 | Network of sinuous, bare eroded banks of the main creek and minor tributaries. 'Classic' Unit A/B sequence with Unit A 150-300 mm thick. |
| T2 | | 500x3 | 1,500 | 80 | 60 | 720 | | Track along eastern boundary fence |
| T3 | | 50x20 | 1,000 | 70 | 100 | 700 | | Eroded areas around dam wall |
| T4 | | 760x220 | 167,200 | 20 | 30 | 10,030 | | Mainly stable alluvial flats |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| **Survey Area 3 Unnamed Tributary to Wollombi Brook** | | | | | | | | |
| T1 remainder | Broad unchannelled drainage line with 2 dams | 400x30 | 12,000 | 10 | 10 | 120 | None | Grassed paddocks with very gentle sides slopes at ~1º |
| T1 E1 | | 10x10 | 100 | 100 | 100 | 100 | PC5 | On boundary between T1 and T4. A sign marking the location of site PC5 is present on a bare eroded exposure with sandy topsoil (Unit A) stripped to clayey subsoil (Unit B) and bedrock, but no artefacts seen |
| T1 E2 | | 50x20 | 1,000 | 70 | 100 | 700 | None | Wide bulldozed drain leading to dam |
| T1 E3 | | 10x10 | 100 | 50 | 100 | 50 | None | Patch of eroded ground with 100 mm thick soil stripped to bedrock |
| T2 remainder | Small, steep-sided valley | 250x30 | 7,500 | 50 | 50 | 1,880 | None | V shaped valley with slopes >5º. Stony, shallow soil covered slopes are eroded and support patchy cover of grasses and shrubs (heavily grazed by horses) under Eucalyptus woodland. Numerous small outcrops of sandstone |
| T2 E1 | | 50x5 | 250 | 80 | 100 | 200 | None | 1 m deep gully with eroded soils along both banks |
| T2 E2 | | 3x3 | 9 | 100 | 50 | 5 | None | |
| T2 E3 | | 150x3 | 150 | 100 | 100 | 150 | None | Well worn stock track along fence forming western boundary of T1 |
| T3 remainder | Broad flat interfluve between T1/T2 drainage line to north and poorly define drainage line to south | 430x30 | 12,900 | 70 | 80 | 7,220 | PC4 | Horse and cattle paddocks with very short sparse grass cover revealing eroded sandy soils and small outcrops of sandstone. Partially formed east-west road containing artefacts recorded by Haglund (PC4), re-recorded during the present survey |
| T3 E1 | | 200x3 | 600 | 100 | 100 | 600 | W74 | Well worn stock track along east-west fence forming northern boundary of T2 |
| T4 remainder | Numerous unchannelled headwater tributaries and adjacent slopes (<2º) | 260x30 | 7,880 | 10 | 10 | 790 | None | Well grassed terrain |
| T4 E1 | | 60x20 | 1,200 | 70 | 80 | 670 | Site PL15 (‘X’) | Extensive bare eroded area of soil on slopes adjacent to drainage line. Open woodland with grass understorey |
| T4 E2 | | 300x3 | 900 | 80 | 100 | 720 | PL11 | Unformed but well used vehicle track along east-west transmission line |
| T5 | Small, steep-sided V-shaped valley | 330x30 | 9,900 | 50 | 50 | 2,480 | W44 | Valley sides have extensive, patchy erosion interspersed with areas with poor visibility due to close cover of shrubs and grass |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T6 remainder | Pronounced flat topped ridge between two entrenched small valleys | 300x30 | 9,000 | 20 | 20 | 360 | None | Ground covered with grass and shrubs, but with numerous stock tracks which reveal shallow sandy soils and some sandstone outcrop |
| T6 E1 | | 300x1 | 300 | 80 | 80 | 190 | None | Main stock track along ridge |
| T6 E2 | | 70x30 | 2,100 | 70 | 90 | 1,320 | None | At northern end of ridge overlooking valley slopes on 3 sides is an extensive area of largely bare, eroded sandy soil with flat sandstone outcrops. Under open Eucalyptus woodland. The absence of artefacts was surprising given its location and large area with excellent 'archaeological visibility' |
| T7 remainder | Small, steep-sided V-shaped valley | 230x30 | 6,900 | 10 | 10 | 70 | None | Steep-sided slopes >5º covered with grass and shrubs and numerous small outcrops of sandstone |
| T7 E1 | | 200x1 | 200 | 80 | 80 | 130 | None | Well formed stock track along narrow floor of valley |
| T8 | Small, steep-sided valley | 335x40 | 13,400 | 50 | 80 | 5,360 | None | V shaped valley with slopes >5º. Stony, shallow soil covered slopes are eroded and support patchy cover of grasses and shrubs (heavily grazed by horses) |
| T9 | Flat interfluve between drainage lines | 200x30 | 6,000 | N/A | N/A | - | None | Most of this area covered by homestead and associated outbuildings and formed roads |
| T10 remainder | Small, U-shaped steep-sided valley (slopes ~5º) | 190x30 | 5,700 | 10 | 10 | 60 | None | Thickly grassed floor and sides of valley |
| T10 E1 | | 30x30 | 900 | 80 | 100 | 720 | None | Eroded area on north valley side below dam. 200 mm of soil removed to expose bedrock |
| T10 E2 | | 20x5 | 100 | 80 | 100 | 80 | None | Area eroded down to bedrock on valley floor |
| T10 E3 | | 80x10 | 800 | 80 | 100 | 640 | None | At foot of northern valley side typical Unit A/B sequence with Unit A stripped over the entire eroded exposure |
| T11 remainder | Broad flat-bottomed valley with side slopes of ~3º | 590x30 | 17,700 | 10 | 10 | 180 | None | Heavily grassed valley side slopes and heavy grassed and machinery-disturbed valley floor |
| T11 E1 | | 100x20 | 200 | 50 | 90 | 90 | None | Extensively eroded areas with bedrock exposed around north side but above large eastern dam |
| T11 E2 | | 50x5 | 250 | 70 | 100 | 180 | None | Uphill cut of major overflow channel between the two main dams along this drainage line |
| T11 E3 | | 50x10 | 500 | 100 | 100 | 500 | PL12 | Discontinuous area with soils up to 300 mm thick eroded down to bedrock. Artefacts noted at Haglund's western pegged findspot, but not elsewhere |

| Survey Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T12 remainder | Broad, flat drainage interfluve (slope <1º) with steeper shoulder slopes (up to 2º) | 580x30 | 17,400 | 10 | 10 | 174 | None | Heavily grassed areas between exposures. One artefact found on side of formed east-west road which forms northern boundary of survey area |
| T12 E1 | | 50x4 | 200 | 100 | 100 | 200 | K(S) | North-south formed vehicle track across western end of T5 with a few artefacts of Site K2 exposed. Surrounding areas heavily grassed and other artefacts recorded by Dyall not visible |
| T12 E2 | | 20x4 | 80 | 70 | 100 | 55 | None | 3 cut drains on south side of formed vehicle track |
| T12 E3 | | 30x3 | 90 | 80 | 100 | 70 | None | |
| T12 E4 | | 30x4 | 120 | 90 | 100 | 85 | None | |
| T12 E5 | | 10x8 | 80 | 30 | 80 | 20 | PL13 | Original PL13 findspot on eroded exposure of thin, stony soil |
| T12 E6 | | 30x20 | 600 | 70 | 90 | 380 | | Additional exposures to west of original on shoulder on interfluve. All have extensive erosion of topsoil up to 200 mm deep to expose bedrock.<br>Artefacts found on all of these exposures included in PL13 |
| T12 E7 | | 20x10 | 200 | 90 | 100 | 180 | | |
| T12 E8 | | 10x10 | 90 | 100 | 90 | 90 | | |
| T12 E9 | | 25x15 | 375 | 90 | 100 | 340 | | |
| T13 | Broad ridge crest | Whole area (260x40) | 10,400 | 20 | 20 | 420 | None | Generally well-grassed landsurface with few eroded exposures. Zig-zag traverses across the ridge |
| T14 | Western slopes and floor of gully | Whole area (490x30) | 14,700 | 10 | 20 | 290 | None | Very well-grassed landsurface with few eroded exposures. Conglomeratic sandstone boulders crop out. Zig-zag traverses across the slopes. |
| T15 remainder | 'Amphitheatre' above entrenched section of 'AGG Creek' | 190x30 | 5,700 | 10 | 10 | 60 | None | Very gentle slopes (~1º) surrounding eroded amphitheatre. Heavily grassed, but sandstone crops out frequently and soils are shallow (<200 mm) and sandy/stony |
| T15 E1 | | 100x10 | 1,000 | 100 | 100 | 1,000 | W20 | 1 m deep to sandstone bedrock irregular eroded edge of very broad shallow gully complex which forms an 'amphitheatre' between the bedrock entrenched reach of the creek downstream and the network of unchannelled drainage lines extending across the hillslopes upstream. Typical Unit A/B sequence with sandy grey Unit A topsoil 150-250 mm thick over stony clayey subsoil. |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T16 remainder | Both sides of upper part of 'AGG Creek' section entrenched in sandstone | 235x30 | 7,050 | 30 | 50 | 1,060 | M(E) | Between 'amphitheatre' and main cluster of axe grinding grooves at M(W) the channel is entrenched to a depth of 0.5-1 m into conglomerate, pebbly sandstone and sandstone. The thin, stony colluvial soils forming flats either side of the creek support open woodland with a sparse grass cover. The grassed hillslopes beyond the survey unit to the south have thin stony soils with some bedrock outcrop. The rising ground to the north (also grassed) is capped with thick gravels derived from the weathering of the conglomerate and these have been extensively quarried for the road |
| T16 E1 | | 100x10 | 1,000 | 80 | 90 | 720 | None | On south bank of creek is a discontinuous area of eroded ground with 100 mm of topsoil stripped to sandy subsoil |
| T17 remainder | Both sides of lower part of 'AGG Creek' section entrenched in sandstone | 305x30 | 9,150 | 30 | 50 | 1,370 | M(W) | Essentially the same as for T7, i.e. below the main cluster of axe grinding grooves at M(W) the channel is entrenched to a depth of 0.5-1 m into conglomerate, pebbly sandstone and sandstone. The thin, stony colluvial soils forming flats either side of the creek support open woodland with a sparse grass cover<br>Quarried area noted T7 extends to NE corner of T8 |
| T17 E1 | | 150x5 | 750 | 70 | 90 | 470 | PL10 | Eroded/stock trampled zone along east-west fence close to southern boundary of survey zone. W25 occurs in a 28x5 m exposure along the fence. PL10 to the west occurs in larger exposures created by the scraping of a fire break along a transmission line which follows the fence in this area. |
| T17 E2 | | 200x4 | 800 | 80 | 90 | 290 | None | An unformed vehicle track parallel to the creek |
| T18 remainder | Lower reaches of 'AGG Creek' entrenched in deep colluvium. Local slope <1° | 240x30 | 7,200 | 5 | 5 | 20 | None | The flat land surface away from the creek banks is very heavily grassed. At the eastern end of T9 older alluvial/colluvial deposits are capped with unweathered alluvium of Holocene to post-European age. This sediment has accumulated as an indistinct fan at the break of slope between T9 and the steeper bedrock entrenched section upstream |
| T18 E1 (channel) | | 200x15 | 3,000 | 90 | 90 | 2,430 | W22 | Channel is cut vertically into colluvium and alluvium up to 2 m deep. Adjacent to Wallaby Scrub Road an extensive and very complex network of gullies has eroded into weathered stony clayey colluvium, which has a well-developed Unit A/B sequence of duplex soils.<br>Artefacts are eroding out of the sandy Unit A material, which is on average about 150 mm thick. Some islands of intact Unit A soils with archaeological potential |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| **Survey Area 4 Sand Sheet Adjacent to Sandy Hollow Creek** | | | | | | | | |
| T1 | Sand sheet covering very gently sloping (1-2º) valley side slope. Distinctive cover of improved grass species | 100x20 | 400 | 50 | 100 | 200 | W86 | Western-most upslope diversion drain along edge of survey area. Extensive erosion along the *in situ* upslope cut of the drain and along its floor. Grassed paddock with virtually no archaeological visibility |
| T2 | | 535x4 | 2,140 | 60 | 100 | 1,280 | | Downslope diversion drain adjacent to creekline. Extensive erosion along the *in situ* upslope cut of the drain and along its floor. One artefact found in excavated spoil used to form downslope wall of drain |
| T3 | | c. 530x380 | 201,400 | 5 | 5 | 500 | Part of W14, W69, W84 | Grassed paddock with virtually no archaeological visibility |
| **Survey Area 5 Saddle Between Doctors Creek and Drainage to Wollombi Brook** | | | | | | | | |
| T1 | Northern side of saddle, with steep, sometimes rocky upper slopes and gentle footslopes | Whole area | 132,200 | 10 | 30 | 3,970 | PL1, PL3, PL4, MT37 | Grassed land surface with few eroded exposures except along vehicle track which cuts through PL4. 1 artefact seen at PL4, but none at PL1 |
| **Survey Area 6 Summit Ridge** | | | | | | | | |
| T1 remainder | | c.250xc.160 | 36,050 | 20 | 20 | 1,440 | None | Grassed slopes (~4°) surrounding knoll |
| T1 E1 | Knoll on conglomeratic sandstone | 20x20 | 400 | 50 | 80 | 160 | None | The highest part of knoll at N end. Rocky outcrop with trees |
| T2 remainder | Flat to slightly undulating ridge crest | 570x80 | 45,600 | 50 | 50 | 11,400 | None | Thinly grassed paddock, thin sandy soil cover. Cultivated |
| T2 E1 | | 20x20 | 400 | 50 | 100 | 200 | None | Bare stock trampled area around single large tree |
| T3 remainder | Saddle | 140x190 | 26,600 | 10 | 10 | 270 | PL14 | Grassed paddocks with small bare patches of eroded ground |
| T3 E1 | | 30x30 | 900 | 50 | 50 | 225 | None | Well-worn stock track |
| T3 E2 | | 100x2 | 200 | 60 | 80 | 100 | None | Unformed vehicle track diagonally across saddle |
| T3 E3 | | 20x10 | 200 | 40 | 90 | 70 | None | Unit A/topsoil stripped by sheet erosion |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T4 remainder | Undulating ridge crest | c.190xc.800 | 155,600 | 10 | 10 | 1,560 | PL6<br>PL7 | Included 2 low knolls, broad slopes to cliffline to north (-1-4°) and narrow sloping shoulder to west (1-5°). Mainly closely grassed paddocks with a few small bare patches of eroded ground. Mainly shallow soils on sandstone and conglomerate, even on slopes. Some open Eucalyptus woodland along crest. The eastern end of this Block is crossed by a bulldozed vehicle track beneath a power line |
| T4 E1 | | 35x15 | 525 | 100 | 100 | 525 | W12 | Site is just below the shoulder of the ridge on a slope of about 4°. Soil completely removed down to bedrock at 300-600 mm by wash and shallow gully erosion. Artefacts visible on exposed surface |
| T4 E2 | | 15x10 | 150 | 100 | 100 | 150 | None | Bare eroded patch with topsoil removed down to clayey B horizon |
| T4 E3 | | 20x10 | 200 | 70 | 90 | 125 | None | Unformed vehicle track along north shoulder of ridge |
| T4 E4 | | 20x20 | 200 | 100 | 100 | 200 | None | Bare patch of eroded and stock trampled ground at gates on crest of ridge |
| T4 E5 | | 50x20 | 1,000 | 80 | 100 | 800 | W13 | Broad shallow gully on north side of ridge (slope of 3°) eroded down to sandstone 100-300 mm below surface. Artefacts visible on exposed surface |
| T4 E6 | | 30x30 | 900 | 100 | 100 | 900 | None | Similar shallow gully on upper north slope (3°) of ridge |
| T4 E7 | | 30x20 | 600 | 40 | 90 | 215 | None | Diffuse eroded area on north shoulder of ridge |
| T5 remainder | Broad knoll on conglomeratic sandstone | c.290xc.320 | 80,550 | 10 | 10 | 810 | None | Grassed slopes (5°) surrounding knoll. Extensive rocky outcrop and thin soil cover. |
| T5 E1 | | 50x50 | 2,500 | 10 | 10 | 25 | None | Almost flat topped knoll, which is highest point of the ridge. Capped with up to 300 mm of grey-brown wind blown sand, the top 150 mm of which is loose to slightly compact and the lower part of which is compact silty sand. Distinctive green grass cover indicates its extent |
| **Survey Area 7 Woodlands** | | | | | | | | |
| T1 remainder | Undulating terrain west of minor creek | | 63,530 | 5 | 5 | 160 | None | Areas under regrowth Casuarina woodland with dense ground cover of needles |
| T1 E1 | | 100x50 | 5,000 | 80 | 90 | 3,600 | None | Heavy machinery disturbed areas of ground at western end of transect |
| T1 E2 | | 200x6 | 1,200 | 100 | 100 | 1,200 | W73 | Two parallel unformed vehicle tracks each 3 m wide through woodland |
| T2 | Minor creek line | 200x1000 | 20,000 | 40 | 50 | 4,000 | W1, F1, F2 | Shallow valley of minor creekline along which W1 has recorded. Some artefacts noted in contour back on east side of drainage line |
| T3 remainder | Undulating terrain east of minor creek | | 61,340 | 5 | 5 | 150 | None | Mixed areas of grassland, woodland and bulldozed ground |
| T3 E1 | | 200x6 | 1,200 | 80 | 100 | 960 | None | 2 unformed vehicle tracks each 3 m wide |
| T3 E2 | | 200x3 | 600 | 80 | 100 | 480 | None | Contour bank south of former Putty Road |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T4 | Hillslope | | 43,060 | 50 | 50 | 10,765 | F3 | Regrowth Eucalyptus woodland on west and north side of hill now partially removed by the new Putty Road. Slope ~5° |
| T5 | Flat to gently undulating terrain | | 84,330 | 10 | 40 | 3,370 | W72 | Area between Doctors Creek (now removed by mining) and former Putty Road. Regrowth Casuarina woodland. Highly variable visibility and exposure. Best along traces of unformed tracks and contour banks but negligible in woodland |
| **Survey Area 8 Undulating Terrain** | | | | | | | | |
| *8a - within impact area. Slopes and tributary valleys to west of Sandy Hollow Creek and east of Longford Creek* | | | | | | | | |
| T1 | Rolling crest of broad ridge | 670x25 | 16,750 | 20 | 70 | 2,350 | W39 | Open, mainly Eucalyptus woodland. W43 is on crest of knoll, on cleared ground beneath transmission line where V=70%, E=90% |
| T2 | Shoulder of ridge | 230x15 | 3,450 | 80 | 90 | 2,480 | W38, W39 | Vehicle track along fence |
| T3 | Hillslope | 220x10 | 2,200 | 20 | 70 | 310 | PN12 | Cleared ground beneath transmission line. The site is on an area of bare, eroded ground |
| T4 | Rolling crest of broad ridge | 240x25 | 6,000 | 10 | 50 | 300 | W40 | Open woodland with grassed understorey and a few patches on bare eroded ground, on one of which the find spot occurred |
| T5 | Undulating terrain | 320x3 | 960 | 50 | 80 | 380 | None | Bare, eroded ground on sides of vehicle track. Gravelly sandstone crops out |
| T6 | Gentle footslopes | 1,040x10 | 10,400 | 60 | 70 | 4,370 | W6, W62 | Contour drain with extensive areas of bare eroded soil |
| T7 | Gentle footslope | 300x5 | 1,500 | 80 | 80 | 960 | W30 | Bare and eroded edges of formed road along perimeter fence |
| T8 | Tributary valley | 500x25 | 12,500 | 20 | 50 | 1,250 | None | Close cover of grass and shrubs |
| *8b – within impact area. Slopes and tributary valleys to east of Sandy Hollow Creek* | | | | | | | | |
| T1 | Broad tributary valley | 205x10 | 2,050 | 30 | 50 | 310 | None | Valley floor heavily disturbed by large dam, around the walls of which were patches of bare, eroded ground |
| T2 | Broad tributary valley | 660x30 | 19,800 | 50 | 90 | 8,910 | W65 | Large tracts of the valley floor bare and eroded, due in part to land use disturbance |
| T3 | Hillslope | 100x3 | 300 | 80 | 100 | 240 | W67 | Well-formed vehicle track across the slope and then up the slope |
| T4 | Hillslope | 885x10 | 8,850 | 50 | 90 | 3,980 | W68, W80 | Northern half of two contour drains separated by an interfluve |
| T5 | Hillslope | 570x10 | 5,700 | 10 | 80 | 460 | W81 | Transect down grassed slope |
| T6 | Hillslope | 1,415x25 | 35,375 | 40 | 90 | 12,735 | W82, Site B | Central section along contour drain and the ends across country. Open Eucalyptus woodland |
| T7 | Hillslope | 990x25 | 34,650 | 60 | 90 | 18,710 | W77 | Transect following vehicle track to south and contour drain to north, linking with T4 |
| T8 | Broad tributary valley | 610x25 | 15,250 | 20 | 50 | 1,530 | W78 | Largely grassed valley floor, with some patches of bare, eroded soil |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T9 | Hillslope and tributary valley | 675x25 | 16,875 | 50 | 90 | 7,590 | W79 | Part of transect followed the uppermost contour drain and the rest the headwaters of a tributary valley |
| *8c - within impact area. Undulating ridge and gentle hillslopes, with patchy sand sheet at north end* | | | | | | | | |
| T1 | Broad ridge crest | 285x3 | 855 | 80 | 90 | 615 | None | Vehicle track though dense regrowth Eucalyptus, Casuarina and Callitris woodland/forest. Patchy sand cover up to 300 mm thick |
| T2 | Gentle hillslope | 575x3 | 1,725 | 80 | 90 | 1,240 | None | Vehicle track through regrowth Eucalyptus forest. Sandy soil |
| T3 | Gentle hillslope | 370x3 | 1,100 | 30 | 50 | 170 | None | Largely overgrown vehicle track through regrowth Eucalyptus forest. Sandy soil. Both sides of the creek were surveyed in T12 but no exposure |
| T4 | Gentle footslope | 470x5 | 2,350 | 50 | 90 | 1,060 | None | Lightly graded firebreak along fence line. Sandy soil |
| T5 | Very gently footslope | 1,640x5 | 8,200 | 80 | 80 | 5,250 | None | Recently graded 5 m wide firebreak along fence. |
| T6 | Very gentle footslope | 1,040x3 | 3,120 | 50 | 90 | 1,400 | None | Vehicle track under transmission line. Highly variable exposure with large areas of bare, eroded ground interspersed with well grassed tracks with tyre marks only |
| T7 | Prominent knoll on ridge | Whole area 100x50 | 5,000 | 30 | 90 | 1,350 | None | Thin sandy soil with extensive sandstone outcrop. Open Eucalyptus woodland |
| T8 remainder | Gully | 435x50 | 21,750 | 20 | 50 | 2,175 | W83, PC2 | |
| T8 E1 | | 20x50 | 1,000 | 100 | 100 | 1,000 | | Deeply eroded patch of ground |
| T9 remainder | Very broad, low ridge crest | 140x80 | 11,200 | 10 | 70 | 780 | PC3 | At south end of transect almost flat ground forming south shoulder of slope. Heavily grassed |
| T9 E1 | | 120x5 | 600 | 90 | 90 | 490 | None | Vehicle track along southern shoulder of ridge. Areas either side heavy grassed with some shrubs and trees |
| T10 | Hillslope | 860x25 | 21,500 | 10 | 50 | 1,070 | W76, PC3 | Grassed paddock |
| T11 | Hillslope | 940x10 | 9,400 | 50 | 70 | 3,290 | W75, W85 | Contour drain with extensive areas of bare, eroded sandy soil |
| T12 | Small tributary valley | 36x10 | 3,600 | 10 | 50 | 180 | None | Heavily grassed paddock with some exposure of bare, eroded ground around dam wall |
| T13 | Flat sand sheet | 320x5 | 1,600 | 90 | 50 | 720 | PN7 | Patch of deep (+500 mm), loose windblown white sand used as an orange grove. Site was located on track |
| T14 | Broad ridge crest with discontinuous mantle of windblown sand | 1,275x3 | 3,825 | 80 | 90 | 2,750 | None | Vehicle track though dense regrowth Eucalyptus, Casuarina and Callitris woodland/forest. Semi-continuous sand cover up to 300 mm thick |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T15 | Very gently footslope | 1,220x5 | 6,100 | 80 | 80 | 3,900 | PN2, W23 | Recently graded 5 m wide firebreak along fence. Very sandy soil, with windblown sand locally up to 500 mm thick |
| T16 | Very gentle footslope | 200x4 | 800 | 100 | 100 | 800 | PN3, W24 | Diversion vehicle track in vicinity of PN3 |
| *8d - outside impact area. Undulating terrain with pronounced high hill* | | | | | | | | |
| T1 | Undulating terrain | 2,280x5 | 11,400 | 50 | 90 | 5,130 | PN4, PN5, W28, W64, W70 | Bare, eroded soils along the edges of a formed road around the perimeter fence |
| T2 remainder | Gully in broad shallow valley | 420x50 | 21,000 | 20 | 70 | 2,940 | None | Flat areas on colluvium between the network of gullies. Open Eucalyptus woodland with grass substorey |
| T2 EI | | 420x3 | 1,260 | 90 | 50 | 500 | None | Network of sinuous, bare eroded banks of the main gully (up to 3 m deep) and minor tributaries. 'Classic' Unit A/B sequence with Unit A 150-300 mm thick |
| T3 remainder | Pronounced spur ridge | 555x25 | 13,875 | 20 | 50 | 1,390 | None | Grassed, with some open Eucalyptus woodland. Thin stony soils |
| T3 E1 | | 50x20 | 1,000 | 50 | 100 | 500 | PN6, W33 | Bare eroded exposure with topsoil largely removed to sandstone bedrock |
| T3 E2 | | 300x3 | 900 | 90 | 90 | 730 | None | Vehicle track up southern part of ridge |
| T4 | Prominent hill on ridge crest | 310x10 | 3,100 | 30 | 90 | 840 | W34 | Rocky outcrops surrounded by areas of thin, bare eroded soils. Woodland |
| T5 | Steep hillslope | 460x5 | 2,300 | 50 | 90 | 1,040 | W35, W36 | Bare, eroded soils along the edges of a formed road around the side of the steep hill |
| T6 | Hillslope | 650x5 | 3,250 | 20 | 50 | 320 | None | Transect down hillslope to Longford Creek through regrowth Eucalyptus and Casuarina woodland. Sandy loose soils |
| T7 | Gentle footslope | 510x5 | 2,550 | 30 | 40 | 310 | None | Overgrown track across area of thick windblown sand adjacent to 'orange grove' |
| *8e - outside impact area. North and west facing hillslopes* | | | | | | | | |
| T1 | Very gentle footslope | 1,420x10 | 14,200 | 80 | 80 | 9,090 | Site J, W55, W56, W57, W58 | Recently graded 5 m wide firebreak along fence and areas either side which had patchy exposure of bare, eroded ground |
| T2 | Gentle footslope | 660x25 | 16,500 | 40 | 80 | 5,280 | W50, W51, W52, W53, PL 8 | Vehicle track 3-5 m under transmission line and areas either side which had patchy exposure of bare, eroded ground. |
| T3 | Hillslope | 510x25 | 12,750 | 10 | 50 | 640 | None | Transect down hillslope across heavily grassed paddock |
| T4 | Gentle footslope | 330x10 | 3,300 | 50 | 80 | 1,320 | PL3, PL5 | Vehicle track 3-5 m under transmission line and areas either side which had patchy exposure of bare, eroded ground. Relocated markers for the two previously recorded sites |

| Surveyed Area or Transect | Landform unit | Dimensions (m x m) | Total area ($m^2$) | %V | %E | ESA | Archaeo-logical materials | Comments |
|---|---|---|---|---|---|---|---|---|
| T5 | Hillslope | 620x50 | 31,000 | 20 | 70 | 4,340 | PL9, W58, W59 | Survey centred on two contour drains with large areas of bare, eroded soil. Better grassed areas, but with some patches of bare, eroded ground either side also surveyed |
| T6 remainder | Gully | 165x25 | 4,125 | 30 | 80 | 990 | W60 | Gully forming the headwaters of the creek with the axe grinding grooves. Dam on this drainage line |
| T6 E1 | | 15x10 | 150 | 70 | 100 | 105 | W61 | Heavily eroded patch of ground with Unit A topsoil removed to expose Unit B clays |
| *8f - outside impact area. Southeast facing steep hillslopes* | | | | | | | | |
| T1 remainder | Gully | 130x15 | 1,950 | 20 | 70 | 270 | None | Grassed banks of gully with very patchy exposure of bare, eroded soil. Sandstone bedrock in gully |
| T1 E1 | | 50x20 | 1,000 | 90 | 100 | 900 | None | Eroded area on south side of gully with topsoil stripped away |
| T1 E2 | | 20x10 | 200 | 90 | 100 | 180 | W47 | Topsoil stripped away to expose sandstone |
| T2 | Hillslope | 1,150x15 | 17,250 | 20 | 70 | 2,410 | None | Transect across the slope in grassed paddocks. Several small stretches of contour drain with extensive areas of bare eroded soil |
| T3 | Hillslope | 450x15 | 6,750 | 10 | 50 | 340 | None | Transect across the slope in grassed paddocks upslope from T2. |
| T4 remainder | Spur ridge | 370x15 | 5,550 | 10 | 60 | 330 | None | Grassed paddock with only one large patch of bare, eroded ground (see next entry) |
| T4 E1 | | 20x15m | 300 | 30 | 80 | 70 | None | Area of bare ground in a grove of trees |
| T5 remainder | Broad spur ridge | 470x15 | 7,050 | 10 | 50 | 350 | None | Grassed paddock |
| T5 E1 | | 100x5 | 500 | 70 | 100 | 350 | W48 | Bare, eroded contour drain on south flank of ridge. Soil eroded down to sandstone |
| T6 | Hillslope | 390x15 | 5,850 | 30 | 80 | 1,400 | None | Mostly grassed slopes but included short stretches of a contour drain. This transect surveyed specifically to find PL2 |
| T7 | Hillslope | 420x15 | 6,300 | 20 | 50 | 630 | PL2 | Transect down the hillslope across grassed paddocks. PL2 was on an area of ground which is still bare and eroded many years after the site was first recorded. This site is close to Doctors Creek |

**Table 5. Effective Survey Coverage**

| Survey Area | Total Area Surveyed ($m^2$) | Effectively Surveyed Area ($m^2$) | % of Surveyed Land Effectively Covered | Total Area for Each Survey Area ($m^2$) | % of Total Area Effectively Covered | Total Area Surveyed as a % of the Total Area of Each Survey Area |
|---|---|---|---|---|---|---|
| 1. Sandy Hollow Creek | 561,000 | 244,040 | 43.5 | 561,000 | 43.5 | 100 |
| 2. Longford Creek | 295,200 | 16,230 | 5.5 | 295,200 | 5.5 | 100 |
| 3. Unnamed Tributary to Wollombi Brook | 198,520 | 35,290 | 17.8 | 780,700 | 4.5 | 25 |
| 4. Sand Sheet | 203,940 | 1,980 | 1.0 | 203,940 | 1.0 | 100 |
| 5. Saddle Between Doctors Creek and Drainage to Wollombi Brook | 132,200 | 3,970 | 3.0 | 132,200 | 3.0 | 100 |
| 6. Summit Ridge | 352,575 | 19,175 | 5.4 | 352,575 | 5.4 | 100 |
| 7. Woodlands | 280,260 | 24,685 | 8.8 | 457,000 | 5.4 | 61 |
| 8a. Undulating Terrain | 53,760 | 12,400 | 23.1 | 1,043,000 | 1.2 | 5.2 |
| 8b. Undulating Terrain | 138,850 | 54,465 | 39.2 | 1,153,000 | 4.7 | 12.0 |
| 8c. Undulating Terrain | 103,725 | 28,240 | 27.2 | 1,740,000 | 1.6 | 6.0 |
| 8d. Undulating Terrain | 60,635 | 13,700 | 22.6 | 891,600 | 1.5 | 6.8 |
| 8e. Undulating Terrain | 82,025 | 21,765 | 26.5 | 760,300 | 2.9 | 10.8 |
| 8f. Undulating Terrain | 52,700 | 7,230 | 13.7 | 339,100 | 2.1 | 15.5 |
| 8. Total (sub-units a-f) | 491,695 | 137,800 | 28.0 | 5,927,000 | 2.3 | 8.3 |

*Notes:*
*Areas were generated from Mapinfo and data contained in Table 4.*
*Total Area Surveyed was calculated by adding all transects within each Survey Area.*
*The Effectively Surveyed Area was calculated by multiplying each transect area by the amount of Exposure and Visibility. The resulting figures for each Survey Area were combined.*
*% of Surveyed Land Effectively Covered is the percentage of the Effectively Surveyed Area within the Total Area Surveyed for each Survey Area.*
*% of Total Area Effectively Covered is the percentage of the Effectively Surveyed Area within the Total Area of each Survey Area.*
*100% survey coverage was gained for Longford Creek, Sandy Hollow Creek, the Saddle and the Summit Ridge. As a result the Surveyed Land Effectively Covered and the Total Area for the Survey Area are the same.*

## 7.2 Test Excavation

### 7.2.1 Introduction, Aims and Permit Details

The overall aim of the test excavation was to assess the geomorphic history of the sand sheet and the nature, distribution and scientific significance of archaeological deposit within the sand sheet. These aims were to be addressed by dating the sand sheet and the cultural evidence (if feasible), and describing the context of the artefacts. The age and integrity of the archaeological deposit and character of the artefact assemblages together with any cultural features will be key considerations in the assessment of scientific significance.

AMBS carried out the test excavation under a Preliminary Research Permit (Permit #1327) issued by NPWS dated 6th May 2002. The permit was issued to Neville Baker and Alison Nightingale (AMBS). The special conditions attached to this permit included that the excavations were to be undertaken in accordance with the research design submitted with the permit application and that representatives from the Upper Hunter Wonnarua Council, Lower Wonnarua Tribal Council, Wonnarua Nation Aboriginal Corporation and Wanaruah Local Aboriginal Land Council be invited to participate in the excavations.

While the permit was issued to AMBS, given the research questions were predominantly related to understanding the geomorphology of the sand sheet and the relationship with Aboriginal archaeological material, the excavations were undertaken in conjunction with Dr Philip Hughes.

The test excavation was undertaken over six days from the 17th to 22nd June 2002. Present during the excavations were Neville Baker, Alison Nightingale, Andrew Collis and Jenny Allen (AMBS archaeologists), Dr Philip Hughes (HEH) acting as both geomorphologist and archaeologist, Luke Hickey (WNAC), Tracey Skene (UHWC), Barry Anderson and John Waters (LWTC) and Rodney Matthews (WLALC).

### 7.2.2 Research Design

During surface survey within the Warkworth West extension area, one area was identified as warranting test excavation in order to allow for an overall archaeological assessment for the EIS. As the Warkworth West Development Application triggers the Integrated Development Assessment (IDA) process, test excavation was required to be undertaken up front.

AMBS and Dr Philip Hughes proposed to excavate within the sand sheet adjacent to Sandy Hollow Creek on which there was a recently recorded Aboriginal site (Site W14). The sand sheet is approximately 500 m by 250 m and is an aeolian sand mantle over a lower gentle hill slope extending to the western bank of Sandy Hollow Creek. The opposite bank has a texture contrast soil comprising the classic Unit A and Unit B sequence as described by Hughes (1984) on which two large and artefact-

rich sites were recorded and partially salvaged by Haglund and her team in the early 1990s (Sites W10 and W11).

During the archaeological surface survey in November 2001, artefacts were recorded in the southern end of the sand sheet. They were eroding from an artificial contour drain next to a dam wall (W14 on Figure 8). The cutting revealed a sand deposit of at least 2 m depth with mottling and cementation in the lower part of the cutting (the B horizon) suggesting late Pleistocene antiquity. The upper 40 cm was a fine yellow/brown sand which may be a post-European reworked aeolian deposit. The contour drain extends the full length (north-south) of the sand sheet, but apart from one other small occurrence at the northern end (W69) no artefacts were observed in the exposed sands.

The contour drain reveals the presence of artefacts at two locations in the sand sheet but did not reveal the stratigraphic location of those artefacts or indicate their true concentration or distribution. Two previously excavated sites in sand dunes in the Hunter Valley have rich stone artefact assemblages in their loose upper sands suggesting sand dunes were a focus of Aboriginal occupation (Cheshunt dune Site 37-5-166 [Hughes and Shawcross 2001] and the Hunter Valley No.1 mine Site 37-5-63 [Hiscock and Shawcross 2000]). The very small amount of archaeological material found along the contour drains at Warkworth West (which cut down to and in places into the indurated B horizon) was surprising. On the basis of the surface survey alone, it was not possible to determine whether the sand sheet has relatively few artefacts or whether other artefacts might be present but are obscured by sand. Therefore, test excavation of the sand sheet was proposed.

The sand sheet may hold archaeological deposit of significant antiquity (if, for example, there were *in situ* artefacts in the B horizon). In addition, if it could be shown there were rich assemblages of artefacts in the sand, this could be used to argue that sand sheets may have been favoured campsites as well as sand dunes. The test excavations aimed to address these issues and identify whether more extensive salvage is warranted as a condition of consent to destroy. There are no options for conservation of this sand sheet as it is situated well within the proposed mine extension area.

#### 7.2.2.1 Archaeological Investigations of Hunter Valley Sand Dunes

Within the western part of the study area several aeolian sand sheets occur. The sand sheet along Sandy Hollow Creek is the most prominent. These sands are part of the CSIRO Warkworth Land System, parts of which have been shown to have high archaeological sensitivity, for example recent studies on site 37-5-63 on the Hunter Valley No.1 mine (Hiscock and Shawcross 2000) and “Site I” (37-5-116) on Hunter Valley South – Cheshunt mine (Hughes and Shawcross 2001). It should be noted that both these sites occur on dunes rather than sand sheets. Dunes are areas of relatively thick, mounded sand covering limited areas and with well-defined boundaries; sand sheets on the other hand are thin, flat and have diffuse boundaries.

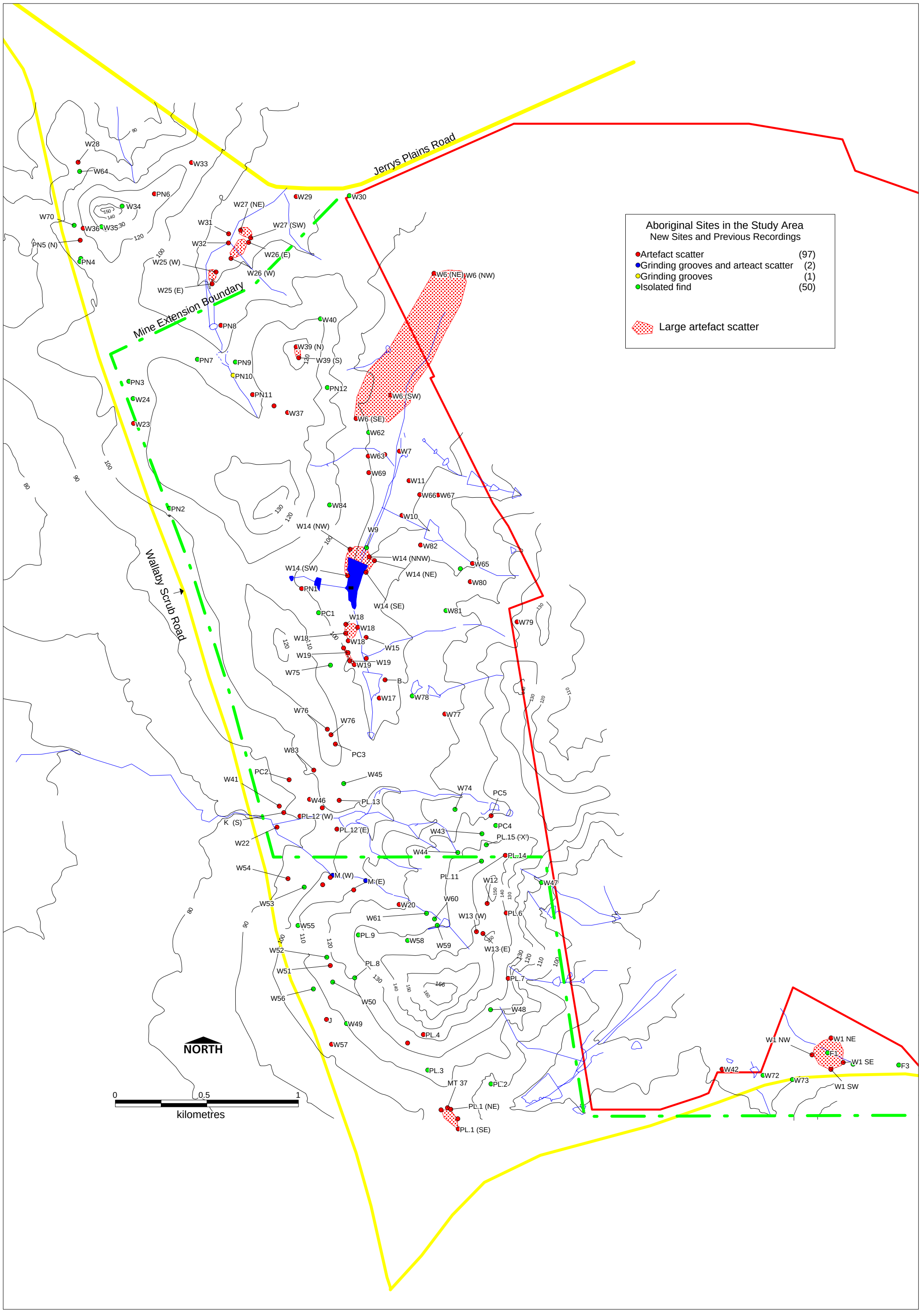


Figure 8. Aboriginal Sites in the Study Area

Recent excavations by Hughes and Shawcross (2001) at Site I on a Pleistocene source-bordering dune have shown that rich, albeit highly disturbed in that instance, archaeological sites can occur on such dunes. However no evidence of Pleistocene occupation was found in those excavations. Though the Site I dune has been dated by OSL to about 88,000 years ago.

Recent excavations by Peter Kuskie at the nearby Lemington mine recorded some archaeological sites on sand dunes. Kuskie has yet to submit his report, but it is understood that he located some artefacts that may be late Pleistocene in age. However whether or not these possible Pleistocene sites were associated with the sand dunes is not known at this stage.

Dean-Jones and Mitchell (1993:37-38) briefly investigated sand dunes along Wollombi Brook and found stratigraphic sections with associated archaeological materials. In that report they state that the sand dunes warrant closer inspection.

At Warkworth a marked association between artefact occurrences and aeolian sands was noted in Haglund's 1999 report of her 1997 archaeological survey, but the potential of those sands to contain further archaeological deposits was not specifically assessed.

These few studies indicate the potential for sand bodies to contain significant archaeological evidence for past Aboriginal land use patterns. The sand sheet has potential for pre-Bondaian Holocene or even Pleistocene archaeological deposit. Pleistocene sites are rare in the Hunter Valley and are of high archaeological research interest here and in other parts Australia. Archaeological evidence of Aboriginal occupation on the sand sheet would be a significant contribution to understanding Aboriginal land use patterns in the distant past. The pits in the northern part of the sand sheet were to assess whether a rich archaeological deposit occurs within the sand body opposite a demonstrably rich deposit exposed in eroded areas of site W11. The presence of artefacts in both the northern and southern ends of the sand sheet will also suggest a continuous archaeological deposit along this side of the creek, as on the eastern side.

### *7.2.3 Field Methods*

The test excavation methodology involved the excavation of a series of test pits at two locations on the sand sheet adjacent to Sandy Hollow Creek, one in the north part of the sand sheet (referred to as the Northern Excavation Area) and the other in the south (called the Southern Excavation Area). The location of the two excavation areas within the sand sheet is shown on Figure 9. The Southern Excavation Area was positioned to be adjacent to the location where artefacts were discovered during the surface survey (at site W14). The Northern Excavation Area was positioned to be near site W69 which was recorded in the contour drain cutting in the sand sheet, and opposite site W11 where a large number of artefacts were exposed on the classic duplex soils.

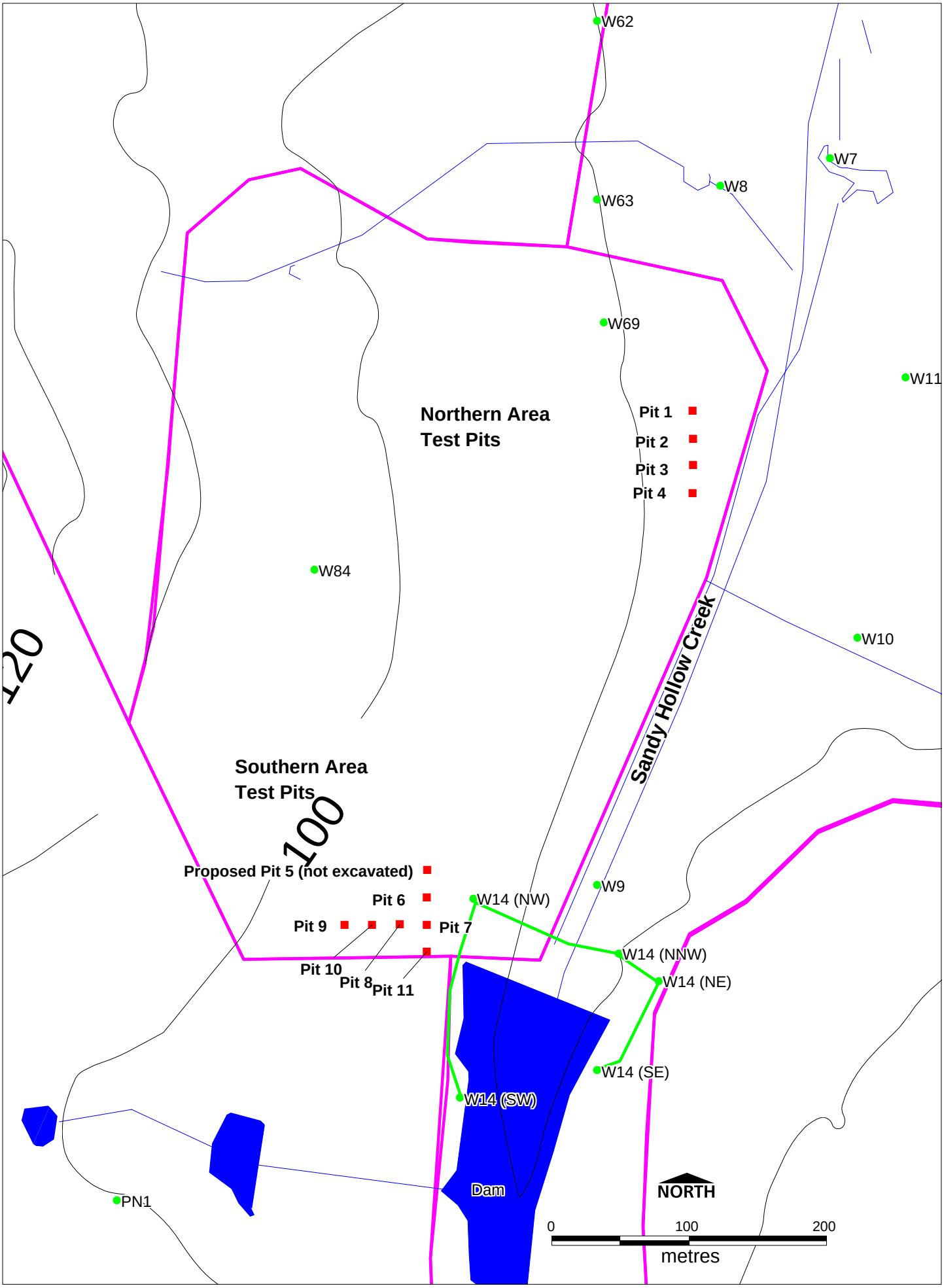


Figure 9. Location of Test Pits

At the two target areas a series of 1m² pits were excavated in 100 mm spits by hand and backhoe with due care to ensure "stratigraphic hygiene". The layout of pits is shown on Figure 9. Test pits 1 to 4 were located in the Northern Excavation Area and pits 6-11 in the Southern Excavation Area. It should be noted that test pit 5 was not excavated (decided in the field) due to the expected water content in the pit and surrounding disturbance including large animal burrows. Therefore, a test pit (Pit 11) was placed 20 m south of test pit 7, along the same alignment of pits (i.e. parallel to the diversion drain and adjacent to W14). This was labelled Pit 11 to avoid confusion in the field.

The excavation methods followed those applied successfully by Hughes and Shawcross (2001:6) in the Cheshunt dune context. Where the backhoe was used, a backhoe with a flat cutting edge rather than teeth allowed for more precise control over the depth of deposit removed. It was proposed that the bulk of deposit in each spit would be removed by backhoe, with the remainder removed by shovel and trowel. However, the excavation was mostly undertaken by hand, using shovel and trowel. The nature of the loose sandy deposit meant that it was faster to excavate by hand and allowed for greater care and control. The size of the pits was generally 2 m long by 0.5 m wide, to allow for greater access and ease when excavating at depth.

Occupational Health and Safety (OH&S) regulations limit the depth of excavations in sand to 1.5 m. No pits exceeded 1.5 m in depth. In all but one case Unit B clay was reached prior to 1.5 m. The walls of Pit 8 collapsed prior to reaching Unit B clay and the pit was abandoned.

In the Southern Excavation Area, near W14, three pits at 20 m intervals were dug adjacent to the drain cutting and parallel with the creek. Three pits at 20 m intervals were also dug in the same manner along a transect running at right angles to and up the gentle slope from the cutting.

In the Northern Excavation Area, opposite site W11 (approximately 350 m north of W14), a series of four pits were dug. The four pits were spaced at 20 m intervals, generally parallel with the creek, as for W14.

All deposit excavated was wet sieved through 5 mm and 3 mm nested screens. All artefacts, and any fragments suspected to be artefactual, were bagged for later analysis.

All artefacts were analysed in accordance with the methods outlined in Section 8.2.2.

At a location where the stratigraphy exposed by the excavations was deemed to be suitable, samples of sand were taken from the deposit for OSL (optically stimulated luminescence) dating. The samples are discussed in Section 8.2.1.3. The samples were collected on the 22nd June 2002 by specialists from the Australian National University (ANU) OSL dating laboratory. The samples are being processed and dated at ANU.

# 8 Results

## 8.1 Surface Survey

A summary of site descriptions and site contents for the 120 Aboriginal archaeological sites recorded in the study area are tabulated below. The details of site contents are generally those observed by AMBS during the November 2001 survey. Where known, the original site contents (number of artefacts or grinding grooves) are also given. A number of sites have been subdivided due to the extensive area that they cover. In some cases re-recording of sites recorded by Dyall and Haglund revealed more extensive artefact scatters, which were then grouped with that site.

**Table 6. Site Descriptions**

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| B | 37-6-152 | A | 1. Sandy Hollow Creek | 316885 | 6390060 | Dyall 1979 Haglund 1999 AMBS (survey in 2001) | 37 of ? | Dyall collected over 100sqm of the site |
| J | 37-6-160 | A | 8e. Undulating terrain | 316600 | 6388200 | Dyall 1979 | | Described as a 'very small campsite in a large area of erosion on a dry water course' |
| K (S) | 37-6-161 | A | 3. Unnamed tributary to Wollombi Brook | 316345 | 6389325 | Dyall 1979 Haglund 1999 AMBS (survey in 2001) | 10 of c.20 | Possibly disturbed since Dyall's recording. Artefacts seen in graded track. |
| M (E) | 37-6-163 | GG + A | 3. Unnamed tributary to Wollombi Brook | 316800 | 6388962 | Dyall 1979 Haglund 1999 AMBS (survey in 2001) | 38 GG's | Dyall recorded 73 GG's. Some of these are probably covered by sediment. Grooves in cluster 7 m x 7 m |
| M (W) | 37-6-163 | GG + A | 3. Unnamed tributary to Wollombi Brook | 316619 | 6388988 | Haglund 1999 AMBS (survey in 2001) | 9 GG's | In one cluster on exposed sandstone in creek bed |
| MT 37 | 37-6-669 | A | 5. Saddle between Doctors Creek and Drainage to Wollombi Brook | 317270 | 6387730 | Brayshaw 1993 | | |
| PC1 | | IF | 8c. Undulating terrain | 316515 | 6390420 | Haglund 1999 AMBS (survey in 2001) | 1 | On slopewash near fence |
| PC2 | | A | 8c. Undulating terrain | 316371 | 6389505 | Haglund 1999 AMBS (survey in 2001) | 2 of 5 | Small scatter in erosion scar |
| PC3 | | A | 8c. Undulating terrain | 316620 | 6389705 | Haglund 1999 AMBS (survey in 2001) | 12 (1 prev rec) | Erosion scar |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| PC4 | | IF | 3. Unnamed tributary to Wollombi Brook | 317504 | 6389277 | Haglund 1999 | 1 | Background scatter or cf. PC5? |
| PC5 | | A | 3. Unnamed tributary to Wollombi Brook | 317478 | 6389329 | Haglund 1999 | 2 | Small scatter near dam |
| PL.1 (NE) | | A | 5. Saddle between Doctors Creek and Drainage to Wollombi Brook | 317288 | 6387722 | Haglund 1999 AMBS (survey in 2001) | 0 of 9 | Extensive but sparse site (Brayshaw 1994) |
| PL.1 (NW) | | | | 317235 | 6387718 | | | |
| PL.1 (SE) | | | | 317331 | 6387616 | | | |
| PL.1 (Mid SE) | | | | 317327 | 6387671 | | | |
| PL.2 | | IF | 8f. Undulating terrain | 317505 | 6387865 | Haglund 1999 AMBS (survey in 2001) | 1 | Gully erosion, a core. E100, V95. |
| PL.3 | | IF | 5. Saddle between Doctors Creek and Drainage to Wollombi Brook | 317158 | 6387934 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | Open area, erosion, background scatter? |
| PL.4 | | A | 5. Saddle between Doctors Creek and Drainage to Wollombi Brook | 317131 | 6388128 | Haglund 1999 AMBS (survey in 2001) | 0 of 3 | Small scatter |
| PL.5 | | A | 8e. Undulating terrain | 317045 | 6388080 | Haglund 1999 AMBS (survey in 2001) | 1 of 6 | Erosion scar, artefacts widely scattered |
| PL.6 | | A | 6. Ridge | 317570 | 6388800 | Haglund 1999 AMBS (survey in 2001) | 0 of 2 | E10, V5 Sparse scatter exposed on rock shelves |
| PL.7 | | A | 6. Ridge | 317588 | 6388443 | Haglund 1999 AMBS (survey in 2001) | 0 of 2 | Sparse scatter exposed on rock shelves |
| PL.8 | | IF | 8e. Undulating terrain | 316750 | 6388430 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | In erosion gully, part of background scatter? |
| PL.9 | | IF | 8e. Undulating terrain | 316765 | 6388665 | Haglund 1999 AMBS (survey in 2001) | 1 of 1 | In scuffed surface; part of background scatter? |
| PL.10 | | A | 3. Unnamed tributary to Wollombi Brook | 316565 | 6388935 | Haglund 1999 AMBS (survey in 2001) | c20 of 3 | E100, V100, more artefacts observed than Haglund's recording. At site marker. Slope <10 deg, entire landscape either side of creek buried in modern alluvium >1 m thick. |
| PL.10 (E) | | | | 316606 | 6388976 | | | |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| PL.11 | | IF | 3. Unnamed tributary to Wollombi Brook | 317430 | 6389080 | Haglund 1999 AMBS (survey in 2001) | 1 of 1 | Exposed by track/ contour drain; background scatter? Site marker is 50 m W of GPS reading |
| PL.12 (W) | | A | 3. Unnamed tributary to Wollombi Brook | 316434 | 6389307 | Haglund 1999 | 7 | Extensive erosion scars, & on farm dam across valley |
| PL.12 (E) | | | | 316637 | 6389240 | | | |
| PL.13 | | A | 3. Unnamed tributary to Wollombi Brook | 316647 | 6389398 | Haglund 1999 AMBS (survey in 2001) | 11 of 18 | Scatter in erosion scar |
| PL.13 new exposures | | A | 3. Unnamed tributary to Wollombi Brook | 316630 | 6399335 | Haglund 1999 AMBS (survey in 2001) | | |
| PL.13 new exposures | | A | 3. Unnamed tributary to Wollombi Brook | 316555 | 6389355 | Haglund 1999 AMBS (survey in 2001) | | |
| PL.14 | | A | 6. Summit Ridge | 317560 | 6389114 | Haglund 1999 AMBS (survey in 2001) | 5 of 9 | Extensive scatter in grass & sheet erosion on ridge crest |
| PL.15 ('X') | | IF | 3. Unnamed tributary of Wollombi Brook | 317455 | 6389170 | Haglund 1999 AMBS (survey in 2001) | 1 | In scar below site PL.14 |
| PN1 | | A | 8c. Undulating terrain | 316420 | 6390550 | Haglund 1999 AMBS (survey in 2001) | 2 of 1 | Exposed in eroded track = background scatter? additional artefact located (AMBS 2001). |
| PN2 | | IF | 8c. Undulating terrain | 315690 | 6390975 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | Exposed in eroded track = background scatter? GPS is 100 m S of boundary marker |
| PN3 | | IF | 8c. Undulating terrain | 315455 | 6391664 | Haglund 1999 | 0 of 1 | Exposed in eroded track = background scatter? |
| PN4 | | IF | 8d. Undulating terrain | 315175 | 6392313 | Haglund 1999 | 0 of 1 | Exposed beside track, cf. PN5 60 m further north |
| PN5 (N) | | A | 8d. Undulating terrain | 315175 | 6392429 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | Exposed beside track. Small scatter but cf. PN4 |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| PN6 | | A | 8d. Undulating terrain | 315575 | 6392690 | Haglund 1999 AMBS (survey in 2001) | 2 of 1 | Recorded as an isolated find (Haglund 1999). 2 artefacts found, 1 20 m E of site marker. In unformed track and adjacent exposure. E100, V80. |
| PN7 | | IF | 2. Longford Creek | 315827 | 6391791 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | In loose sand of bracken covered former orchard. Refer sites PN8-11 nearby. |
| PN8 | | A | 2. Longford Creek | 315952 | 6391979 | Haglund 1999 AMBS (survey in 2001) | 0 of 3 | Sparse scatter but more in area, cf. PN9-11 |
| PN9 | | IF | 2. Longford Creek | 316035 | 6391780 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | Exposed on farm track: note finds nearby, PN8, PN10-11. GPS taken at site marker, NB annotated LH's notes. |
| PN10 | | GG's | 2. Longford Creek | 316024 | 6391708 | Haglund 1999 AMBS (survey in 2001) | 4 GG's | Exposed along drainage channel, note PN8-9, PN11 nearby |
| PN11 | | A | 2. Longford Creek | 316132 | 6391604 | Haglund 1999 AMBS (survey in 2001) | 4 | Small scatter on track, note sites PN8-10 nearby. |
| PN12 | | IF | 8a. Undulating terrain | 316540 | 6391650 | Haglund 1999 AMBS (survey in 2001) | 0 of 1 | Exposure 2500sqm on small shelf in fairly steep hill slope |
| W1 NE | | A | 7. Woodlands | 319357 | 6388151 | Haglund 1991 AMBS (survey in 2001) | 10 | |
| W1 NW | | | | 319255 | 6388057 | | | |
| W1 SW | | | | 319360 | 6387979 | | | |
| W1 SE | | | | 319426 | 6388018 | | | |
| W6 (NE) | 37-6-151 | A | 1. Sandy Hollow Creek | 317110 | 6392285 | Haglund 1991 AMBS (survey in 2001) | 100+ | Extensive site in erosion scar adjacent to Sandy Hollow Creek. Detailed recording and excavation undertaken by Haglund et al. |
| W6 (NW) | | | | 317273 | 6392276 | | | |
| W6 (SE) | | | | 316700 | 6391484 | | | |
| W6 (SW) | | | | 316887 | 6391615 | | | |
| W7 | 37-6-589 | A | 1. Sandy Hollow Creek | 316940 | 6391310 | Haglund 1991 AMBS (survey in 2001) | c. 160 | |
| W8 | 37-6-590 | A | 1. Sandy Hollow Creek | 316860 | 6391290 | Haglund 1991 AMBS (survey in 2001) | 15-20 | |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W9 | 37-6-591 | IF | 1. Sandy Hollow Creek | 316770 | 6390780 | Haglund 1991 AMBS (survey in 2001) | 1 | |
| W10 | | A | 1. Sandy Hollow Creek | 316960 | 6390960 | Haglund 1999 | c. 110 | |
| W11 | | A | 1. Sandy Hollow Creek | 316995 | 6391150 | Haglund 1999 | c. 150 | |
| W12 | | A | 6. Summit Ridge | 317465 | 6388850 | AMBS (survey in 2001) | 5 | On exposure formed by sheet and gully erosion, up to 1 m depth |
| W13 (E) | | A | 6. Summit Ridge | 317445 | 6388685 | AMBS (survey in 2001) | 2 | Western slope off ridgeline, skeletal topsoil. |
| W13 (W) | | A | 6. Summit Ridge | 317410 | 6388695 | AMBS (survey in 2001) | | |
| W14 (NE) | | A | 1. Sandy Hollow Creek | 316815 | 6390710 | AMBS (survey in 2001) | | Total area approx 90 m x 100 m |
| W14 (NNW) | | | | 316786 | 6390730 | | 20+ | On contour bank. |
| W14 (NW) | | | | 316680 | 6390770 | | 21 | Artefacts by dam waters edge and dam wall and cuttings. Artefacts on both sides of Sandy Hollow Creek. |
| W14 (SE) | | | | 316770 | 6390645 | | | |
| W14 (SW) | | | | 316670 | 6390625 | | | |
| W15 | | A | 1. Sandy Hollow Creek | 316777 | 6390290 | AMBS (survey in 2001) | 12 | In eroded vehicle track, 5 m from creek bank. |
| W16 | | A | 1. Sandy Hollow Creek | 316780 | 6390175 | AMBS (survey in 2001) | 21 | On creek flat. |
| W17 | | A | 1. Sandy Hollow Creek | 316855 | 6389960 | AMBS (survey in 2001) | 5 | About 40 m south of site B, a small thicket of ironbark saplings to the north. |
| W18 | | A | 1. Sandy Hollow Creek | 316665 | 6390310 | AMBS (survey in 2001) | 1 | On slope next to SH creek. Total area 90 m x 60 m |
| | | | | 316731 | 6390345 | | 1 | In creek bed which has intermittent ponds in this section. |
| | | | | 316665 | 6390360 | | 16 | On unformed track to west of Sandy Hollow Creek. |
| | | | | 316680 | 6390270 | | 14 | Along wire fence to the east of the contour bank and unformed track. |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W19 | | A | 1. Sandy Hollow Creek | 316680 | 6390205 | AMBS (survey in 2001) | 1 | On grassed surface. Total area 110 m x 20 m |
| | | | | 316690 | 6390160 | | 3 | On unformed track. |
| | | | | 316715 | 6390140 | | 6 | On track and contour bank. Immediately west of dam. |
| | | | | 316655 | 6390230 | | 4 | On contour bank. |
| W20 | | A | 3. Unnamed tributary to Wollombi Brook | 316985 | 6388835 | AMBS (survey in 2001) | 3 | Sheet and gully erosion in 'amphitheatre'. |
| W21 | | A | 3. Unnamed tributary to Wollombi Brook | 316735 | 6388910 | AMBS (survey in 2001) | 9 | Well worn cattle pad 50 m downstream of Site M (west). |
| W22 | | A | 3. Unnamed tributary to Wollombi Brook | 316310 | 6389245 | AMBS (survey in 2001) | 22 | Artefacts eroding from A unit on high edge of deep gullies. 15 m west of transmission line and track. |
| W23 | | A | 8c. Undulating terrain | 315485 | 6391435 | AMBS (survey in 2001) | 2 | Artefacts 20 m apart along graded track. |
| W24 | | IF | 8c. Undulating terrain | 315480 | 6391570 | AMBS (survey in 2001) | 1 | Artefact in unformed track. |
| W25 (E) | | A | 2. Longford Creek | 315900 | 6392205 | AMBS (survey in 2001) | 36 | In dam bank and gully erosion next to Longford Creek. |
| W25 (W) | | | | 315920 | 6392270 | | 18 | On west side of Longford Creek, exposed by gully erosion. |
| W26 (E) | | A | 2. Longford Creek | 316095 | 6392435 | AMBS (survey in 2001) | | Artefacts in unformed track with intermittent exposure, patchy Unit A |
| W26 (W) | | | | 316000 | 6392345 | | 53 | |
| W27 (NE) | | A | 2. Longford Creek | 316050 | 6392500 | AMBS (survey in 2001) | | Artefacts in unformed track, running perpendicular to Longford Creek. |
| W27 (SW) | | | | 316105 | 6392460 | | 29 | |
| W28 | | A | 8a. Undulating terrain | 315155 | 6392855 | AMBS (survey in 2001) | 2 | In exposure next to graded track. |
| W29 | | A | 2. Longford Creek | 316350 | 6392690 | AMBS (survey in 2001) | 3 | In windrow of graded track. Disturbed context. |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W30 | | IF | 8a. Undulating terrain | 316640 | 6392700 | AMBS (survey in 2001) | 1 | On graded track near Jerry's Plains Rd. |
| W31 | | A | 2. Longford Creek | 315985 | 6392480 | AMBS (survey in 2001) | 28 | Western bank of Longford Ck, deep gully erosion. |
| W32 | | A | 2. Longford Creek | 315985 | 6392430 | AMBS (survey in 2001) | 9 | |
| W33 | | A | 8d. Undulating terrain | 315775 | 6392865 | AMBS (survey in 2001) | 2 | Erosion scar on a broad flat ridge |
| W34 | | IF | 8d. Undulating terrain | 315400 | 6392620 | AMBS (survey in 2001) | 1 | On unformed track. |
| W35 | | IF | 8d. Undulating terrain | 315290 | 6392505 | AMBS (survey in 2001) | 1 | On unformed track, 70 m from top of spur. 5 deg slope. |
| W36 | | A | 8d. Undulating terrain | 315190 | 6392495 | AMBS (survey in 2001) | 2 | On unformed track, 150 m from top of spur, slope easing. 25 m from junction with Wallaby Scrub Rd, firebreak. |
| W37 | | A | 8a. Undulating terrain | 316325 | 6391510 | AMBS (survey in 2001) | 18 | On unformed track, on high ridge, eroding out of very thin compact sandy topsoil onto gravely clay, bedrock no more than 20 cm below surface. |
| W38 | | A | 8a. Undulating terrain | 316250 | 6391545 | AMBS (survey in 2001) | 3 | On unformed track, thin compact sandy topsoil and gravely clay. |
| W39 (S) | | A | 8a. Undulating terrain | 316380 | 6391810 | AMBS (survey in 2001) | 5 | On exposure just below ridge knoll 30 m down on east shoulder. Thin topsoil, artefacts resting on gravely clay. |
| W39 (N) | | | | 316365 | 6391870 | | 2 | |
| W40 | | IF | 8a. Undulating terrain | 316495 | 6392025 | AMBS (survey in 2001) | 1 | Amongst open ironbark woodland on a slope within a ridge crest. Thin topsoil, gravely clay underneath. |
| W41 | | A | 8c. Undulating terrain | 316320 | 6389360 | AMBS (survey in 2001) | 5 | In unformed track on western slope of SH Ck. |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W42 | | A | 7. Woodlands | 318765 | 6387970 | AMBS (survey in 2001) | 2 | Exposed on unformed track under transmission line, 20 m north of a contour bank. |
| W43 | | IF | 3. Unnamed tributary to Wollombi Brook | 317430 | 6389230 | AMBS (survey in 2001) | 1 | |
| W44 | | IF | 3. Unnamed tributary to Wollombi Brook | 317300 | 6389125 | AMBS (survey in 2001) | 1 | At head of badly eroded gully. |
| W45 | | IF | 8c. Undulating terrain | 316670 | 6389490 | AMBS (survey in 2001) | 1 | On main track to house next to fence on watershed crest. |
| W46 | | A | 8c. Undulating terrain | 316485 | 6389400 | AMBS (survey in 2001) | 2 | Adjacent to recently graded track. Two artefacts 20 m apart |
| W47 | | IF | 10. Undulating slopes facing Doctors Creek | 317760 | 6388970 | AMBS (survey in 2001) | 1 | |
| W48 | | IF | 8g. Undulating terrain | 317495 | 6388270 | AMBS (survey in 2001) | 1 | Gully erosion |
| W49 | | IF | 8e. Undulating terrain | 316710 | 6388180 | AMBS (survey in 2001) | 1 | In exposure including a track under transmission line. |
| W50 | | IF | 8e. Undulating terrain | 316630 | 6388405 | AMBS (survey in 2001) | 1 | On side of track under transmission line. Lower slope, open forest, near NW cnr of dam below PL8. |
| W51 | | A | 8e. Undulating terrain | 316615 | 6388495 | AMBS (survey in 2001) | 2 | Artefacts in unformed track along transmission line |
| W52 | | IF | 8e. Undulating terrain | 316595 | 6388540 | AMBS (survey in 2001) | 1 | On unformed track |
| W53 | | IF | 3. Unnamed tributary to Wollombi Brook | 316465 | 6388920 | AMBS (survey in 2001) | 1 | On unformed track under transmission line. |
| W54 | | A | 3. Unnamed tributary to Wollombi Brook | 316375 | 6388965 | AMBS (survey in 2001) | 2 | Just east of graded track along fence along WS Rd. |
| W55 | | IF | 8e. Undulating terrain | 316435 | 6388710 | AMBS (survey in 2001) | 1 | On graded track adj to WS Rd. |
| W56 | | IF | 8e. Undulating terrain | 316525 | 6388365 | AMBS (survey in 2001) | 1 | Exposure west of graded track between track and fence along WS Rd. |
| W57 | | A | 8e. Undulating terrain | 316630 | 6388065 | AMBS (survey in 2001) | 4 | On graded track adj to WS Rd. |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W58 | | IF | 8e. Undulating terrain | 317035 | 6388640 | AMBS (survey in 2001) | 1 | On contour bank |
| W59 | | IF | 8e. Undulating terrain | 317195 | 6388725 | AMBS (survey in 2001) | 1 | SW corner of dam, exposed dam outer wall |
| W60 | | IF | 8e. Undulating terrain | 317180 | 6388760 | AMBS (survey in 2001) | 1 | Upper reaches of drainage line west of dam |
| W61 | | IF | 8e. Undulating terrain | 317135 | 6388790 | AMBS (survey in 2001) | 1 | Upper reaches of drainage line with grinding groove site PN10. |
| W62 | | IF | 8a. Undulating terrain | 316770 | 6391410 | AMBS (survey in 2001) | 1 | In drainage bank, mid-slope |
| W63 | | A | 1. Sandy Hollow Creek | 316770 | 6391280 | AMBS (survey in 2001) | 2 | Drainage bank, mid-slope. |
| W64 | | IF | 8d. Undulating terrain | 315165 | 6392805 | AMBS (survey in 2001) | 1 | |
| W65 | | A | 8b. Undulating terrain | 317350 | 6390705 | AMBS (survey in 2001) | 5 | On contour bank and exposures close by |
| W66 | | A | 1. Sandy Hollow Creek | 317055 | 6391075 | AMBS (survey in 2001) | 2 | In unformed vehicle track |
| W67 | | A | 8b. Undulating terrain | 317155 | 6391075 | AMBS (survey in 2001) | 2 | In graded protracted drain spoil and exposure on south side of formed track |
| W68 | | IF | 8b. Undulating terrain | 317285 | 6390675 | AMBS (survey in 2001) | 1 | On edge of contour bank |
| W69 | | A | 4. Sand Sheet adjacent to Sandy Hollow Creek | 316775 | 6391190 | AMBS (survey in 2001) | 3 | On high contour bank |
| W70 | | IF | 8d. Undulating terrain | 315140 | 6392510 | AMBS (survey in 2001) | 1 | |
| W71 | | IF | 8d. Undulating terrain | 315180 | 6392330 | AMBS (survey in 2001) | 1 | |
| W72 | | IF | 7. Woodlands | 318990 | 6387940 | AMBS (survey in 2001) | 1 | Isolated find in windrow of graded track. |
| W73 | | IF | 7. Woodlands | 319150 | 6387920 | AMBS (survey in 2001) | 1 | On contour bank |
| W74 | | IF | 3. Unnamed tributary to Wollombi Brook | 317280 | 6389360 | AMBS (survey in 2001) | 1 | Ridge crest, interfluve between 2 drainage lines. |
| W75 | | IF | 8c. Undulating terrain | 316585 | 6390135 | AMBS (survey in 2001) | 1 | |

| Site Name | NPWS Site No. | Site Type | Landform Zone | AMGE | AMGN | Recorder | Site Contents * | Comments |
|---|---|---|---|---|---|---|---|---|
| W76 | | A | 8c. Undulating terrain | 316595 | 6389755 | AMBS (survey in 2001) | 3 | Artefacts on unformed track west of small dam. |
| | | | | 316575 | 6389785 | | 2 | On unformed track |
| W77 | | A | 8b. Undulating terrain | 317215 | 6389880 | AMBS (survey in 2001) | 2 | Near drainage channel |
| W78 | | IF | 8b. Undulating terrain | 317035 | 6389975 | AMBS (survey in 2001) | 1 | On dam wall |
| W79 | | A | 8b. Undulating terrain | 317600 | 6390390 | AMBS (survey in 2001) | 3 | At junction with contour bank |
| W80 | | A | 8b. Undulating terrain | 317340 | 6390605 | AMBS (survey in 2001) | 2 | On contour bank - mid slope |
| W81 | | IF | 8b. Undulating terrain | 317210 | 6390445 | AMBS (survey in 2001) | 1 | On contour bank |
| W82 | | A | 8b. Undulating terrain | 317065 | 6390800 | AMBS (survey in 2001) | 5 | Ants nest exposure |
| W83 | | A | 8c. Undulating terrain | 316505 | 6389560 | AMBS (survey in 2001) | 3 | In area of gully erosion at upper reaches of drainage channel |
| W84 | | IF | 4. Sand sheet | 316564 | 6391010 | AMBS (survey in 2001) | 1 | Western section of sand sheet one chert flake. |
| F1 | | IF | 7. Woodlands | 319340 | 6388070 | Haglund 1991 | 1 | |
| F2 | | IF | 7. Woodlands | 319480 | 6388010 | Haglund 1991 | 1 | |
| F3 | | IF | 7. Woodlands | 319730 | 6388010 | Haglund 1991 | 1 | |

Notes:
* Site Contents column refers to number of artefacts/grooves observed by AMBS compared to number originally recorded.
Site Types include Artefact Scatter (A), Isolated Find (IF) and Grinding Groove (GG).

A total of 120 Aboriginal sites have been recorded in the Warkworth western extension area. This includes 47 previously recorded sites and 73 additional sites (artefact locations).

Site locations across the study area are shown on Figure 8. Artefact numbers present at sites across the study area are presented on Figure 10.

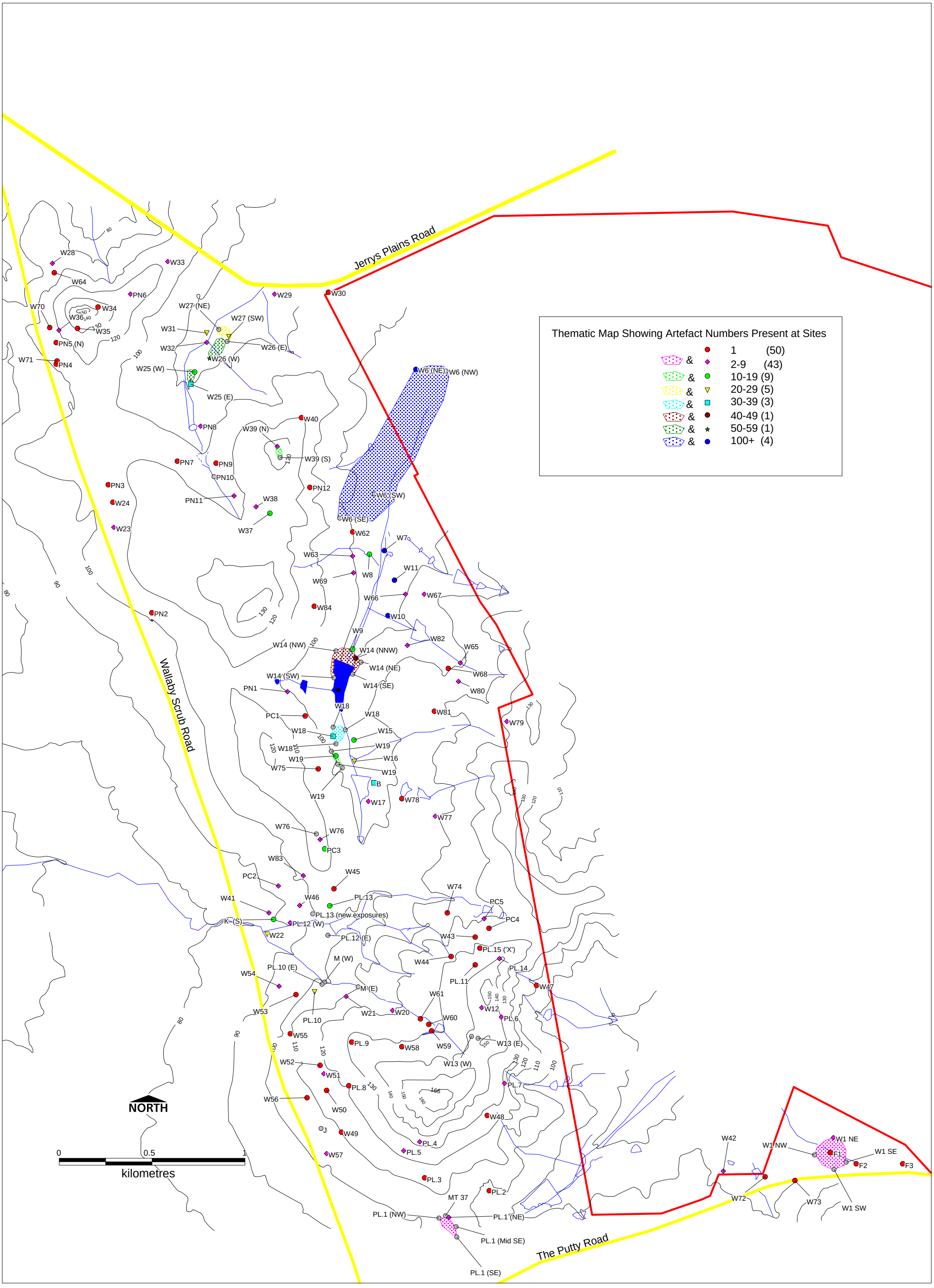


Figure 10. Numbers of Artefacts Present at Sites

The number of sites recorded in each Survey Area is shown in Table 7 below.

**Table 7. Number of Sites in each Survey Area**

| Landform Zone | Total Number of Sites | Site Types | Sites |
|---|---|---|---|
| 1. Sandy Hollow Creek | 15 | Artefact Scatter (14)<br><br><br><br><br>Isolated Find (1) | B, W6, W7, W8, W10, W11, W14, W15, W16, W17, W18, W19, W63, W66<br>W9 |
| 2. Longford Creek | 11 | Grinding Groove (1)<br>Artefact Scatter (8)<br><br>Isolated Find (2) | PN10<br>PN11, PN8, W25, W26, W27, W29, W31, W32<br>PN7, PN9 |
| 3. Unnamed tributary to Wollombi Brook | 17 | Grinding Groove (1)<br>Artefact Scatter (9)<br><br><br>Isolated Find (7) | M<br>K, PC5, PL10, PL12, PL13, W20, W21, W22, W54<br>PC4, PL11, PL15 ('X'), W43, W44, W53, W74 |
| 4. Sand Sheet | 2 | Artefact Scatter (1)<br>Isolated Find (1) | W69<br>W84 |
| 5. Saddle | 4 | Artefact Scatter (3)<br>Isolated Find (1) | MT37, PL1, PL4<br>PL3 |
| 6. Summit Ridge | 5 | Artefact Scatter (5) | PL6, PL7, PL14, W12, W13 |
| 7. Woodlands | 7 | Artefact Scatter (2)<br>Isolated Find (5) | W1, W42<br>F1, F2, F3, W72, W73 |
| 8. Undulating Terrain | 59 | Artefact Scatter (26)<br><br><br><br><br><br><br><br>Isolated Find (33) | J, PC2, PC3, PL5, PN1, PN5, PN6, W23, W28, W33, W36, W37, W38, W39, W41, W46, W51, W57, W65, W67, W76, W77, W79, W80, W82, W83<br>PC1, PL2, PL8, PL9, PN2, PN3, PN4, PN12, W24, W30, W34, W35, W40, W45, W47, W48, W49, W50, W52, W55, W56, W58, W59, W60, W61, W62, W64, W68, W70, W71, W75, W78, W81, |
| **Total** | **120** | | |

*Grinding Grooves:*
Clusters of grinding grooves were located in three separate locations within the study area. Site PN10 contained four grooves on a sandstone boulder next to Longford Creek. This site had previously been recorded by Haglund (1999). Site M had previously been recorded by Dyall (1979). Dyall recorded a total of 73 grooves in a distinct cluster within the bed of the tributary to Wollombi Brook. Additional survey of this area by Haglund (1999) recorded another nine grooves in a cluster approximately 250 metres upstream of Dyall's original recording. As a result, Dyall's Site M was re-named M (W) (for the western cluster) and the additional nine grooves as M (E). All three of the groove sites were re-located during the present survey.

PN10:
Site PN10 was recorded by Haglund (1999) as three grooves on a sandstone boulder approximately 1.5 metres long set into the bank of Longford Creek. Groove dimensions were given by Haglund (1999:30) as:

1. 300 mm x 75 mm x 15 mm
2. 270 mm x 75 mm x 9 mm
3. 290 mm x 80 mm x 13 mm

During the present survey a rounded indentation was identified on the same boulder (dimensions: 280 mm x 200 mm x 25 mm). It was not certain whether the indentation was the result of natural factors or human modification.

M (W):
Site M (W) was originally recorded by Dyall (1979) as Site M. Dyall recorded a total of 73 grooves at this location. During the present survey 38 grooves were visible. The grooves were located in a section of fine grained sandstone within the bed of the tributary to Wollombi Brook. A coarse conglomerate was located around the fine grained sandstone. Silt and vegetation encroached onto the sandstone creek bed, probably covering grooves recorded by Dyall so that they were not seen during the present survey.

Sketch plans of the grinding grooves at Site M (W) are contained in Appendix B.

M (E):
Site M (E) was recorded by Haglund (1999) as nine grooves in a cluster approximately 250 metres east of M (W). No other details were given. Only two grooves were clearly visible during the current survey, however, part of the sandstone platform in the creek bed was covered with silt and vegetation.

*Artefact scatters:*
Descriptions of artefacts recorded during the field survey for this project are presented in Appendix C.

A total of 533 artefacts were recorded during the survey (detailed in Table 8). The majority of artefacts recorded are flakes or broken flakes. A variety of other artefact classes were also recorded, including cores, retouched flakes (including a number of backed artefacts), hammerstones, flaked pieces, heat shatters and a single grinding stone. Mudstone and silcrete are the dominant raw material across the study area. Combined, these two raw materials account for 94% of all artefacts. Other raw materials include quartz, petrified wood, igneous material, chert, porcellanite, quartzite and sandstone (detailed in Tables 8 and 9).

The results fit with site prediction models. Stone artefact scatters were the predominant type of site recorded. The largest sites occur along major water courses. The nature of artefacts and raw materials were as expected. The artefacts were of locally derived raw materials. Grinding grooves occur where there are outcrops of sandstone in the creeklines.

**Table 8. Raw Material and Artefact Type Numbers across the Study Area**

| | **Raw Material** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Artefact Type** | Chert | Igneous | Mudstone | Porcellanite | Petrified wood | Quartz | Quartzite | Silcrete | Sandstone | **Grand Total** |
| Broken Flake | | 1 | 57 | | 1 | 3 | | 21 | | 83 |
| Core | | 1 | 19 | 1 | 1 | | 2 | 14 | | 38 |
| Flake | 3 | 3 | 254 | | 2 | 10 | 5 | 71 | | 348 |
| Flaked Piece | | | 29 | | | 1 | | 8 | | 38 |
| Grinding Stone | | | | | | | | | 1 | 1 |
| Hammerstone | | | 2 | | | | | | | 2 |
| Hammerstone Fragment | | 1 | | | | | | | | 1 |
| Heat Shatter | | | 5 | | | | | | | 5 |
| Not Recorded | | | | | | | | 1 | | 1 |
| Retouched Flake | | | 13 | | 2 | | | 1 | | 16 |
| **Grand Total** | 3 | 6 | 379 | 1 | 6 | 14 | 7 | 116 | 1 | **533** |

**Table 9. Distribution of Raw Materials across the Survey Areas (% of raw materials)**

| | **Survey Area** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Raw Material** | 1. Sandy Hollow Creek | 2. Longford Creek | 3. Unnamed Tributary to Wollombi Brook | 4. Sand sheet | 6. Summit Ridge | 7. Woodlands | 8. Undulating Terrain | 10. Slopes facing Doctors Creek * | **Survey Areas Combined** |
| Chert | | | | 8.3 | | | 1.8 | | 0.6 |
| Igneous | 1.5 | 1.6 | 1.4 | | | | | | 1.1 |
| Mudstone | 73.5 | 72.5 | 76.1 | 75 | 57.1 | 26.7 | 67 | 100 | 70.7 |
| Porcellanite | | 0.5 | | | | | | | 0.2 |
| Petrified Wood | 0.7 | 1.1 | | | | | 2.8 | | 1.1 |
| Quartz | 1.5 | 0.5 | 1.4 | | 42.9 | 20 | 3.7 | | 2.7 |
| Quartzite | | 1.1 | | | | 30 | | | 1.3 |
| Silcrete | 22.1 | 22.5 | 21.1 | 16.6 | | 20 | 24.8 | | 22.1 |
| Sandstone | 0.7 | | | | | | | | 0.2 |
| **Total (%)** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Total no artefacts** | 136 | 182 | 71 | 12 | 7 | 15 | 109 | 1 | **533** |

** Note: Landform Zone 10 was not surveyed however a single artefact was located and recorded in this landform zone during the survey.*

**Table 10. Artefact Types across the Survey Areas (% of artefact types)**

| | **Survey Area** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Artefact Type** | 1. Sandy Hollow Creek | 2. Longford Creek | 3. Unnamed Tributary to Wollombi Brook | 4. Sand sheet | 6. Summit Ridge | 7. Woodlands | 8. Undulating Terrain | 10. Slopes facing Doctors Creek * | **Survey Areas Combined** |
| Broken Flake | 21 | 11.5 | 25 | 25 | | 6.6 | 8.2 | 100 | 15.2 |
| Core | 8.7 | 4.4 | 8.8 | | | 33.3 | 9.1 | | 7.7 |
| Flake | 58 | 72 | 58.8 | 75 | 85.7 | 60 | 66.4 | | 65.3 |
| Flaked Piece | 8.7 | 7.1 | 1.5 | | 14.3 | | 10 | | 7.1 |
| Grindstone | 0.7 | | | | | | | | 0.2 |
| Hammerstone | | | | | | | 1.8 | | 0.4 |
| Hammerstone Fragment | | 0.5 | | | | | | | 0.2 |
| Heat Shatter | | 2.2 | | | | | 0.9 | | 0.9 |
| Retouched Flake | 2.9 | 2.2 | 5.9 | | | | 3.6 | | 3 |
| **Total (%)** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Total number artefacts** | 136 | 182 | 68 | 12 | 7 | 15 | 110 | 1 | 531 |

** Note: Landform Zone 10 was not surveyed however a single artefact was located and recorded in this landform zone during the survey.*

**Table 11. Flake:Core and Flake:Retouched Flake Ratios for Landform Zones 1, 2 and 8**

| | Zone 1 | Zone 2 | Zone 8 |
|---|---|---|---|
| flake:core | 9:1 | 19:1 | 8:1 |
| flake:retouched flake | 27:1 | 38:1 | 21:1 |

**Table 12. Comparison of Artefacts between Landform Zones**

| Survey Area | Total Area Surveyed ($m^2$) | Effective Survey Area ($m^2$) | % of Surveyed Land Effectively Covered | Total Area for Each Survey Area ($m^2$) | % of Total Area Effectively Covered | Number of Artefacts | Artefact Density (a/ESA $m^2$) |
|---|---|---|---|---|---|---|---|
| 1. Sandy Hollow Creek | 561,000 | 244,040 | 43.5 | 561,000 | 43.5 | 136 | 1/334 * |
| 2. Longford Creek | 295,200 | 16,230 | 5.5 | 295,200 | 5.5 | 182 | 1/89 |
| 3. Unnamed tributary to Wollombi Brook | 198,520 | 35,290 | 17.8 | 780,700 | 4.5 | 71 | 1/497 |
| 4. Sand Sheet | 203,940 | 1,980 | 1.0 | 203,940 | 1.0 | 12 | 1/165 |
| 5. Saddle | 132,200 | 3,970 | 3.0 | 132,200 | 3.0 | - | 1/3,970 |
| 6. Summit Ridge | 352,575 | 19,175 | 5.4 | 352,575 | 5.4 | 7 | 1/2,739 |
| 7. Woodlands | 280,260 | 24,685 | 8.8 | 457,000 | 5.4 | 15 | 1/1,646 |
| 8. Undulating Terrain | 491,695 | 137,800 | 28.0 | 5,927,000 | 2.3 | 109 | 1/1,264 |

** Note: Artefact density for Sandy Hollow Creek (Landform Zone 1) has been affected by the salvage collections and excavations (undertaken by Haglund). Artefact density for this landform zone was calculated from estimates of artefact numbers before salvage, provided by Haglund (1991). All other density calculations are based on artefacts recorded by AMBS.*

### 8.1.1 Artefact Distribution and Density

The artefacts recorded during the survey provide some opportunity to compare the archaeological patterns within different landform zones. Most of the artefacts recorded were located near drainage lines, within Landform Zones 1, 2, 3 and 8 (Table 10). When survey coverage within landform zones is considered it becomes apparent that these are also zones with high artefact densities (Table 12). This result suggests more intensive use within these landforms and is consistent with other survey results in the study area (Haglund 1999). The large number of sites and artefacts recorded within Landform Zone 8 is interesting, as this is not a drainage line zone, but undulating terrain. However, this landform zone was the predominant landform for the study area. Therefore, while there is a high number of sites and artefacts recorded within this landform, these are spread over this landform zone within the study area, therefore the density of artefacts is lower. Figure 10 shows that most of the sites recorded within this landform are isolated finds or contain less than 10 artefacts.

The results also suggest a relatively high artefact density on the sand sheet, Landform Zone 4. While only 12 artefacts (and 3 sites) were recorded on the sand sheet it represents a high artefact density, second only to the artefact density calculated for Longford Creek, Landform Zone 2. Artefact density calculated for Sandy Hollow Creek, Landform Zone 1, is much lower than expected (and lower than the artefact density calculated for the sand sheet). But this density was calculated using estimates of artefact numbers provided by Haglund (1991) in sites along the creek (W6, W7, W8, W10 and W11). These sites were subsequently salvaged and were not rerecorded by AMBS. The artefact numbers at these sites may have been underestimated, as artefact densities along Sandy Hollow Creek are likely to be similar to (or higher than) densities along Longford Creek. The high artefact density recorded for the sand sheet remains an interesting result. Its location adjacent to Sandy Hollow Creek may be a contributing factor.

The lowest artefact densities were found on the saddle (Landform Zone 5) and summit ridge (Landform Zone 6). This is interesting in that these two landform zones are often targeted for archaeological survey, with the expectation that sites will be found in these areas.

### 8.1.2 Raw Material and Artefact Classes

Comparing variation in the artefacts, in terms of raw material type and artefact classes, within different landform zones might also indicate differences in behaviour or occupation of different areas.

The frequency of mudstone and silcrete across the area is remarkably constant. Within Landform Zones 1, 2, 3, and 8, mudstone comprises about 70% of recorded artefacts (varying between 67% and 74.7%) and silcrete about 23 % (varying between 21.1% and 25%) (refer to Table 9). Proportions of artefacts in other landform zones vary considerably, but the numbers of artefacts recorded within these zones do not constitute large enough sample sizes to provide comparable data. The distance from

raw material sources is effectively the same for all zones (raw material sources are within gravels associated with the Hunter River or further afield). Similar proportions of the different raw materials might therefore be an expected result. However the frequency of different materials might also be associated with different patterns of behaviour, or activities that occur, in different zones. For example, if camping or more long term occupation occurs along creeklines (close to water) then sites within these zones might be the location of more intensive knapping or where good quality material might be knapped more intensively than at sites away from creeks. These differences might be reflected in the frequency of different materials within the different zones. Table 9 indicates greater variety of raw materials at sites in Landform Zones associated with creeks, but that a higher frequency of raw material other than silcrete and mudstone occurs within Landform Zone 8 undulating terrain (see also Figure 11). These findings are consistent with the model describing differential use of the landscape where more complex sites (i.e. sites with a greater variety of raw materials and artefact types) which represent extended periods of occupation, are associated with drainage lines.

Variation of artefact classes within landform zones offers limited support for differential patterns of behaviour (Tables 10 and 11). Three landform zones (1, 2 and 8) have sample sizes of over one hundred (here considered a minimum sample size for analysis). The ratio of flake to cores and flakes to retouched flakes, within these three Landform Zones, are provided in Table 11. The results suggest that the greatest variety of artefact types is found in these three landform zones, however it could also be a factor of sample size. It does appear interesting that there is as much variety across the undulating terrain landform zone as for those associated with creeklines.

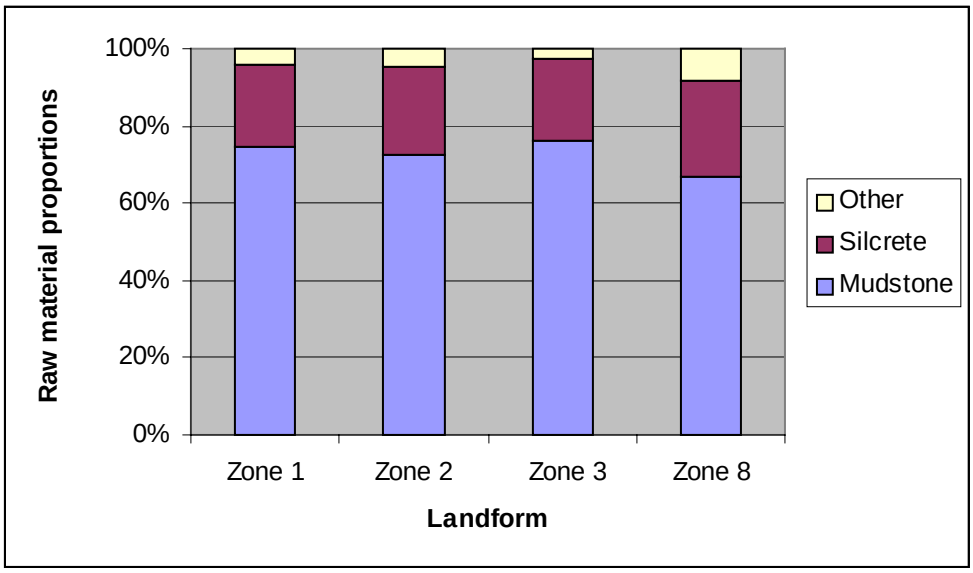


**Figure 11. Histogram indicating Raw Material Frequencies in Landform Zones 1, 2, 3 and 8**

## 8.2 Test Excavation

The following section describes the results of the test excavation of the sand sheet adjacent to Sandy Hollow Creek (Landform Zone 4). It details the stratigraphy and geomorphic context of the sand sheet and the analysis of the cultural material recovered.

### *8.2.1 Stratigraphy*

When the excavations were carried out the moisture content of the sediment ranged from damp at the surface to saturated at the base of the A horizon sands. In all pits except Pit 10, the one most distant upslope from the creekline, seepage occurred at the junction between the soft A horizon sand and the dense, impermeable B horizon clayey sand and sandy clay. In all the pits where there was seepage the walls eventually collapsed to some extent before they were backfilled. The high moisture content of the sand may have masked any slightly blocky structure or friable texture that might otherwise have been evident if the sand had been dry. The B horizon sediments were similarly damp to wet and this may have masked any tendency the material would have had to break into blocky peds if dry. The B horizon material here closely resembled that from the Cheshunt dune (Hughes and Shawcross 2001), which was dry at the time of the excavations and was moderately pedal.

The stratigraphy of the excavated deposits was similar across the sand sheet. The profile can be described using conventional terminology as having A, B and C horizons, however as discussed below, there appears to be a major hiatus between the A and B horizons. In the Northern Excavation Area the A horizon sands were generally only 250-500 mm thick, whereas in the Southern Area they were 700-1,500 mm thick.

Figure 12 illustrates the stratigraphy of pits excavated across the sand sheet and shows the thickness of sands in relation to relative contour level.

| | |
|---|---|
| $A_1$ horizon | Turf and slightly organic greyish brown topsoil formed on soft, well sorted sand. Usually about 200 mm thick and the sharpness of the boundary with the underlying $A_2$ horizon suggests it may represent the plough zone. |
| $A_2$ horizon | Homogenous well sorted soft sand. Usually pale yellowish grey, especially downslope towards the diversion drain, but brown upslope. Variable but usually very small amounts of granules and fine gravel. A sharp, unconformable and generally undulating break to: |
| B horizon | Characteristically about 50-100 mm of compact clayey sand giving way downwards sharply to extremely hard sticky sandy clay. Grey throughout with well developed red-orange-brown mottles. Occasional fissures filled with soft grey clayey sand extend at least 200 mm into the B horizon. Because the deposit was wet, it is uncertain to what extent these are desiccation cracks, infilled tree roots or jointed soil peds. In Pit 4 at the Northern Excavation Area the B horizon was 450 mm thick and in the trench associated with Pit 7 in the Southern Excavation Area it was 330 mm thick. Gradational change to : |
| C horizon | Compact generally structureless grey clayey sand with some mottling, usually either at the top or base. Moderately weathered. |

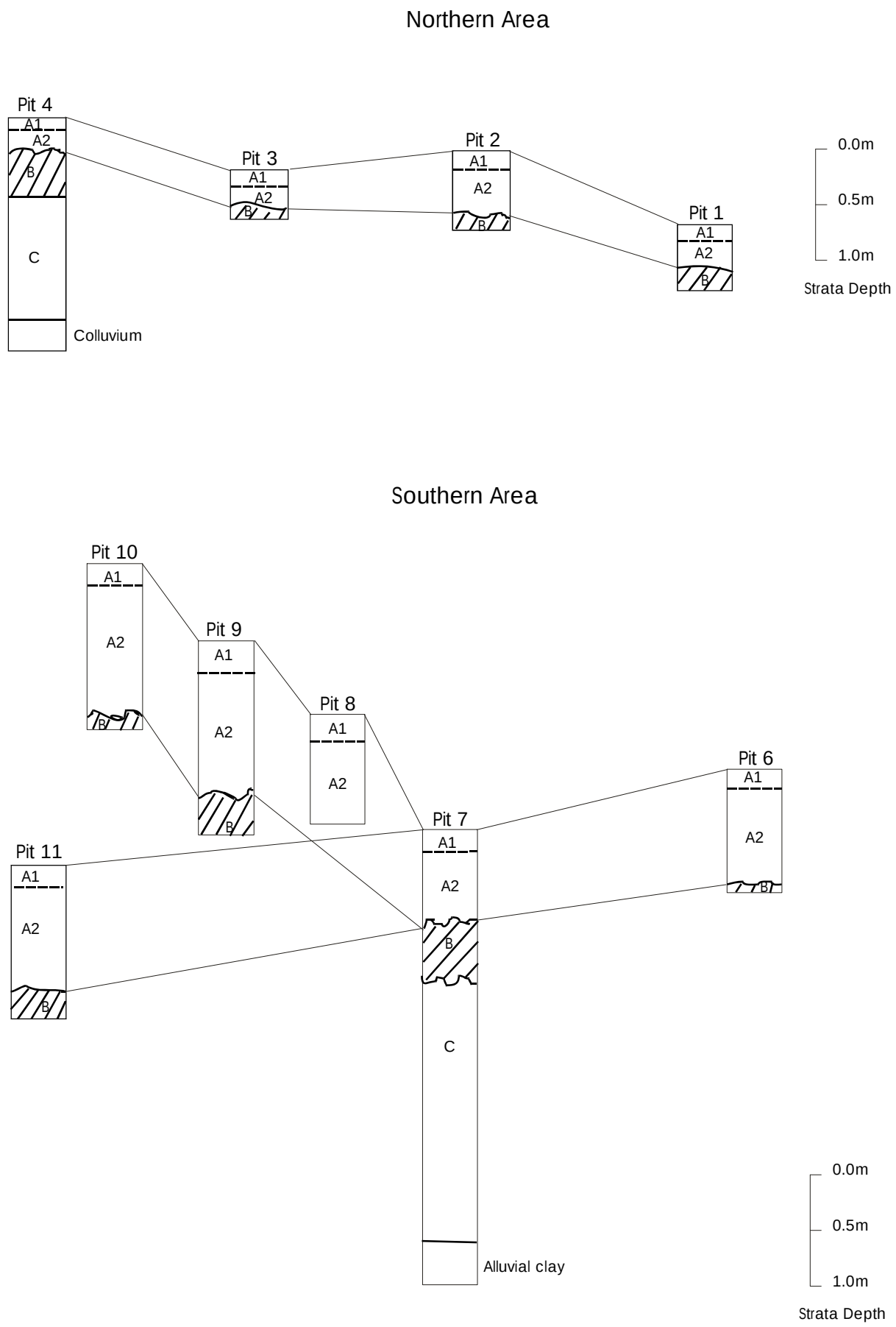


Figure 12
Section Showing the Stratigraphy of Pits Excavated on the Sand Sheet Showing the Thickness of Sands in Relation to Relative Contour Level

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### 8.2.1.1 Northern Excavation Area

**Pit 1**

| | | |
|---|---|---|
| *Location* | | Northernmost pit, 20 m north of Pit 2 |
| *Stratigraphy (mm from surface)* | | |
| | 0-200 | $A_1$ Greyish brown slightly organic sand and turf. Irregular but sharp change to |
| | 200-450 | $A_2$ Pale yellowish grey sand with faint reddish brown mottles at base. Numerous pieces of fine gravel (~1% by volume), increasing with depth. Abrupt change to |
| | 450-600 | B Compact orange, yellow and grey mottled clayey sand, increasing content of clayey aggregations with depth, with base of excavation on dense, extremely hard sandy clay |

**Pit 2**

| | | |
|---|---|---|
| *Location* | | 20 m south of Pit 1 |
| *Stratigraphy (mm from surface)* | | |
| | 0-200 | $A_1$ Greyish brown slightly organic sand and turf. Irregular but sharp change to |
| | 200-500 | $A_2$ Pale yellowish grey sand. Numerous pieces of fine gravel (~1% by volume), increasing with depth. Abrupt change to |
| | 500-550 | B 50 mm of compact grey mottled clayey sand with orange-red mottles. Base of excavation on dense, extremely hard sandy clay |

**Pit 3**

| | | |
|---|---|---|
| *Location* | | 40 m south of Pit 1 |
| *Stratigraphy (mm from surface)* | | |
| | 0-200 | $A_1$ Greyish brown slightly organic sand and turf. Irregular but sharp change to |
| | 200-300 | $A_2$ Pale yellowish grey sand. Numerous pieces of fine gravel (~1% by volume), increasing with depth. Abrupt change to |
| | 300-400 | B 50 mm of compact grey mottled clayey sand with orange-red mottles. Base of excavation 50 mm into dense, extremely hard sandy clay |

**Pit 4**

| | | |
|---|---|---|
| *Location* | | 60 m south of Pit 1 |
| *Stratigraphy (mm from surface)* | | |
| | 0-110 | $A_1$ Greyish brown slightly organic sand and turf. Irregular but sharp change to |
| | 110-250 | $A_2$ Pale yellowish grey sand with some fine gravel. Abrupt change to |
| | 250-350 | B 100 mm of compact grey mottled clayey sand with orange-red mottles excavated by shovel down to dense, extremely hard sandy clay |
| | 350-700 | B Excavated with backhoe. Massive grey sandy clay with orange brown mottles. Gradual change to |
| | 700-1,700 | C Compact mottled grey and yellow clayey sand with aggregations of massive sandy clay. Gradual change to |
| | 1,700-1,800 | C Compact grey clayey sand with large orange mottles. Gradual change to |
| | 1,800-2,000 | Mixed transition between C horizon and 'bedrock'. Gritty/stony grey sandy clay. Abrupt change to |
| | 2,000-2,100 | 'Bedrock'. Gravel rich very poorly sorted dark grey sandy clay. Probably colluvium. Base of hole at 2,100 mm. |

### 8.2.1.2 Southern Excavation Area

**Pit 6**

*Location* 20 m north of Pit 7, immediately adjacent to diversion drain

*Stratigraphy (mm from surface)*

| | |
|---|---|
| 0-200 | $A_1$ Greyish brown slightly organic sand and turf. Irregular change over 20 mm to |
| 200-1,100 | $A_2$ Pale yellowish grey sand with traces of fine gravel. Increasingly waterlogged at depth. Abrupt, undulating change to |
| 1,100-1,150 | B 50 mm of compact grey mottled clayey sand with diffuse orange-red mottles excavated by shovel down to dense, extremely hard sandy clay at base of excavation. |

**Pit 7**

*Location* At junction of the two lines of pits, immediately adjacent to diversion drain

*Stratigraphy (mm from surface)*

| | |
|---|---|
| 0-200 | $A_1$ Greyish brown slightly organic sand and turf. Irregular change over 20 mm to |
| 200-900 | $A_2$ Pale yellowish grey sand with traces of fine gravel. Increasingly waterlogged at depth. Abrupt, undulating change to |
| 900-950 | B 50 mm of compact grey mottled clayey sand with diffuse orange-red mottles excavated by shovel down to dense, extremely hard sandy clay at base of excavation. |

Backhoe excavated a 1 m 'slot trench' down the face of the diversion drain immediately in front of Pit 7. Stratigraphy recorded and OSL sample collected from this trench. At base of drain about 2.5 m below surface of sand sheet dug pit to below base of sand sheet

| | |
|---|---|
| 950-1,230 | B Mixed massive grey sandy clay and clayey sand with large orange-yellow mottles. Gradual change to |
| 1,230-3,700 | C Compact moderately weathered clayey sand with diffuse red-yellow mottles which decrease in frequency downwards. Abrupt change to |
| 3,700-4,000 | 'Bedrock' Massive grey clay. Darker grey and mottled orange with increasing depth. No gravel. Probably alluvial fill of former course of Sandy Hollow Creek. |

**Pit 8**

*Location* 20 m west of Pit 7

*Stratigraphy (mm from surface)*

| | |
|---|---|
| 0-250 | $A_1$ Greyish brown slightly organic sand and turf. Irregular undulating change over 20 mm to |
| 250-1,000 | $A_2$ Pale yellowish grey sand with traces of fine gravel. Faint yellowish mottling below 900 mm. Increasingly waterlogged at depth. Sections collapsed at this stage. B horizon was not reached. |

**Pit 9**

*Location* 40 m west of Pit 7

*Stratigraphy*
*(mm from surface)*

| | |
|---|---|
| 0-200 | $A_1$ Brown to dark brown slightly organic sand and turf. Irregular but abrupt change to |
| 200-1,500 | $A_2$ Yellowish brown sand with traces of fine gravel. Below about 700 mm brown in colour and from about 900 mm occasional soft reddish iron rich nodules up to 20 mm across. Between about 1,100 and 1,300 mm very much higher gravel content (about 0.5% by volume) than above or below. Below about 1,300 mm nodules not present but diffuse orange brown mottles occur. Increasingly waterlogged at depth, but not as wet as downslope Pits 6, 7 and 11. Abrupt, undulating change to |
| 1,500-1,720 | B 50 mm of compact grey mottled clayey sand with diffuse orange-red mottles overlaying dense, extremely hard sandy clay at base of excavation. The hard sandy clay was grey, with large (~100 mm) bright orange brown mottles. A few vertical cracks filled with grey clayey sand extended down into the sandy clay. |

**Pit 10**

*Location* 60 m west of Pit 7

*Stratigraphy*
*(mm from surface)*

| | |
|---|---|
| 0-200 | $A_1$ Dark brown to dark yellowish brown slightly organic sand and turf. Irregular but abrupt change to |
| 200-1,400 | $A_2$ Brown to yellowish brown sand with traces of gravel, much of it coarser than in the downslope pits. Below about 400 mm numerous soft to firm reddish brown iron rich nodules up to 20 mm across. These nodules decline sharply in frequency below 800 mm. Below about 900 mm to the base of this horizon sharp increase in gravel content to about 1% by volume. Sand is soft and dry to damp. Abrupt, undulating change to |
| 1,400-1,500 | B Compact grey mottled clayey sand to sandy clay with diffuse orange-red mottles. Extremely hard and 100 mm thick spit removed by pick from 20% of floor area. Gravel was present in the sieved sample. |

**Pit 11**

*Location* 20 m south of Pit 7, immediately adjacent to diversion drain

*Stratigraphy*
*(mm from surface)*

| | |
|---|---|
| 0-200 | $A_1$ Brown slightly organic sand and turf. Irregular change over 20 mm to |
| 200-1,100 | $A_2$ Pale yellowish grey sand with virtually no gravel. Massive burnt tree stump and root system encountered in this pit. Increasingly waterlogged at depth. Abrupt, undulating change to |
| 1,100-1,320 | B Compact grey mottled clayey sand and sandy clay with large reddish brown mottles. 220 mm of deposit excavated by shovel. Grey sand filled fissures extended into the hard sandy clay. These are probably infilled tree roots associated with the large tree stump recorded in the A horizon. |

### 8.2.1.3 Optically Stimulated Luminescence (OSL) Dating Samples

Optical Dating is a luminescence dating technique which relies on measuring light emitted from naturally occurring mineral crystals (such as quartz or feldspar) found in sediments. This light represents energy which has slowly accumulated through time as charges are trapped as defects in the crystal lattices of these minerals. The energy originates principally from decay of the naturally-occurring radio-isotopes in the soil, with a lesser contribution from cosmic rays.

Optical Dating utilises luminescence signals which are very sensitive to exposure to light; consequently when the sediment was deposited in antiquity the light exposure at that time erased these signals completely. During the period of burial darkness, the absorption of radiation from the environmental radiation field slowly rebuilt the signal. Measurement of this re-accumulated signal, along with the intensity of the environmental radiation field, permit calculation of the time elapsed since the burial of the measured mineral grains - this is the Optical Age of the sediment.

Three samples of deposit for OSL dating were collected by Norman Hill and Iain McCulloch from the Australian National University.

- Sample 1. From Pit 9, 600 mm below the surface in the $A_2$ horizon.
- Sample 2. From Pit 9, 1,250 mm below the surface in the $A_2$ horizon
- Sample 3. From the trench in front of Pit 7. In the C horizon 2.8 m below the projected original ground surface and 1 m below the projected surface of the B horizon.

These samples are currently being processed and age estimates will not be available until September or October 2002. Results will be forwarded to Coal & Allied, the relevant Aboriginal organisations and NPWS as soon as available.

### 8.2.1.4 Discussion and Interpretation

The alignment of the sand sheets (specifically B and C on Figure 3) indicates that they were derived from Wollombi Brook to the northwest. Wollombi Brook drains a large area of quartzose Sydney Basin sandstones and its present sediment load consists largely of quartz sand. The two sand sheets along Sandy Hollow Creek examined in this study and by Fahey (1994) also consist predominantly of quartz sand. Given the lack of abundant easily weatherable minerals in these sands, the degree of weathering and clay formation exhibited by the B horizon (and to a lesser extent the C horizon) indicates that these sands were emplaced and stabilised well before the Holocene. Given their broad similarity to the 88,000 year old Cheshunt dune, it is likely that the B horizon sands are of a similar if not older age than that dune.

In the Northern Area the sand sheet rests on even older stony colluvial material. In the Southern Area it rests on stone-free clay interpreted as older Sandy Hollow Creek alluvium. If so, the evidence from both sand sheets along the creek indicates that their formation forced a migration of the creek channel east of its former position (c.f. Fahey 1994: 5-6).

The excavated A horizon sands show little sign of weathering except for some slight mottling at their base and some soft iron-rich nodule formation in the upslope sands. They cannot be the original *in situ* A horizon material that existed when the sand sheet first accumulated in the Pleistocene. Their looseness and lack of weathering suggest that they probably accumulated during the Holocene. If so, this would mean that the excavated assemblage of artefacts is also Holocene in age.

It is hypothesised that since the initial formation of this sand sheet, the loose upper sands have always been mobile to varying degrees and that there has been slow but progressive movement of sand under the influence of the dominant northwesterly winds. The moving sand was captured and transported by Sandy Hollow Creek, perhaps to form the 'fluvially redeposited aeolian sand' older than 12,000 years described by Fahey (1994) from the vicinity of Site W6 and downstream. The sand was replenished from the larger sand sheet to the northwest (C on Figure 3). It is noteworthy that the sand sheet where the excavations were carried out (B on Figure 3) is below and in the lee of a small hill, a circumstance which would have facilitated the accumulation of sand at this particular locality. The presence of small amounts of gravel in the A horizon sands interpreted as colluvium/alluvium (see below) supports the contention that these sands have been mobile.

Gravel and granules component:
In most of the pits the soft A horizon sands contained very small amounts of granules and in a few cases fine gravel. In the upslope Pits 9 and 10 in the Southern Excavation Area, larger amounts of coarser gravel comprised up to 1% by volume of the basal part of the A horizon. Given that the feature is an aeolian sand sheet, this coarser sediment could not have been blown in along with the sand.

At Cheshunt, where the sand dune formed the highest feature in the local landscape, the presence of similar coarser fractions (albeit in the B and C horizons rather than the A horizon) it was hypothesized that these coarse grains were derived from the underlying alluvium and were brought up into the sand by tree throw early in its history of accumulation and/or consolidation. This explanation is unlikely for the Warkworth West A horizon sands as the underlying 'bedrock' is sealed in by between 1.5 m and 3 m of B and C horizon sands.

The small amounts of coarser basal gravel in the upslope Pits 9 and 10 are most likely to have been transported from the hillslopes several hundred metres to the west by slope wash, i.e. they constitute a colluvial/alluvial component in sands which are ultimately aeolian in origin but appear to have been fluvially reworked to an unknown degree. If this is accepted, then the very much smaller and finer content of granules and gravel elsewhere is also probably colluvial/alluvial in origin.

Bioturbation:
Evidence for extensive bioturbation of the loose upper sands has been demonstrated at both the Cheshunt site (37-5-166) (Hughes and Shawcross 2001) and the Hunter Valley No. 1 site (37-5-63) (Hughes 1997, Hiscock and Shawcross 2000). This Sandy Hollow Creek sand sheet has undoubtedly also been affected by bioturbation, as discussed in the section on site formation processes (refer to Section 8.2.2). Foremost amongst these are likely to have been large scale processes such as tree throw (very

large trees are currently growing on parts of the sheet), the decay of the roots and boles and the consequent formation of voids, large animal burrows and insect, beetle and ant burrowing.

The archaeological and stratigraphic evidence indicates however that some residual stratification may have survived such processes.

<u>The nature and distribution of artefacts – implications for the geomorphic history:</u>
There are three lines of archaeological evidence that indicate the site is stratified to some extent.

1. No artefacts made on silcrete were recovered from below Spit 6 in any of the pits. With the exception of two quartz artefacts, all of the 25 artefacts recovered from below Spit 6 were made on mudstone. This distribution could not have come about as a result of bioturbation.

2. In the Southern Area there are indications of a bimodal distribution of artefacts with depth. This is most evident in Pits 8 and 9 and less so in Pits 6 and 10. The distributions in Pits 7 and 11 are unimodal, although Pit 7 has the smallest number of artefacts in this sample (n=17) and therefore the lack of bimodality could reflect small sample size.

3. The two deepest artefacts (from Spits 13 and 15 in Pit 9) both had consolidated sand adhering to a surface, suggesting they may have been in their place of deposition for a considerable period.

If the site is stratified, then since Aboriginal use of the site first became archaeologically visible (e.g. with the artefact in Spit 15 of Pit 9) there has been net accumulation of up to 1.5 m of sand across those parts of the site subjected to excavation. The movement of sand and its accumulation on the lower slopes where the excavations were undertaken apparently increased considerably as a result of European land use changes such as cultivation and stock grazing, presumably preceded by tree clearing. At the Northern Excavation Area about 400 mm of loose sand had accumulated upslope of a now-abandoned netting fence between the sand sheet paddock and the creekline. In total only two artefacts were recovered from Spit 1 (one each in Pits 8 and 11) (see Table 18) indicating that the archaeological deposit has been buried by the products of European induced erosion of sands from upslope.

### *8.2.2 Artefact Analysis*

This section details the analysis of the stone artefact assemblage recovered during the test excavations of the sand sheet. The assemblage consists of 213 artefacts recovered from nine of ten test pits in two excavation areas. The methodology employed was designed to characterise the assemblage and to investigate the vertical distribution of artefacts through the sand. Patterns of artefact distribution may provide evidence for sequential occupation over time and identify vertical migration of artefacts caused by taphonomic processes.

#### 8.2.2.1 Objectives

Test excavations on the Warkworth West sand sheet were conducted for two interrelated reasons: 1) to investigate the archaeological significance of the sand sheet, and 2) to investigate the formation and history of the sand sheet in the context of our understanding of the Late Pleistocene and Holocene geomorphology of the region.

In the Hunter Valley, sand dunes and sand sheets are thought to have some potential for providing stratified sites and for containing older archaeological material than the Bondaian assemblages recovered from the more common duplex soils of this region. The Unit A layers of duplex soils are considered to be both relatively recent in age and to have limited or no stratigraphic integrity and therefore are likely to provide little if any opportunity to study pre-Bondaian assemblages (refer to Section 5.3.4 above).

The artefact analysis had three objectives:

1. To quantify the presence of artefacts on and in the sand sheet and describe the distribution of artefacts through the sand sheet;
2. To describe the assemblage and characterise its components in a way that enables comparison with other assemblages; and
3. To describe the vertical distribution of artefacts within the sand sheet and investigate the extent to which this distribution may be the result of sequential occupation or other taphonomic processes.

#### 8.2.2.2 Site Formation Processes

Site formation involves a broad range of complex processes. Discard and accumulation of artefacts first relates to human behaviour and is determined by the types of activities, frequency of visitation to the site, size of groups using the site and period of occupation. Investigating these behaviours is complicated by a number of other natural and cultural processes that impact on the artefacts and disturb the site's integrity (Schiffer 1987). These are commonly referred to as taphonomic processes.

Understanding site formation is crucial to this analysis. At Warkworth, taphonomic processes are likely to have had a significant impact on archaeological material. These processes are briefly outlined below.

##### 8.2.2.2.1 Natural Processes

<u>Aeolian Processes:</u>
The sand sheet is aeolian in origin – it derives from windblown sands. The nature of the excavated deposit indicates that the soft sand overlying the core of hard sandy clay is of Holocene age and that during the period stone artefacts accumulated wind was a significant erosional and depositional force, resulting in the net accumulation of up to 1.5 m of sand (refer to Sections 5.3.1 and 8.2.1).

Hydrological Processes:
The sand sheet slopes gently towards Sandy Hollow Creek. The presence of small amounts of gravel and granules in the deposit – especially at the base of Pits 9 and 10 – indicates that during some periods runoff carrying coarser sediment contributed to deposition of sediment (albeit in a very minor way). This fluvial activity may have disturbed the cultural materials to an unknown extent.

Bioturbation:
During excavation many animals were found living in the deposit. The action of these animals may cause the artefacts to be displaced vertically - a process known as bioturbation. Ants probably have the greatest effect (ants were found at depths of about 1,000 mm), but beetles and other insects were common throughout the deposit.

Larger burrowing animals (such as rabbits and other small mammals) may also have affected the sand sheet, although no evidence of this was encountered in the pits excavated.

Plants may also affect the deposit and provide mechanism for vertical migration of artefacts. Grass roots extended at least 1000 mm into the sand. Burnt tree roots and the remnant of a tree stump were evident in Pit 11. In this pit cavities formed by old roots and extending into the clay were filled with sand, and potentially artefacts.

Another form of bioturbation is tree throw. When a tree dies and falls it may lift up large amounts of earth and sand with its roots and effectively mix the deposit. Although the sand sheet is now covered with improved pasture, there are a few very large Eucalyptus trees, which indicate that the area was once forested.

#### 8.2.2.2.2 Cultural Processes

There are many cultural processes that may disturb sites. From the time a site is first occupied, people's behaviour may impact on its integrity. Movement of people over the site during occupation, construction of shelters and campfires, and sweeping of material may act to damage and displace artefacts. Campfires may also shatter the artefacts. Bushfires and fires used by people for hunting or land management (see Brayshaw 1986) might have had a similar effect.

Land use by people after Aboriginal occupation may also affect site integrity and may be the cause of the most severe disturbance. There is evidence that since European land use began there has been accelerated sand movement downslope, leading to the build up of a layer of sand at least 400 mm thick against a former netting fence adjacent to the creek.

Ploughing:
The sand sheet has been cleared of trees to provide pasture for cattle. A common practice is to rip or plough the ground surface to improve the quality of the pasture. The excavated deposit indicated a plough zone extending approximately 200 mm into the deposit. As ploughing breaks and lifts the topsoil it is likely that within this zone artefacts have moved down into the deposit.

Cattle and Sheep:
The sand sheet is currently used as grazing land for cattle. Trampling may impact on artefacts and their distribution.

### 8.2.2.3 Methods

The methodology employed for this study was designed primarily to investigate vertical movement of artefacts through the sand sheet in order to distinguish sequential occupation and stratification from subsequent vertical migration of artefacts through the deposit. Analysing artefact densities, size and raw material was sufficient for this purpose.

The test excavations constitute a very small sample of the sand sheet, however the assemblage also has some potential to compare occupation at this site with occupation at other sites. To facilitate this comparison a number of other variables were recorded and considered in the analysis.

#### 8.2.2.3.1 Artefact Identification and Classification

Flaked stone artefacts have a number of diagnostic features that distinguish them from naturally occurring stone (Cotterell and Kamminga 1987, Andrefsky 1998). Features such as negative or positive bulbs of percussion, ring cracks, ripple marks, terminations, and errailure scars are all indicative of flaked stone artefacts. For this analysis, artefacts were identified using one or more of these features. A number of heat shattered pieces without diagnostic features were also recovered. Heat shatters were identified by features indicative of heat exposure such as crenated surfaces, potlidding or crazing, the lack of diagnostic flake features and by raw material (exotic stone that does not originate from the site and is the same as the artefactual material). Heat shatters are included in the analysis as they derive from either flaked artefacts or material transported to the site and in this sense are either non-diagnostic fragments of artefacts or manuports. In any case they are likely to reflect occupation surfaces and be affected by taphonomic processes in the same way as the diagnostic flaked stone artefacts.

In this analysis artefacts are classified within a technological framework (following Hiscock 2000). Using this framework all flaked artefacts fall into four categories:

*Core*: an artefact that has only negative scars from flake removal, and no positive ventral surface.

*Flake*: a piece of stone struck off a core. This class will have a positive bulbar surface and will often display features associated with the force used to remove the flake. The features can include a positive ring crack, bulb of force, eraillure and force ripples (Cotterell and Kamminga 1987).

*Retouched flake*: a flake that has had flakes removed from it after the initial flake was made. Negative scars either encroaching over the ventral surface of the flake, or initiating from the ventral surface identify this sequence of events.

*Flaked piece*: an artefact that has technologically diagnostic features but has no discernible ventral or dorsal surface and hence is unidentifiable as either a flake or a core.

#### 8.2.2.3.2 Raw Materials

Mudstone:
In the Hunter Valley mudstone occurs as cobbles within gravel associated with the Hunter River. The material is a fine-grained siliceous sedimentary rock ideal for the manufacture of stone tools. Mudstone has been variously identified as indurated mudstone, and rhyolitic or silicified tuff (e.g. Hiscock and Shawcross 2000, Kuskie and Kamminga 2000, White 1999a). The material is variable but these terms probably reflect archaeologist's preferred name as much as the petrology of the material. As mudstone or indurated mudstone is most commonly used to describe this raw material and is a more inclusive term, mudstone is used here.

Silcrete:
Silcrete is a silicified sedimentary rock, often with fine inclusions or grains in a cryptocrystalline matrix. Silcrete is sometimes heat treated to improve its flaking quality (Flenniken and White 1983). Heat treatment and heat exposure will also affect the stone in terms of colour (which may become red) and lustre (surfaces knapped after heat treatment are more lustrous) and surface quality (potlidding crenation and crazing may occur). Heat treatment can not be easily distinguished from heat exposure (Rowney and White 1997, Mercieca 1999).

#### 8.2.2.3.3 Other Variables

A number of other variables were recorded in order to characterise the assemblage and provide data comparable with that from other assemblages. These variables include the completeness of flakes, the type of retouched flake and two key flake attributes: platform type and presence or absence of overhang removal. Particular flake attributes are associated with backed artefact manufacture and frequencies of these attributes have been correlated with different backed artefact (or Bondaian) industries or phases (Hiscock 1986, 1993; Hiscock and Shawcross 2000).

Completeness of flake:
Flakes are categorised as either complete or broken. Broken flakes are further categorised as proximal fragments - with a point of force application (pfa) or ring crack intact, or as other fragments - without pfa.

Type of retouched flake:
Retouched flakes are categorised as either backed artefacts or other retouched flakes. Backed artefacts are small retouched flakes that have abrupt retouch or backing along a margin (see Hiscock and Attenbrow 1996). Backing generally involves bipolar or anvil assisted knapping along a margin opposite a sharp edge.

Platform class:
The surface characteristics of a flake platform can be used to allocate it to one of five groups:

*Cortical platforms*: Any platform on which cortex is present, either partially or completely, is termed a cortical platform.

*Plain platforms*: Plain platforms consist of a single flake scar or tertiary surface. They may be the result of flaking within a flake scar during an alternating reduction or from continuous unifacial reduction. Most commonly, plain platforms result from unifacial reduction of unprepared core platforms.

*Multiple scars or flaked platforms*: During the process of alternate flaking, the flake scars formed during flake removal in one direction are used to set up a platform for another flake removal in an opposing direction forming a ridged or flake scarred platform surface.

*Faceted platforms*: Faceting involves the removal of flakes from the platform before a flake is detached. It is defined in this study as the repetitive removal of small flakes across a platform surface.

*Indeterminate or shattered platforms*: During flaking, the platform may collapse at the time of flake detachment, shattering the platform surface. This is not a desired outcome of flaking. It usually occurs because the platform was too weak to sustain a hammerstone blow or because of some internal flaw unnoticed by the knapper.

Overhang removal:
Overhang removal refers to a series of small flake scars along the platform edge (on the dorsal surface of a flake) that has removed overhang.

Table 13 indicates all variables considered in the analysis. All variables were entered into a Microsoft Access database. Data was imported into Microsoft Excel and SPSS in order to produce some descriptive statistics and graphs used to characterise the assemblage.

**Table 13. Variables Recorded for Analysis**

| Variable | Attribute |
|---|---|
| Pit | 1 – 11 (excluding 5, which was not excavated) |
| Spit | 1-15 |
| Raw material | Mudstone, silcrete, quartz, petrified wood, igneous, or sandstone |
| Classes | Flake, core, retouched flake, flaked piece, heat shatter or non flaked artefact |
| Length | Maximum length in mm |
| Width | Maximum width (perpendicular to length) in mm |
| Thickness | Maximum thickness (perpendicular to both length and width) in mm |
| Shape | Calculated field (Length/Width) |
| Completeness of flake | Complete, proximal fragment or other fragment |
| Platform type | Cortical, plain, multiple scars, faceted, or indeterminate |
| Overhang removal | Yes or no |

### 8.2.2.4 Results

A total of 213 stone artefacts and heat shattered fragments was recovered from the test excavations (detailed in Table 14). Flakes are the predominant artefact type constituting 83.1% of the assemblage. The remaining artefacts include retouched flakes, 4.2%, flaked pieces, 3.8%, and heat shatters, 8.5%. The assemblage also includes a single fragment of sandstone with a possible ground surface. The artefacts are predominantly mudstone, 60.6%, and silcrete, 34.3%. Other artefacts are made from quartz, petrified wood, a fine-grained igneous material and sandstone.

**Table 14. Types and Raw Material**

| | **Artefact type** | | | | | |
|---|---|---|---|---|---|---|
| **Raw material** | Flake | Flaked piece | Retouched flake | Other | Heat shatter | **Total** |
| Mudstone | 104 | 5 | 7 | | 13 | 129 (60.6%) |
| Silcrete | 64 | 2 | 2 | | 5 | 73 (34.3%) |
| Quartz | 7 | | | | | 7 (3.3%) |
| Petrified wood | 1 | 1 | | | | 2 (0.9%) |
| Igneous | 1 | | | | | 1 (0.5%) |
| Sandstone | | | | 1 | | 1 (0.5%) |
| **Total** | 177 (83.1%) | 8 (3.8%) | 9 (4.2%) | 1 (0.5%) | 18 (8.5%) | 213 (100%) |

The size of artefacts in the assemblage is generally small - almost half the assemblage is 10 mm or less. Details of artefact sizes are provided in Table 15.

**Table 15. Artefact Size Classes**

| | **Length** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Artefact type** | 0–5mm | 6-10mm | 11-20mm | 21-30mm | 31-40mm | 41-50mm | 51-60mm | 61-70mm | **Total** |
| Complete flake | 5% | 39% | 27% | 14% | 11% | 1% | 0% | 4% | 100% |
| Broken flake | 3% | 43% | 27% | 27% | 0% | 0% | 0% | 0% | 100% |
| Flake fragment | 0% | 53% | 38% | 8% | 0% | 2% | 0% | 0% | 100% |
| Retouched flake | 0% | 11% | 44% | 11% | 33% | 0% | 0% | 0% | 100% |
| Flaked piece | 0% | 25% | 63% | 13% | 0% | 0% | 0% | 0% | 100% |
| Grindstone | 0% | 0% | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| Heat shatter | 6% | 39% | 50% | 0% | 0% | 6% | 0% | 0% | 100% |
| **Total** | 3% | 42% | 34% | 13% | 6% | 1% | 0% | 1% | 100% |

#### 8.2.2.4.1 Raw Material

Most flaked artefacts are made from either mudstone, 60.6%, or silcrete, 34.3%. The remaining artefacts are quartz, 3.3%, petrified wood, 0.9%, and a fine grained igneous material, 0.5%. Silcrete is generally red in colour with variable lustre (which in some cases may indicate heat treatment). Mudstone varies from quite grainy to chert-like in appearance. A single igneous flake is fine grained and dark grey in colour. The grindstone fragment has a layered or banded structure and one smooth surface (possibly used as a grinding surface). It is distinct from the sandstone gravel that occurs in the sand, which is not banded and has no smooth flat surfaces.

#### 8.2.2.4.2 Artefact Classes

Flakes:
Most of the flakes in the assemblage are broken. Of 177 flakes, 83 are complete flakes, 30 are proximal fragments and 64 are other fragments (refer to Table 16).

**Table 16. Completeness of Flakes**

| | **Flake Type** | | | |
|---|---|---|---|---|
| **Raw Material** | Complete flake | Proximal fragment | Other fragment | **Total** |
| Mudstone | 53 | 17 | 34 | 104 |
| Silcrete | 26 | 11 | 27 | 64 |
| Quartz | 3 | 2 | 2 | 7 |
| Igneous | 1 | | | 1 |
| Petrified wood | | | 1 | 1 |
| **Total** | 83 | 30 | 64 | 177 |

A number of flakes provide evidence for particular knapping techniques having been used at the site. Two bipolar flakes provide evidence for bipolar or anvil assisted knapping and one backing flake provides evidence for the manufacture of backed artefacts. Backing flakes are small flakes struck off a backed artefact during the backing process. They have a distinctive dorsal surface indicating bipolar knapping.

Flake platforms are predominantly plain (53%) Other platforms are either indeterminate (26%) cortical (14%), multiple scars (5%) or faceted (2%). Overhang removal was identified on seven flakes.

Retouched flakes:
Nine retouched flakes were identified in the assemblage. All but one was recovered from Pit 11 (detailed in Table 17). These artefacts can be further categorised as backed artefacts or other retouched flakes. One complete backed artefact and two backed artefact fragments were identified. The complete backed artefact is mudstone and symmetric in form. The fragments are also mudstone and derive from both symmetric and asymmetric forms. These forms denote what are often called geometric microliths - symmetric form - and Bondi points – the asymmetric form (McCarthy 1976). The other retouched flakes are retouched along margins using the ventral surface as a platform (they are unifacially worked) and might be described within a typological framework as various types of scrapers.

**Table 17. Provenance and Details of Retouched Flakes**

| Pit | Spit | Raw material | Description |
|---|---|---|---|
| 9 | 3 | Mudstone | Backed artefact fragment (symmetric) |
| 11 | 2 | Mudstone | Complete retouch flake, retouch on distal margin |
| 11 | 3 | Mudstone | Broken retouched flake, retouch on distal margin |
| 11 | 3 | Mudstone | Backed artefact fragment (asymmetric) |
| 11 | 4 | Silcrete | Complete retouched flake, retouch on distal margin |
| 11 | 4 | Silcrete | Retouched flake distal fragment |
| 11 | 4 | Mudstone | Complete retouched flake, retouch on distal and lateral margins |
| 11 | 4 | Mudstone | Complete backed artefact (symmetric) |
| 11 | 5 | Mudstone | Complete retouched flake, retouch along one lateral margin |

### 8.2.2.4.3 Artefact Distribution

Artefacts were distributed unevenly, both across the site and vertically through the deposit. The number of artefacts per pit and spit are indicated in Figure 13 and Table 18.

**Table 18. Distribution of Artefacts within each Pit**

| | **Pit** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Spit** | **1** | **2** | **3** | **4** | **6** | **7** | **8** | **9** | **10** | **11** | **Total** |
| **1** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 |
| **2** | 2 | 4 | 0 | 0 | 2 | 2 | 5 | 2 | 12 | 9 | 38 |
| **3** | 0 | 2 | 0 | 0 | 14 | 7 | 7 | 4 | 8 | 33 | 75 |
| **4** | 0 | 0 | 1 | | 14 | 2 | 6 | 5 | 2 | 12 | 42 |
| **5** | 0 | 1 | 0 | | 6 | 4 | 3 | 1 | 0 | 7 | 22 |
| **6** | 0 | 1 | | | 4 | 1 | 1 | 1 | 0 | 1 | 9 |
| **7** | | | | | 0 | 1 | 3 | 0 | 0 | 1 | 5 |
| **8** | | | | | 2 | 0 | 3 | 0 | 0 | 0 | 5 |
| **9** | | | | | 0* | 0 | 5 | 2 | 0 | 0* | 7 |
| **10** | | | | | 0* | | 1 | 1 | 1 | 0* | 3 |
| **11** | | | | | 0* | | | 2 | 0 | 0* | 2 |
| **12** | | | | | | | | 1 | 0 | | 1 |
| **13** | | | | | | | | 1 | 0 | | 1 |
| **14** | | | | | | | | 0 | 0 | | 0 |
| **15** | | | | | | | | 1 | 0 | | 1 |
| | | | | | | | | | | | |
| **Total** | 2 | 8 | 1 | 0 | 42 | 17 | 35 | 21 | 23 | 64 | 213 |

*Note: numbers indicate number of artefacts, 0* indicates no artefacts found but not all material was sieved from these spits.*

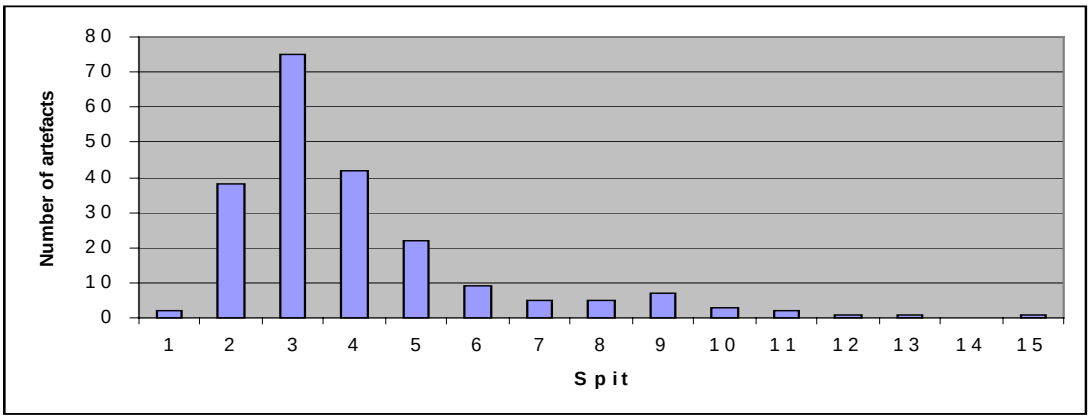



**Figure 13. Histogram indicating Number of Artefacts per Spit**

## 8.2.2.5 Discussion

Artefacts recovered during the test excavations confirm the presence of significant artefact densities on the sand sheet and of artefacts at depth. The assemblage provides information about post depositional (taphonomic) processes and the likelihood that the deposit represents a number of occupation surfaces. Accordingly this discussion focuses on artefact densities within pits and patterns of artefact distribution through the deposit.

### 8.2.2.5.1 Use of the Sand Sheet

The number of artefacts recovered per test pit varied from 0 to 64 with the average being 21 artefacts per pit. These artefact densities are comparable with those at nearby sites (Haglund 2002). The maximum density of 64 is lower than maximum densities at other excavated sites. For example, at W2 and W6 the maximum number of artefacts per square metre were 166 and 93 respectively (White 1999a, Haglund 2002). This is not surprising given that sites near creeklines were targeted for salvage (by Haglund) because of the high density of artefacts visible on eroded ground surfaces along or near creeklines.

Artefact densities on the sand sheet appear to decline upslope away from the creek, but densities remain unexpectedly high. More than twenty artefacts were recovered from both Pits 9 and 10 that are about one hundred metres from Sandy Hollow Creek. Relatively few excavations have tested artefact densities away from creek lines, but test excavations at Bulga (Koettig 1991), Betty's Creek (Baker 1997) and Hunter Valley South (Baker, Clarke and Martin in prep) on duplex soils all indicate that densities rapidly decline 20 to 50 metres away from creek banks. Maximum artefact densities beyond 50 m from creek banks are less than 10 artefacts per square metre and average densities are less than 2 artefacts per square metre. The results of the recent excavations indicate that artefact densities on the sand sheet do not decline away from creeklines to the same extent that would be expected on duplex soils. This suggests that the sand sheet may have been preferentially targeted.

The number of artefacts, the size of artefacts and the types of artefacts all indicate that activities that occurred at this site may not have been significantly different from activities on the duplex soils on the other side of Sandy Hollow Creek. The number and size of artefacts, particularly the size of flakes indicates that the sand sheet was the location of knapping (cf. W2 - White 1999a: Figure 13, Table 13). The presence of backed artefacts and flakes with faceted platforms and of a backing flake is strong evidence for the manufacture of backed artefacts having occurred. Bipolar flakes indicate that at least one other reduction strategy was employed. There is no indication that the sand sheet was targeted as the location for different activities. Testing these ideas would require further excavation (on sand sheets and in other environmental contexts) and is not in the scope of this study.

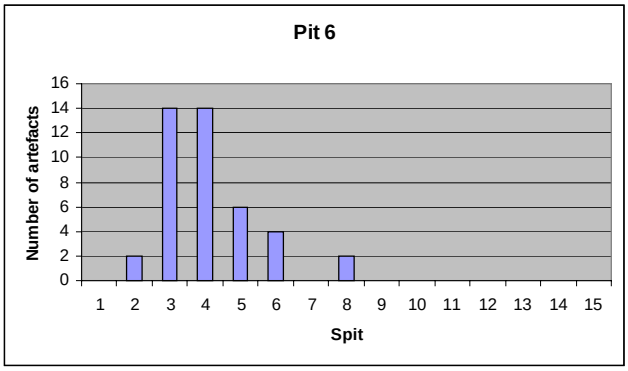
#### 8.2.2.5.2 Patterns of Artefact Distribution – Testing Stratigraphic Integrity

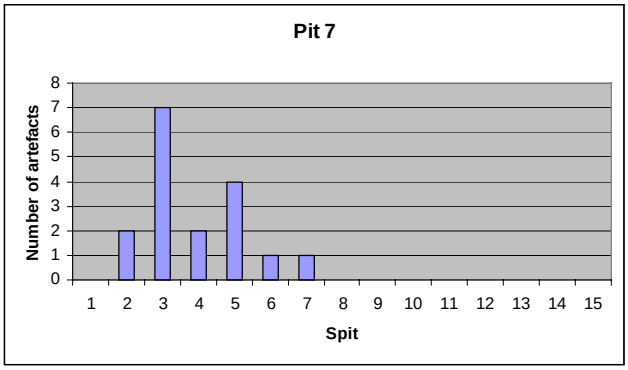
The artefact distribution through the deposit (indicated in Table 18) is not even. Most of the artefacts were recovered from spits two, three, four and five. Few artefacts were recovered from spit one, and from spit four artefact densities steadily decline. A slight increase in artefact densities occurs at spit eight but the sample size at this depth is very small. The paucity of artefacts in spit one is explicable in terms of recent deposition of sand and ripping or ploughing to improve pasture. Explaining the pattern of artefact distribution below spit one is more difficult. This pattern may either be the result of sequential occupation on the sand sheet (and in this sense the sand sheet represents a stratified deposit) or of bioturbation and other taphonomic processes acting on artefacts that originate from a single occupation surface.

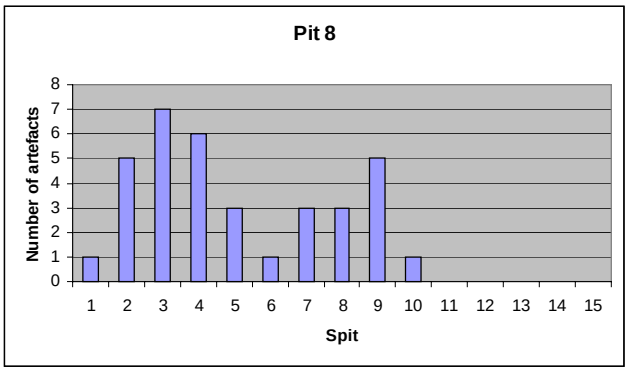
If the sand sheet represents a stratified deposit it is not readily apparent. Apart from a plough zone the deposit has little visible stratigraphy. However, three aspects of artefact distribution provide some insight into site formation and possibly distinguish multiple occupation surfaces: the pattern of artefact densities, proportions of raw material, and size sorting and "coating" (i.e. material adhering to artefact surfaces).

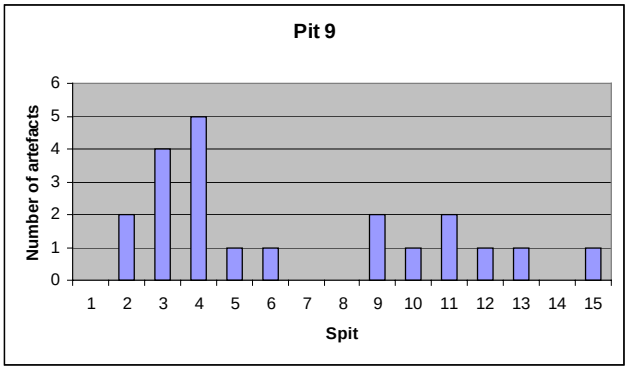
<u>Artefact densities:</u>
The pattern of artefact densities through the deposit appears to approximate a skewed unimodal distribution. However, there is a slight increase in artefact densities in the tail of the distribution curve (at about spit nine) which hints at a bimodal distribution. This more complex distribution is apparent in pits excavated in the southern excavation area, where sample size is larger and deposit deeper than in the northern excavation area (refer to Figure 14). A bimodal distribution is evident in Pits 8, 9 and 10.

The artefact densities themselves are also difficult to interpret. Low artefact densities could reflect less frequent use of the sand sheet or be the result of relatively rapid sand deposition at that time. High artefact densities might reflect more intensive use of the sand sheet, or a period of slow sediment accumulation or could even be the result of erosion concentrating artefacts as a lag.

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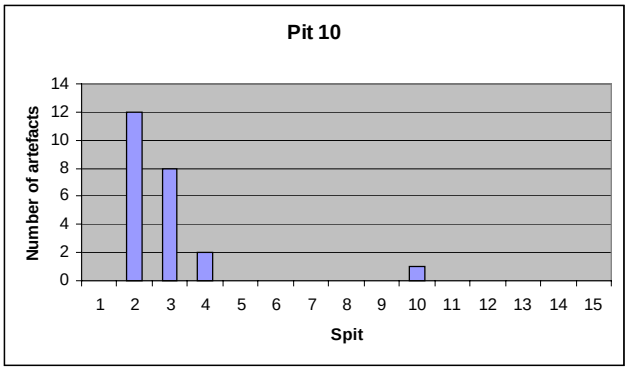


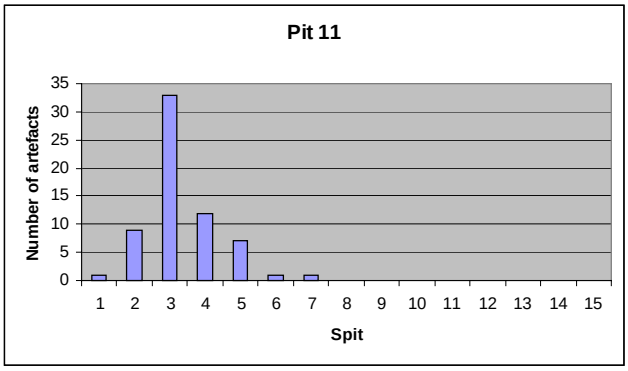


**Figure 14. Histograms indicating Artefacts per Spit for each Pit in the Southern Excavation Area**

Raw material proportions:

The proportions of mudstone and silcrete vary through the deposit and silcrete does not occur at all below spit six. Sample size alone can not account for this pattern and it suggests earlier occupation surfaces where mudstone was the preferred material. Patterns of distribution also support this proposition (Figure 15). Silcrete occurs as a unimodal distribution whereas the distribution of mudstone is clearly bimodal.

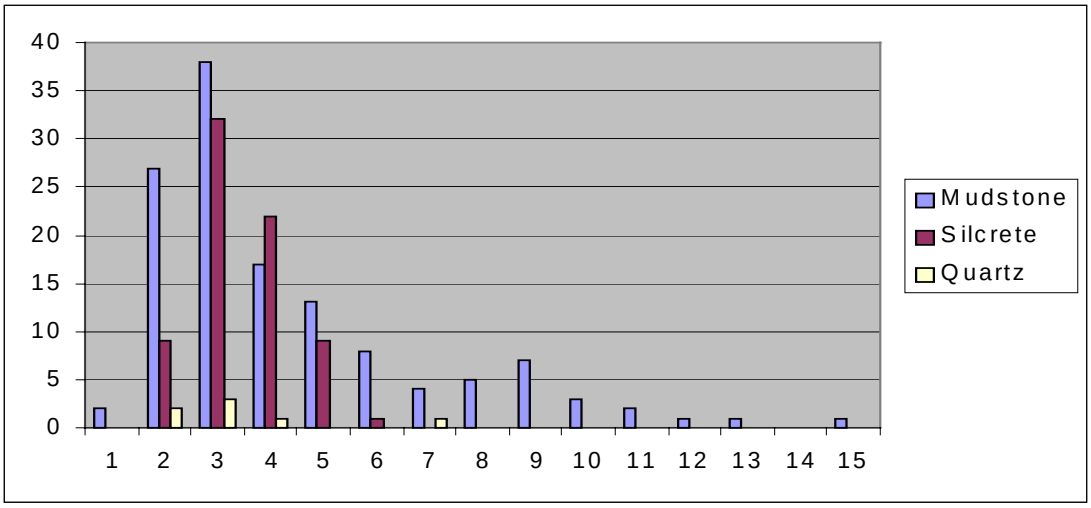


**Figure 15. Histogram indicating Distributions of Raw Materials (all Pits).**

Size sorting and coating:

Size sorting has been demonstrated within other sandy deposits and is perhaps the most robust indicator of vertical migration and bioturbation. Hiscock and Shawcross (2000) found that the size of artefacts increased with depth through a 300 mm sand deposit at Hunter Valley 1, and Baker (unpublished data) found clear increase in artefact size at depths between 500 and 1,000 mm at Moffat's Swamp. Size sorting of artefacts was also noted in relation to two sites excavated at Glennies Creek (SGCD 9 and SGCD 16), where results also suggest that Pleistocene artefacts are present (Koettig 1986).

There is no clear pattern of size sorting through the deposit (Figure 16). Within the first 500 mm (five spits) there is a slight trend towards an increase in artefact size indicated by the median artefact length. Below 500 mm the median artefact length decreases and between spit seven and ten the size of artefacts again increases. This decrease in size of artefacts against the trend and a subsequent increase in size might reflect a previous occupation surface, but sample size at these depths is very small.

Three artefacts recovered at depth support the argument for a stratified site. Two artefacts recovered from spits thirteen and fifteen of Pit 9 and one artefact recovered from spit ten of Pit 8 are quite large (64 mm, 14 mm and 24 mm in length respectively) and have consolidated sand adhering to a surface. They are unlikely to have moved through the existing deposit and are potentially older than the material in the upper spits.

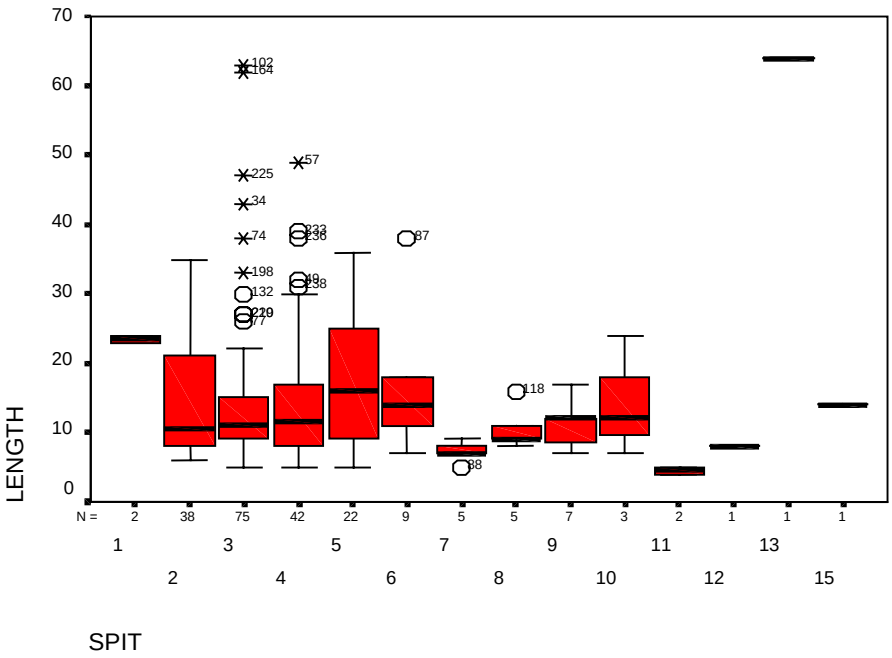


**Figure 16. Boxplot indicating Size of Artefacts with Depth**

#### 8.2.2.6 Conclusion

Answers to the 3 objectives set for the stone artefact analysis are summarised below:

1. **Quantify the presence of artefacts on and in the sand sheet and describe the distribution of artefacts through the sand sheet.**

Artefacts were recovered from nine of the ten test pits excavated on the sand sheet and were found to occur at depths of 1,500 mm. Densities varied from 0 to 64 artefacts per $m^2$ pit. Most artefacts occur between depths of 10 mm and 50 mm.

2. **Describe the assemblage and characterise its components in a way that enables comparison with other assemblages**

The assemblage is comparable with other assemblages collected and excavated from areas along creeklines and within adjacent duplex soils. It provides no evidence to suggest activities that occurred on the sand sheet were different from activities that occurred on creeklines. Relatively high artefact densities (i.e. compared to expected artefact densities on duplex soils) within pits 100 m upslope from Sandy Hollow Creek suggest that the sand sheet may have been preferentially targeted.

3. **Describe the vertical distribution of artefacts within the sand sheet and investigate the extent to which this distribution may be the result of sequential occupation or other taphonomic processes.**

The sand sheet very likely represents a number of occupation surfaces which have been affected by erosional and depositional forces, and bioturbation, over thousands of years. Analysis of artefact densities within spits, variation in raw material and artefact size indicate that the pattern of artefact distribution through the deposit is not simply a consequence of bioturbation and the vertical movement of artefacts through the deposit. The evidence suggests at least two periods of occupation at different levels and times within the existing deposit.

## 8.3 Summary Discussion

The results of the survey and excavations fit with site prediction models. The largest sites occur along major water courses. Grinding grooves occur where there are outcrops of sandstone in the creeklines. Stone artefact scatters were the predominant type of site recorded. The nature of artefacts and raw materials were as expected. The artefacts were of locally derived raw materials. The overall artefact assemblage did not contain any attributes that make them unique or rare in the Upper Hunter Valley.

However, this study was able to address two current issues: 1) settlement patterns as reflected in differential use of landforms units within the study area, and 2) antiquity of occupation through the identification of open sites with stratified deposit.

In relation to models of forager settlement patterns, it is difficult to distinguish between or identify residential base sites as opposed to activity locations in the archaeological record at Warkworth West. However, the results have indicated that there was extensive and varied use of the area, particularly along the creeklines, with

a continuous archaeological distribution close to creeks. The sand sheet may have been a favoured camping location at which activities similar to those occurring on the opposite side of the creek (on the duplex soils) were carried out. Two grinding groove sites and a grindstone fragment recovered during excavation suggests a degree of permanence or less mobile occupation in this area (see section 6.2.1.2). Nearby ceremonial sites are also known. It is not clear where the closest stone source was situated, however, the Warkworth West landscape would have provided food and water resources, at least throughout the Holocene. The archaeological evidence also shows a diversity of raw materials and artefact types, indicating that occupation of this area may have included base camps as well as carrying out specific activities. These activities are likely to include the manufacture of formal implements (backed artefacts), manufacture and maintenance of axes, and grinding activities involved in food preparation or the use of ochre.

A total of 533 artefacts were recorded during the surface survey. The majority of artefacts were flakes or broken flakes. A variety of other artefact classes were also recorded, including cores, retouched flakes (including a number of backed artefacts), hammerstones, flaked pieces, heat shatters and a single grinding stone. Mudstone and silcrete are the dominant raw material across the study area, making up 94% of all artefacts. Other raw materials include quartz, petrified wood, igneous material, chert, porcellanite, quartzite and sandstone.

The frequency of mudstone and silcrete across the area is remarkably constant. Within Landform Zones 1, 2, 3, and 8, mudstone comprises about 70% of recorded artefacts and silcrete about 23 %. Proportions of artefacts in other landform zones varied, but the numbers of artefacts recorded within these zones did not constitute large enough sample sizes to provide comparable data. The distance from raw material sources is effectively the same for all zones (raw material sources are within gravels associated with the Hunter River or further afield). Similar proportions of the different raw materials might therefore be an expected result. However the frequency of different materials might also be associated with different patterns of behaviour, or activities that occur, in different zones. For example, if camping or more long term occupation occurs along creeklines (close to water) then sites within these zones might be the location of more intensive knapping or where good quality material might be knapped more intensively than at sites away from creeks. These differences might be reflected in the frequency of different materials within the different zones. The survey results indicate that a greater variety of raw materials occur within Landform Zones associated with creeks, but that a higher frequency of raw material other than silcrete and mudstone occurs on undulating terrain. These findings are consistent with the model describing differential use of the landscape where more complex sites (i.e. sites with a greater variety of raw materials and artefact types) which represent extended periods of occupation, are associated with drainage lines.

The highest artefact densities were also associated with drainage lines suggesting more intensive use within these landforms. This is consistent with other survey results in the study area (Haglund 1991,1999). The large number of sites recorded within the undulating terrain landform zone was interesting, although most of the sites recorded within this landform were isolated finds or contained less than 10 artefacts. This fits with the model that most of the artefacts observed on the surface are in

association with drainage lines, Sandy Hollow Creek, Longford Creek and the unnamed tributary to Wollombi Brook, suggesting more intensive use of these areas.

There was also a high density of surface artefacts on the sand sheet adjacent to Sandy Hollow Creek. Test excavations also revealed artefacts within the sand sheet, including a small number at depth. This indicates that the sand sheet may have been a favoured location or focus of activity throughout time. In addition, the geomorphology and the bimodality of the archaeological evidence, suggests a stratified site. The results appear to have met the expectation that sand sheets may provide stratified sites and potential for containing older archaeological material (i.e. as opposed to the more commonly recovered assemblages from duplex soil contexts).

Test excavation of the sand sheet recovered 213 stone artefacts and heat shattered fragments from 10 pits. As with the surface results, mudstone was the predominant raw material, although at a slightly lower proportion. There was not as much variety in terms of raw materials in the overall assemblage recovered from the test excavations, although there was still a range of raw materials, consistent with raw materials for surface finds. Flakes were the predominant artefact type, making up over 80% of the assemblage. Retouched flakes only comprised a small proportion of the artefact assemblage. There were no cores recovered in the test excavations. One grindstone fragment was found. A number of flakes provided evidence of bipolar knapping and backed artefact manufacture, indicative of Bondaian technology.

The size of artefacts in the excavated assemblage is generally very small, with almost half the assemblage being 10 mm or less. However, this is not unusual for an excavated assemblage (in an area where knapping has been carried out and artefacts have been retained in the deposit). It is important to note that there does not appear to be size sorting through the stratigraphy of the pits. Artefacts were not evenly distributed either across the site or vertically within the deposit. Most were recovered in the Southern Excavation Area, near to and associated with site W14. Most artefacts occurred in spit 3, but between spits 2 and 4 and even more broadly between spits 2 and 6. This pattern may either be the result of sequential occupation on the sand sheet (and in this sense the sand sheet represents a stratified deposit) or of bioturbation and other taphonomic processes acting on artefacts that originate from a single occupation surface. However, our investigations of the stratigraphy of the site suggests that bioturbation would not have had this kind of effect. The proportions of mudstone and silcrete vary through the deposit and silcrete does not occur at all below spit 6. Sample size alone can not account for this pattern and it suggests earlier occupation surfaces where mudstone was the preferred material. Patterns of distribution also support this proposition. Silcrete occurs as a unimodal distribution whereas the distribution of mudstone is bimodal. In addition, the two larger artefacts recovered at depth are unlikely to have moved through the deposit and so are potentially older than the material in the upper spits.

It was also notable that a number of artefacts were recovered from two pits placed about 100 m away from Sandy Hollow Creek. It is generally expected that artefact densities decline more than 50 m from creeklines.

The results suggest that the sand sheet may have been one of the preferred locations for occupation or specific activities, such as knapping, including backed artefact manufacture, along with Sandy Hollow Creek and Longford Creek. The number, size and types of artefacts all indicate that activities that occurred at this site may not have been significantly different from activities on the duplex soils on the other side of Sandy Hollow Creek. The number and size of artefacts, particularly the size of flakes indicates that the sand sheet was the location of knapping. The presence of backed artefacts or flakes with faceted platforms and of a backing flake is strong evidence for the manufacture of backed artefacts having occurred. Bipolar flakes indicate that at least one other reduction strategy was employed.

Across the broader area, the known sites represent a range of activities. Artefact scatters occur across the landscape, although the larger, denser sites are mainly located on the creeklines (Sandy Hollow Creek, Longford Creek and the unnamed tributary to Wollombi Brook) as expected. Grinding groove sites include a large cluster along the unnamed tributary to Wollombi Brook and a smaller number of grooves on a sandstone boulder in Longford Creek. There is also a known ceremonial site situated nearby on Wollombi Brook. Combined, this evidence of occupation reflects camping activities across the broader landscape as well as different activity areas (i.e. specific locations used for specific purposes). In addition, on the basis of the subsurface testing, it appears that occupation may have occurred for some time (throughout the Holocene) and the sand sheet has the potential for retaining older, stratified deposit.

# 9 Significance Assessment

## 9.1 Criteria

One of the primary steps in the process of cultural heritage management is the assessment of significance. Not all sites are equally significant and not all are worthy of equal consideration and management (Sullivan and Bowdler 1984, Pearson and Sullivan 1995: 7).

The determination of significance can be a difficult process as the social and scientific context within which these decisions are made is subject to change (Sullivan and Bowdler 1984). This does not lessen the value of the heritage approach, but enriches both the process and the long-term outcomes for future generations as the nature of what is conserved and why, also changes over time.

Significance assessment can generally be described under three broad headings (Pearson and Sullivan 1995:7).

- Value to groups such as Aboriginal communities.
- Value to scientists and other information gatherers.
- Value to the general public in the context of regional, state and national heritage.

The first two are addressed below. Public significance has not been assessed as part of this study.

Social Significance

This area of assessment concerns the value(s) of a site or feature to a particular community group, in this case the local Aboriginal community. Aspects of social significance are relevant to sites, items and landscapes that are important or have become important to the local Aboriginal community. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for sites generally and their continued protection.

Cultural significance may include the spiritual, social, aesthetic, historic or scientific value of a place.

The social value of Aboriginal sites recorded during the present survey and the cultural heritage value of the Warkworth West area is assessed by the local Aboriginal community. Representatives of the Upper Hunter Wonnarua Council, Lower Wonnarua Tribal Council, Wonnarua Nation Aboriginal Corporation and Wanaruah Local Aboriginal Land Council were involved in the field survey and/or test excavation (note that in regards to the field survey, all representatives were employed by UHWC). A significance statement from the Upper Hunter Wonnarua Council is provided in section 9.2.1 below and recommendations are incorporated into section 11. The UHWC report (endorsed by WNAC) is also attached as Appendix A. The responses from the Lower Wonnarua Tribal Council and Wanaruah Local Aboriginal Land Council are also outlined below and their letters included in Appendix A.

Scientific/Archaeological Significance

Scientific significance is assessed according to the contents of a site, state of preservation, integrity of deposits, representativeness of the site type, rarity/uniqueness and potential to answer research questions on past human behaviour (NPWS 1997).

For open camp sites, evidence required to adequately assess significance includes information about the presence of subsurface deposits, integrity of these deposits, nature of site contents and extent of the site. A review of information about previously recorded sites within the local area and region, enables the rarity and representativeness of a site to be assessed.

High significance is usually attributed to sites, which are so rare or unique that the loss of the site would affect our ability to understand an aspect of past Aboriginal use/occupation of an area. In some cases a site may be considered highly significant because its type is now rare due to destruction of the archaeological record through development. Medium significance can be attributed to sites which provide information on an established research question. Low significance is attributed to sites which cannot contribute new information about past Aboriginal use/occupation of an area. This may be due to site disturbance or the nature of the site's contents.

## 9.2 Assessment

### *9.2.1 Aboriginal Cultural/Social Significance*

The Upper Hunter Wonnarua Council has prepared a report on the assessment of Aboriginal Cultural Heritage for Warkworth West. It indicates that UHWC is recognised by the Wonnarua Nation Aboriginal Corporation (as Registered Native Title Claimants) to represent the Wonnarua people in all cultural heritage matters within the Wonnarua Tribal lands.

The report highlights the fact that a cultural heritage assessment undertaken by Aboriginal people is different to archaeology or scientific studies.

The UHWC identified the cultural values as:

- Aboriginal sites, stating that "all Sites within their Traditional Homeland are of high importance and are in need of proper care and protection" and also that the archaeological evidence of "camping and tool making sites found today remind people of their forefathers, the original inhabitants of the land" (Perry 2002:8);

- the physical landscape, saying that "the land and water running through it are the lifeblood of their culture. The hills and plains, the forest and mountains provided people in past generations with the resources needed to survive" (Perry 2002:8); and

- visual connections to the land, indicating that "local Aboriginal people are attached to the land through physical, spiritual and visual connections" (Perry 2002:9).

The cultural heritage assessment report states that the two hill top locations (one in the north west of the study area and one at the southern end of the main ridgeline) as well as the deep sand deposits in the central part of the study area are unusual in terms of the environment.

The grinding groove sites have been identified as the most significant physical feature for cultural reasons.

It is clear that it is not only the archaeological sites but the actual physical features of the landscape that are considered in the assessment of cultural heritage values.

The landscape including the area proposed to be mined has been identified as being important. The impact of the development on cultural heritage is significant within the proposed mining area, however, the areas of greatest cultural significance, including the hilltop locations and southern grinding groove sites have been avoided through modifications to the original mine plan.

The Cultural Heritage Report states that the "total destruction" of the landscape (within the proposed mining area) results in an environment which "will be changed forever and our Tribal and Spiritual as well as physical connection to the land will be changed due to the mining of this landscape" (Perry 2002:5).

It was also identified that the two grinding groove sites (the northern one on Longford Creek and the southern one on the unnamed tributary of Wollombi Brook) are of "major concern" (Perry 2002:11). It was noted that CNA has modified the mine plan to avoid disturbance to the site on the Wollombi Brook tributary, however the site on Longford Creek is within the proposed mine extension boundary.

It has also been identified by the UHWC that burials could potentially be contained within the sand sheet. However, a strategy will be implemented during the mining process to involve the local Wonnarua people (WTC) if potential burial remains are found (Perry 2002:11).

In addition, it is highlighted that there is a cumulative effect of mining on cultural heritage, as over 2,500 Aboriginal sites have been destroyed across their lands. This means that "the remaining sites are becoming rare and more valuable to the community" (Perry 2002:9).

Given the importance of sites and places to present Aboriginal people, the UHWC has specified that it is critical to protect them (Perry 2002:21).

A site of particular significance was identified near the study area. This is the ceremonial site, where carved trees had been recorded, near Wollombi Brook, approximately 2 km west of the study area. It is specified that "these Initiation Grounds and the surrounding areas must be Protected from further development" (Perry 2002:22). Given the importance of this site to the local Aboriginal community, recommendations have been made in this report to ensure that it is considered for the future.

The Lower Wonnarua Tribal Council and Wanaruah LALC oppose the destruction of any of the Aboriginal sites through the proposed mine extension. In addition, the LWTC letter states that it intends to nominate the area for declaration as an Aboriginal Place due to the heritage significance and "to protect our cultural and heritage for future generations" (LWTC letter dated 19th August 2002).

The Wanaruah LALC letter (emailed to Coal & Allied on 16th August 2002), which is a standard letter outlining the policies of the Land Council, states that WLALC "considers all Aboriginal sites within its constituted boundaries important to the local Aboriginal community". As such, the "Wanaruah LALC does not agree to the destruction of any Aboriginal sites within its constituted boundaries and all sites should be considered as a constraint to development and that development proposals be designed recognising these constraints". The Land Council also indicates that Aboriginal cultural heritage is not just confined to the archaeological evidence of past Aboriginal occupation, but "it is a living culture and includes landforms, water holes, vegetation zones, habitats, and peoples". In relation to the Warkworth West EIS, Wanaruah LALC has stated that it is "alarmed and concerned by the number and

types of sites listed for destruction" and that it does "not agree with or consent to the destruction of any Aboriginal Sites within this project".

### 9.2.2 Archaeological Significance

The vast majority of sites in the Warkworth West extension area were open artefact scatters which comprised low numbers of artefacts, and many in already disturbed contexts. The artefacts were of locally derived raw materials and generally did not contain any attributes that make them unique or rare in the Upper Hunter Valley.

Therefore, these sites are generally of low archaeological significance. They do not have the potential to contribute appreciable additional information to that already obtained, during the survey stage and previous salvage work, to current research questions on antiquity, spatial patterning or inter-site variation. In order to address these research questions, intact archaeological deposit, with some depth, is required. The archaeological deposit contained within the sand sheet adjacent to Sandy Hollow Creek is an exception (see below).

While much of the overall landscape of the Warkworth West Extension Area remains largely intact, and therefore has the potential to contain archaeological material not found during the surface survey (either as it was not along a transect or it is covered over), there is no evidence that such contribution would substantially add to existing knowledge about such sites or about Aboriginal life in the past.

There was an overall low number of commonly identified artefacts and raw materials. Often sites were situated in disturbed contexts, such as in eroded exposures or on tracks or fire breaks (which are subject to regular grading). Other sites were located in areas where no there was no or limited potential depth of deposit.

There are a number of sites with higher numbers of artefacts. These were mostly found in the Landform Zones associated with the creeklines (Sandy Hollow Creek, Longford Creek and the unnamed tributary to Wollombi Brook). The sites along Sandy Hollow Creek, while being large and to some degree still having intact deposit with some research potential, are still assessed as only having low archaeological significance at this stage, as this area has already been extensively salvaged and so much is already known about the stone artefact technology and use of this area. There is no evidence to suggest that further excavation and analysis of these stone artefacts would substantially add to existing knowledge about such sites or about Aboriginal activity in the past. The sites along Longford Creek, while most had not been identified by previous archaeological survey of the Warkworth West area, conformed to what is known about Aboriginal archaeological sites along watercourses. It is a similar landform zone to Sandy Hollow Creek, just smaller, therefore, it is not surprising that the archaeological evidence is similar. There were many isolated artefacts (Isolated Finds) recorded across the landscape during the surface survey, which can be generally seen as an overall background scatter of artefacts.

The grinding groove sites, PN10 on Longford Creek and Site M on the unnamed Wollombi Brook tributary, can also be seen to have some archaeological significance, given they are a relatively rare (although not unexpected) site type. While such sites

do not provide much research value, they can be seen to have social, educational and aesthetic values.

Sand sheets, however, may have some archaeological significance. Sand sheets are a relatively rare landscape feature. Test excavation of the sand sheet adjacent to Sandy Hollow Creek confirmed the presence of artefacts. The loss of this sand sheet through the proposed extension of mining may affect our ability to understand past occupation of this landform feature. Consequently, the sand sheet (Landform Zone 4) can be viewed as having moderate to high archaeological significance. It should be noted that other sand sheets have been identified adjacent to the proposed mine extension area.

# 10 Impact Assessment

## 10.1 Development Impacts

Extension of the mine west of the current development consent boundary will impact on the known and potential archaeological resource. There are a large number of Aboriginal archaeological sites that will be directly impacted by the extension of the mine. In addition, test excavation of the sand sheet has shown that it may hold older archaeological deposit (it appears that there are in situ artefacts in the lower $A_2$ horizon, probably of Holocene age, but this waits to be confirmed by the OSL dates). There are no options for conservation of this sand sheet as it is situated well within the proposed mine extension area. There are also a number of Aboriginal sites situated outside the mine extension area. Through the course of this project, the original mine footprint was revised to avoid a number of the Aboriginal sites situated within the western extension area. While these will not be mined out, there is the risk that they could be affected by indirect impacts of mining operations.

The sites affected by the proposed mine extension are shown on Figure 17. A list of these sites is also provided in section 10.4 below. A number of Landform Zones will also be completely removed or partially affected by the extension of mining into this area. The Landform Zones of Sandy Hollow Creek (Landform Zone 1), the adjacent sand sheet (Landform Zone 4), the Woodlands area (Landform Zone 7) and the undulating terrain both to the east and west of Sandy Hollow Creek (Landform Zones 8a and 8c) will be completely removed by mining. According to the proposed mine extension plan, the upper reaches of Longford Creek will be affected. This includes the axe grinding groove site at PN10. Other Landform Zones partially affected include the summit ridge (Landform Zone 6) and the unnamed tributary to Wollombi Brook (Landform Zone 3). The mine plan shows that the southern grinding grooves (Site M [37-6-163]) are outside the impact area.

The impact on Aboriginal cultural significance has been described as being significant. The impact is described in the Cultural Heritage Assessment Report (Perry 2002).

The two grinding groove sites (the northern one on Longford Creek and the southern one on the unnamed tributary of Wollombi Brook) are of “major concern” to the UHWC (Perry 2002:11). It was noted that CNA has modified the mine plan to avoid

disturbance to the site on the Wollombi Brook tributary, however the site on Longford Creek is within the proposed mine extension boundary.

The impact to the sand sheet was also of concern, given the UHWC identified the potential for burials to be contained within it. However, CNA has agreed to develop a strategy to "involve the WTC should any potential burial remains be found as part of the mining process" (Perry 2002).

In addition, the cumulative effect of mining on cultural heritage was identified by the UHWC. This means that "the remaining sites are becoming rare and more valuable to the community" (Perry 2002:9).

Recommendations to address these impacts are outlined in section 11 below.

Both the Lower Wonnarua Tribal Council and the Wanaruah LALC have opposed the development proposal.

## 10.2 Development Alternatives and Conservation Options

NPWS IDA guidelines state that "the assessment of Aboriginal sites should be directed towards their conservation and protection. While the NPW Act provides for the destruction of sites, this option should always be considered as a last option and must be well supported".

The mine extension boundary has been developed by Coal & Allied in consideration of the archaeological and cultural significance of the area. Where possible, areas of significance have been avoided. A number of mine plan alternatives have been considered and the proposed mine extension boundary is shown on Figure 17.

There are no options for conservation within the immediate boundaries of the proposed mine extension. However, there are areas within the broader Warkworth Mine Lease that may be appropriate to set aside on the basis of natural and cultural heritage and other values.

Coal & Allied propose a Green Offset Strategy to result in a net improvement in natural heritage values. Coal & Allied will show due diligence in continuing to talk with the local Aboriginal community groups regarding potential recommendations and mitigation. Results of such discussions will be provided to NPWS and PlanningNSW.

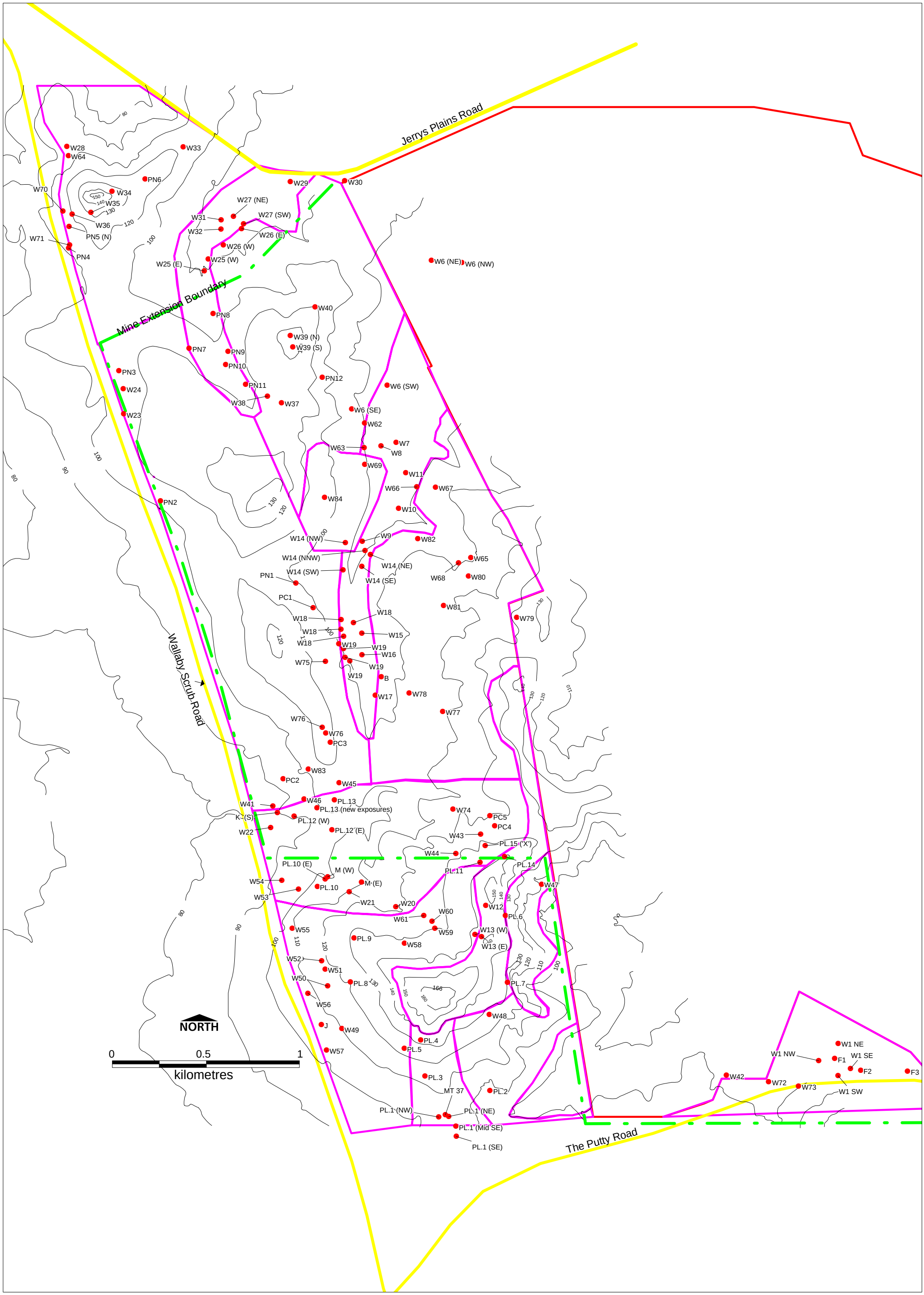


Figure 17. Aboriginal Sites and Mine Extension Boundary

## 10.3 Legislative Obligations

In New South Wales, items of Aboriginal heritage are protected under the *National Parks and Wildlife Act 1974*.

Under the Act, an "Aboriginal object" (formally known as "relic") is defined as "any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains". As such, "objects" are confined to physical evidence and are commonly referred to as Aboriginal sites.

All "objects" are protected under section 90 of the Act. It is an offence to destroy, deface or damage an Aboriginal site without the prior consent of the Director-General of NPWS.

The NPW Act does not provide protection for spiritual areas or natural mythological areas that have no physical remains of Aboriginal occupation, unless they have been declared an Aboriginal Place under section 84 of the Act. An Aboriginal Place is a place which has been declared as such by the Minister for the Environment because it has been shown that the place is or was of special significance to Aboriginal culture. It may or may not contain physical objects.

Development consent does not equate to a consent to destroy an Aboriginal object or Aboriginal Place (section 90 consent) issued under the NPW Act. A consent to destroy is required to be granted by the NPWS before an Aboriginal site or Aboriginal Place can be disturbed. Failure to obtain this consent may result in prosecution.

## 10.4 Section 90 Consent Required

Sites that will be impacted by the proposed mine extension will require section 90 consent under the National Parks and Wildlife Act 1974. These sites and the Landform Zone in which they occur are presented in the table below.

**Table 19. Sites Requiring Section 90 Consent**

| Site Name | Site Type | Landform Zone |
|---|---|---|
| B | A | 1. Sandy Hollow Creek |
| K | A | 3. Unnamed Tributary to Wollombi Brook |
| PN1 | A | 8c. Undulating Terrain |
| PN2 | IF | 8c. Undulating Terrain |
| PN3 | IF | 8c. Undulating Terrain |
| PN7 | IF | 2. Longford Creek |
| PN8 | A | 2. Longford Creek |
| PN9 | IF | 2. Longford Creek |
| PN10 | GG | 2. Longford Creek |
| PN11 | A | 2. Longford Creek |
| PN12 | IF | 8a. Undulating Terrain |
| PC1 | IF | 8c. Undulating Terrain |
| PC2 | A | 8c. Undulating Terrain |
| PC3 | A | 8c. Undulating Terrain |
| PC4 | IF | 3. Unnamed Tributary to Wollombi Brook |
| PC5 | A | 3. Unnamed Tributary to Wollombi Brook |
| PL12 | A | 3. Unnamed Tributary to Wollombi Brook |
| PL13 | A | 3. Unnamed Tributary to Wollombi Brook |
| PL14 | A | 3. Unnamed Tributary to Wollombi Brook |
| PL15 ('X') | IF | 3. Unnamed Tributary to Wollombi Brook |
| F1 | IF | 7. Woodlands |
| F2 | IF | 7. Woodlands |
| F3 | IF | 7. Woodlands |
| W1 | A | 7. Woodlands |
| W6 (remainder – not already covered by partial consent to destroy Consent #453). | A | 1. Sandy Hollow Creek |
| W7 | A | 1. Sandy Hollow Creek |
| W8 | A | 1. Sandy Hollow Creek |
| W9 | IF | 1. Sandy Hollow Creek |
| W10 | A | 1. Sandy Hollow Creek |
| W11 | A | 1. Sandy Hollow Creek |
| W14 | A | 1. Sandy Hollow Creek and<br>4. Sand Sheet adjacent to Sandy Hollow Creek |
| W15 | A | 1. Sandy Hollow Creek |
| W16 | A | 1. Sandy Hollow Creek |
| W17 | A | 1. Sandy Hollow Creek |
| W18 | A | 1. Sandy Hollow Creek |

| | | |
|---|---|---|
| W19 | A | 1. Sandy Hollow Creek |
| W22 | A | 3. Unnamed Tributary to Wollombi Brook |
| W23 | A | 8c. Undulating Terrain |
| W24 | IF | 8c. Undulating Terrain |
| W30 | IF | 8a. Undulating Terrain |
| W37 | A | 8a. Undulating Terrain |
| W38 | A | 8a. Undulating Terrain |
| W39 | A | 8a. Undulating Terrain |
| W40 | IF | 8a. Undulating Terrain |
| W41 | A | 8c. Undulating Terrain |
| W42 | A | 7. Woodlands |
| W43 | IF | 3. Unnamed Tributary to Wollombi Brook |
| W44 | IF | 3. Unnamed Tributary to Wollombi Brook |
| W45 | IF | 8c. Undulating Terrain |
| W46 | A | 8c. Undulating Terrain |
| W62 | IF | 1. Sandy Hollow Creek |
| W63 | A | 1. Sandy Hollow Creek |
| W65 | A | 8b. Undulating Terrain |
| W66 | A | 1. Sandy Hollow Creek |
| W67 | A | 8b. Undulating Terrain |
| W68 | IF | 8b. Undulating Terrain |
| W69 | A | 4. Sand Sheet adjacent to Sandy Hollow Creek |
| W72 | IF | 7. Woodlands |
| W73 | IF | 7. Woodlands |
| W74 | IF | 3. Unnamed Tributary to Wollombi Brook |
| W75 | IF | 8c. Undulating Terrain |
| W76 | A | 8c. Undulating Terrain |
| W77 | A | 8b. Undulating Terrain |
| W78 | IF | 8b. Undulating Terrain |
| W79 | A | 8b. Undulating Terrain |
| W80 | A | 8b. Undulating Terrain |
| W81 | IF | 8b. Undulating Terrain |
| W82 | A | 8b. Undulating Terrain |
| W83 | A | 8c. Undulating Terrain |
| W84 | IF | 4. Sand Sheet adjacent to Sandy Hollow Creek |

# 11 Recommendations

On the basis of the archaeological survey and test excavation of the Warkworth mine proposed western extension area, it is recommended that:

- No further archaeological investigation is required for the assessment for the Development Application.

- The proposed extension results in the loss of the sand sheet adjacent to Sandy Hollow Creek. A salvage excavation could be carried out, as a condition of development consent. Salvage could be targeted in the southern part of the sand sheet where most of the artefacts were recovered during the test excavations, including the artefacts at depth. The aim of the salvage would also be to increase the sample size of artefacts recovered from the sand sheet. An appropriate methodology would be developed in consultation with NPWS.

It should be noted that the above may not be warranted if similar areas of sand sheet are preserved adjacent to this site as part of the mine's proposed Offsets Strategy.

- The northern grinding groove site at PN10, on Longford Creek should be discussed with the local Aboriginal community to determine an appropriate outcome, given there is no potential for these to be retained in situ. The possibility of the boulder on which they occur being removed (salvaged) and displayed within a local cultural centre has been raised. (Note that this is preferred to the option of placing them with the other grinding groove site on the unnamed tributary to Wollombi Brook, which is excluded from the mine extension boundary and will not be impacted by the present development proposal).

- Sites that are outside the proposed impact area should be managed to ensure they are not inadvertently damaged or destroyed. Access to these areas will be maintained to interested Aboriginal community groups. Measures may include fencing of sites or whole areas to restrict access to these areas, cultural heritage awareness training of relevant Coal & Allied staff, establishing a management plan for internal use by Coal & Allied and regular inspection of these areas to monitor site condition. Ground disturbance should be avoided in areas potentially retaining buried Aboriginal archaeological material.

In addition, the Upper Hunter Wonnarua Council has stated that it would not oppose any application for Consent to Destroy for Aboriginal Heritage Sites within the development if the company agrees to the following recommendations:

- That the Upper Hunter Wonnarua Council be funded to carry out an Historical Video of the entire Lease Area prior to Coal Mining to add to our Historical Library. This video is to be carried out by Upper Hunter Council personnel only.

- That an Aboriginal Collection and Salvage Program be drawn up by the Upper Hunter Wonnarua Council for all the affected Aboriginal Sites recorded inside the area of Mining for Warkworth Mine.

- That representatives of the Upper Hunter Wonnarua Council be employed to develop a strategy to be incorporated within the Archaeological and Cultural Heritage Environmental Management Plan for possible identification of Aboriginal Remains, during the topsoil stripping process. Should remains be found, the Upper Hunter Wonnarua Council, Wonnarua Nation Aboriginal Corporation, Lower Wonnarua Tribal Council and Wanaruah Local Aboriginal Land Council must be immediately contacted prior to any further work proceeding. NPWS will also be contacted.

- That representatives of the Upper Hunter Wonnarua Council be employed to assist in the removal of the 9 northern Stone Axe Grinding Grooves that are to be affected by this development.

- It is the opinion of the Upper Hunter Wonnarua Council that once the Grinding Grooves have been removed then they should be either placed close to the larger set of southern Grinding Grooves located or placed in a cultural heritage centre.

- That relics recovered by the Upper Hunter Wonnarua Council are to be cleaned and catalogued by the Upper Hunter Wonnarua Council representatives and that a report developed by the Upper Hunter Wonnarua Council detailing this activity is to be supplied to the developer and NPWS once finished. Care and Control of all the Aboriginal Relics, salvaged by the Upper Hunter Wonnarua Council, will be applied for by the Upper Hunter Wonnarua Council. All expenses are to be paid for by the developer.

- That the Upper Hunter Wonnarua Council be able to fence off the Ceremonial Site at the developers expense.

A section 90 consent application is not required to be submitted with the Integrated Development Application. However, the proponent is required to apply to the NPWS for a section 90 consent within three years of the granting of development consent. Sites for which section 90 consent is required as part of this Integrated Development Application (i.e. sites located within the mine disturbance boundary/mine extension area) are listed above in Section 10.4. Section 90 consent is required for all sites that will be affected by the proposed mine extension. Consent must be issued by NPWS prior to the sites being impacted.

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# Appendix A

**Aboriginal Cultural Heritage Assessment Reports**

# Aboriginal Cultural Heritage Assessment

**for**

# WARKWORTH MINE COAL EXTENSION

Upper Hunter Valley Region, NSW
August 2002

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# Table of Contents



## Tables



## Appendices

# INTRODUCTION

The Upper Hunter Wonnarua Council were commissioned by Coal & Allied Warkworth Operation to assist in an Aboriginal and Archaeological Cultural Heritage Assessment for the proposed Coal Mine Extension of the Warkworth Mine.

The landscape preceding the new area has been actively disturbed by the current coal mine during the past 15 to 20 years.

Coal & Allied Mining Group have been involved in the extraction of coal from our Region for over 25 years, through various mining leases.

The Local Descendants of the Wonnarua Tribal people have been engaged in Cultural Heritage Management Issues during the past 15 years either through the Local Land Council or the Wonnarua Tribal Council to the present day Upper Hunter Wonnarua Council.

Our recognition and continuing authority in relation to Wonnarua Heritage Management Issues has been reinforced by the acknowledgement of the Registrared Native Title Boby, the Wonnarua Nation Aboriginal Corporation, with whom the Upper Hunter Wonnarua Council has an agreement to represent on all Cultural Heritage Matter within the Wonnarua Tribal Lands.

To this end the Upper Hunter Wonnarua Council will provide a Cultural Heritage Assessment to the developer, National Parks and Wildlife Service and the Wonnarua Nation if required, as per the Guidelines for Aboriginal Heritage Consultants.

Therefore the Upper Hunter Wonnarua Council will provide the following objectives:

1. Effective Field Survey of the Extension area

2. Identification of all Aboriginal Places, Artefacts or Camping Areas.

3. Meet all requirements of the NPWS ACT.

4. To provide Management options if any Aboriginal Sites are located

# N.P.W.S ACT AND EP A & ACT.

## NATIONAL PARKS AND WILDLIFE SERVICE ACT 1974

The National Parks and Wildlife Service Act 1974 provides statutory protection;

*For Aboriginal Relics and Places under Section 90 of the Act

*Provides for the Declaration of Aboriginal Places under Section 84 of the Act

The protection provided to the Aboriginal Relics applies to all Sites irrespective of the level of Significance or Land Tenure.

Landscape features and areas can be gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the area is of Special Significance to the Local Traditional Land Owners of Indigenous Community.

It is expected that a revision of the Act will change the wording to exclude the word *Knowingly* from the ACT. This revision is planned to be enforced on 1st January 2003.

It is an Offence to Damage or Destroy Aboriginal Objects or Relics or Aboriginal Places without the permission of the Director General of the National Parks and Wildlife Service.

## ENVIRONMENTAL PROTECTION & ASSESSMENT ACT

The Environmental Planning and Assessment Act 1979 and it's regulations, schedules and associated guidelines requires that environmental impacts are considered in land use planning and decision making. Environmental impacts are interpreted in NSW in the broadest sense, including impacts on Aboriginal Cultural Heritage. The EP & A Act has three main parts of relevance to Aboriginal Heritage:

- Part (3) governs that preparation of planning instruments:
- Part (4) relates to development assessment process for local Government (Consent Authorities) and
- Part (5) relates to activities and approvals by Government (determining) Authorities (N.P.W.S 1997:1).

## 1.1 DESCRIPTION OF THE SURVEY AREA

The Study area is located inside the Upper Hunter Region approximately 12km or less south-west of the township of Singleton.

The viewing aspects to the east looks across the Valley towards Singleton and beyond, whereas the southerly aspects has views towards the Hunter Mountain Range and the Wollombi Brook landscape.

The landscape is dominated by a ridgeline running East-West. The area has undulating features covered presently by heavy timber groups across the Western and Southern sections.

There is a major landscape feature and drainage known as Sandy Hollow Creek.

Parts of the landscape have been cleared and altered by farming practices, predominantly used for cattle grazing. The headwaters of Doctors Creek is also found within the study area.

The unusual features located within the environment are two hill tops as well as deep sand deposits found within the centre of the study area.

Culturally the Grinding Grooves are the most significant physical feature within the study area.

The vegetation is mixed with a high count of Iron Bark Trees giving way to Casuarina closer to the creek lines.

## 1.2 DESCRIPTION OF IMPACT

CNA's Warkworth Mine is planning to extend west of their current consent boundary to the Wallaby Scrub Road..

The impact to the landscape, over the proposed mining area, will be total destruction.

The environment will be changed forever and our Tribal and Spiritual, as well as physical connection to the land will be changed due to the mining of this landscape.

The description of the impact will speak for itself.

# 2 QUALIFICATIONS / RELEVANT EXPERIENCE

## QUALIFICATIONS

The Wonnarua people have fully endorsed the consultant Mr. Victor Perry to act as independent consultant on behalf of the Traditional Owners and to provide input from the local Koori people.

The primary consultant Victor Perry has already completed 34 reports on behalf of the Wonnarua People;

***1998***

- Hunter Valley Mine - The Mining of Site 37 - 5 - 63
- Ethno Historical Report for Bengalla Mine
- South Lemington Open cut Mine Extension

***1999***

- Lower Hunter Water Pipeline
- The Olive Fruit Processing Plant
- Mt Thorley Cultural Heritage Assessment
- DLWC Merriwa River, Coulsons Creek Bank Rehabilitation Work

***2000***

- Carrington Mine Cultural Heritage Assessment
- Ellerston Property Cultural Heritage Assessment
- Inglewood Vineyards Pty Ltd Cultural Heritage Assessment
- Broke Water Pipeline Cultural Heritage Assessment
- AGL Gas Main Extension Cultural Heritage Assessment
- DLWC Wallis & Nerone Creeks Cultural Heritage Assessment
- Lot 1 DP 628392 Sub-Division Cultural Heritage Assessment
- Mt Owen Mine Water Storage Dam Cultural Heritage Assessment
- Hunter Valley South Pit Extension Cultural Heritage Assessment
- Highfield Way Sub-Division Cultural Heritage Assessment
- Dartbrook Extended Cultural Heritage Assessment

***2001***

- Jerrys Plains Coal Terminal Rail Spur Cultural Heritage Assessment
- Cumnock No1 Coal Extension Cultural Heritage Assessment
- "Poggy" Sandstone Quarry Cultural Heritage Assessment

- DLWC Pages, Isis & Hunter Rivers Cultural Heritage Assessment
- Liddell Extension Cultural Heritage Assessment
- Ashton Mine Cultural Heritage Assessment
- Klaudios Sand & Gravel Quarry Cultural Heritage Assessment
- Drayton Coal Lease Renewal Cultural Heritage Assessment

***2002***

- Dartbrook mine Kayuga Access Slot Cultural Heritage Assessment
- DLWC South Arm Wollombi Brook & Stockyard Creek CHA
- Redbank II Power Station Cultural Heritage Assessment
- Singleton Army Base Rehabilitation
- Muswellbrook Coal No 1 Cultural Heritage Assessment
- Abbey Green Cultural Heritage Assessment
- Mt Owen / Bettys Creek Cultural Heritage Assessment
- United Mine Emplacement Area Cultural Heritage Assessment

**Victor Perry**

- NATIONAL PARKS AND WILDLIFE SERVICE

  Victor Perry has worked in partnership with the NPWS in relation to protection and management of Wonnarua Heritage and Culture during the past 18 years.

- FIELD EXPERIENCE

  Victor Perry has over 14 years practical experience working for the Local Aboriginal Community on Aboriginal Archaeological Site Surveys and Salvage Excavations. Mr Perry has worked with consultant archaeologists including Haglund, Rich, Baker, Kuskie, McDonald, Stuart, Keottig, Kelly, Hardy and other well known archaeological consultants in the Hunter Valley.

- WONNARUA CULTURAL HERITAGE

  Victor Perry gained Aboriginal Cultural training through his family's knowledge of Aboriginal History and Customs. This knowledge and its associated customs have been passed down through the generations.
  Victor Perry has been endorsed from the present day Wonnarua Aboriginal People and Native Title Claimants in the Hunter Valley. Victor Perry is employment with the Upper Hunter Wonnarua Council as the Aboriginal Cultural Heritage Manager.

- WANARUAH LOCAL ABORIGINAL LAND COUNCIL MEMBER
  Victor Perry worked with the Wanaruah Local Aboriginal Land Council. During this time he managed the Wanaruah LALC Aboriginal Heritage Unit.

## COMMUNITY ENDORSEMENT

The Wonnarua people fully endorse Victor Perry to carry out Cultural Heritage Assessments within their Tribal Boundaries.

Cultural Heritage is gaining similar recognition to archaeology and scientific studies and the local communities are best placed to undertake these surveys.

In this way Aboriginal people become the Consultant for their Heritage, for their people.

## KNOWLEDGE AND HERITAGE LEGISLATION

Victor Perry has a working knowledge of the Heritage Legislation (NPWS Act 1974) Section 90 which provides statutory protection for Aboriginal Relics, states that it is an offence to damage or destroy Aboriginal Relics without the Minister's Consent. The Environmental Planning and Assessment Act 1979 (EP & A Act) provides regulated guidelines to assess the environmental impact that developments would have on land and water etc. The EP & A Act also incorporates impacts on Aboriginal Heritage, within it's guidelines

# 3 ABORIGINAL CULTURAL VALUES ASSESSMENT

The Wonnarua people consider that all Sites within their Traditional Homeland are of high importance and are in need of proper care and protection.

The land and water running through it are the lifeblood of their culture. The hills and plains, the forest and mountains provided people in past generations with the resources needed to survive.

Camping and tool making sites found today remind people of their forefathers, the original inhabitants of the land.

The Wonnarua wish to protect their history and culture wherever possible, and maintain a connection with the land by providing recommendations in regards to Wonnarua Koori Heritage.

The land and its stories were passed down from father to son over 200 generations before the arrival of Cook from England.

According to Tribal Law the local family group of Wonnarua people were obligated to care, maintain and protect this part of the Country.

The Wonnarua people of today are still obligated to care for the environment as their ancestors did in the past, although they can no longer enforce Traditional Law for its protection.

Aboriginal Cultural Assessments can look at many things. Local Aboriginal people are attached to the land through physical, spiritual and visual connections.

Important areas include any combination of certain Aboriginal Cultural Places such as Bora Grounds, Spiritual Teaching Areas, Stone Arrangements, Traditionally visited Camping Areas, Dreamtime Sites and Song Lines as well as Scared Trees for Ceremonial and War Shields, Cultural Assessments includes consideration of all these things.

At this point in time, in the Central Lowlands of the Hunter Valley over two and a half thousand (2500) Wonnarua Cultural Heritage Sites have been destroyed by open cut mining, which means that the remaining Sites are becoming rare and more valuable to the community.

# 4 DOCUMENTATION OF CONSULTATION

The Upper Hunter Wonnarua Councils representative Mr Victor Perry was contacted by Coal & Allied's Environmental Specialist, Mick Lovely to assist the AMBS Archaeologist in a Cultural Heritage and Archaeological investigation for the Warkworth Extension area in late 2001.

At that stage only the Upper Hunter Wonnarua Council was involved in Cultural Heritage Management Issues.

Since this date, other Aboriginal Groups have put their hats into the ring to claim a right to be consulted about Aboriginal Heritage Matters in the Upper Hunter Valley.

Our view is that Aboriginal people have a right to be consulted but may we stress that this right comes from a person's connection to the Country and through the Correct Blood Lines and not just because I am an Aboriginal person.

Being an Aboriginal person is only the first step in identifying and qualifying for Heritage Consultation.

# 5 METHODOLOGY

## 5.1 PRE-FIELDWORK

Coal & Allied's Environmental Specialist Mr Mike Lovely contacted the Upper Hunter Wonnarua Council and asked us to be involved in the Warkworth Aboriginal and Archaeological Cultural Heritage Assessment .

The Upper Hunter Wonnarua Council considered Coal & Allied's invitation to be involved and agreed to be involved in the Cultural Heritage Assessment.

As required a National Parks and Wildlife Service Minark Data Base Search of the Singleton and Bulga 1;25,000 Topographic Map area has been done and will be included in this report please see *Table 1*

This information covers the topographical maps for the development area in which known or recorded Aboriginal Relic Sites have been previously recorded by archaeologists or unqualified people interested in Aboriginal Heritage.

No other Aboriginal interested groups were contacted to be involved in this survey.

## 5.2 FIELDWORK

The field work or ground survey was organized by AMBS Archaeological Services during late November early December 2001.

The whole of the study area was inspected by vehicle and on foot.

Transects covered at least all the major landscape features represented in the area.

The AMBS Archaeologists were Alison Nightingale, Neville Baker, Jenny Allen, Gavin Martin, Andrew Collis and Geomorphologist, Philip Hughes.

Mr Barry French, John Mathews, Tracey Skene, Field Assistants and Cultural Heritage Manager Victor Perry of the Upper Hunter Wonnarua Council were employed to assist the AMBS Archaeologists identify and record all Aboriginal Relics inside the study area.

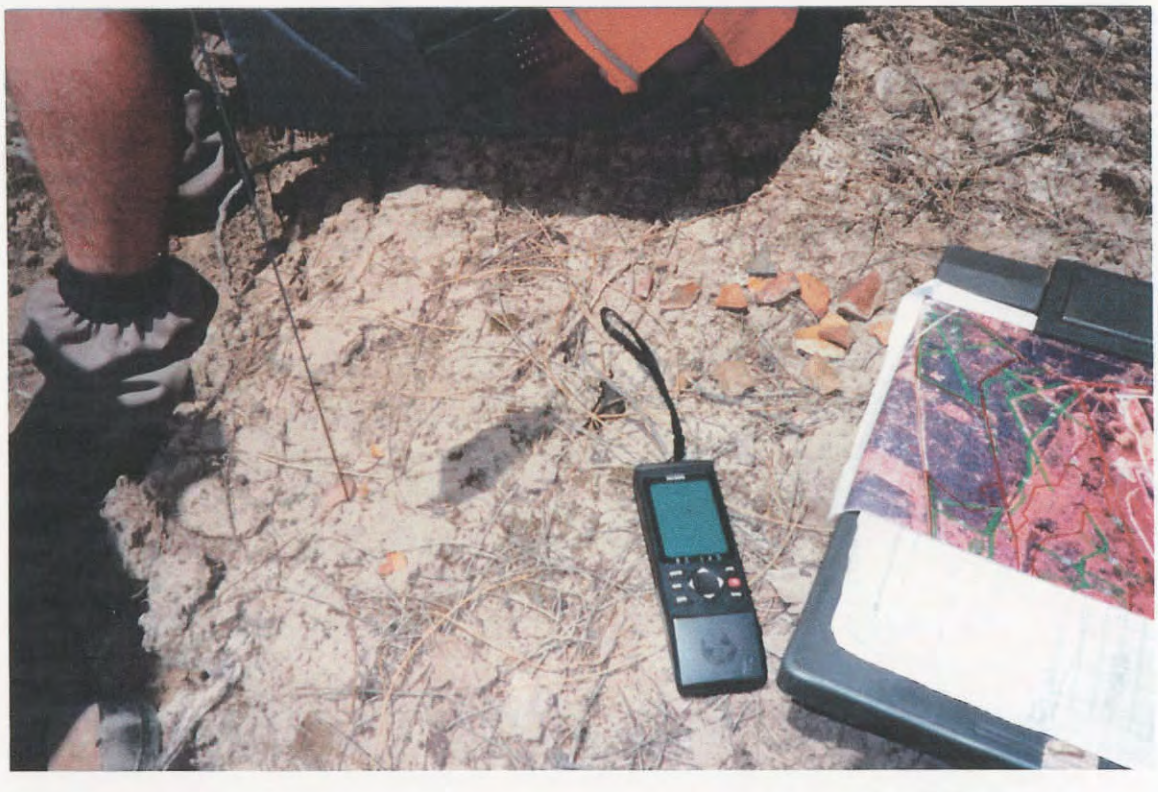
The Wonnarua Tribal Descendants consider this area to be a part of their Ancestral Homeland, therefore we believe that most if not all the Artefactual Evidence recorded in this development would have been manufactured by our Wonnarua Ancestors.

There are a number of Small Tool Production Centres recorded along Sandy Hollow Creek, but of major concern are the Axe Grinding Grooves that were found in two places. CNA have modified their mine plan to ensure the southern grooves are not to be disturbed as a part of this application, however, the northern grooves will be impacted upon.

The sand sheet areas which may possibly contain Burial's located within it. CNA have agreed to develop specific management plans for these sand sheet areas and involve the Upper Hunter Wonnarua Council should and potential Burial remains be found as a part of the mining process.

# 6 PHOTOGRAPHS


**TYPICAL PICTURES SHOWING ARTEFACTS FOUND ACROSS THE LANDSCAPE**



B FRENCH, J MATHEWS & T SKENE CONDUCTING SURVEY



AN EROSION SCAR BEING MEASURED BY GEOMORPHOLOGIST P.HUGHS,

**CONTOUR BANK WITH AMBS ARCHAEOLOGISTS**



**EROSION ALONG SAND SHEET AREA**

FLAGS SHOW WERE ARTEFACTS ARE LOCATED

V PERRY, B FRENCH, J MATHEWS RECORDING ARTEFACT



T SKENE, J MATHEWS INSPECTING ERODING GULLY

**T SKENE, B FRENCH INSPECTING THE SANDSTONE OUTCROP WHICH IS A MAJOR GRINDING GROOVE SITE.**

**GOOD PICTURE OF 2 STONE AXE GRINDING GROOVES**

**A TOTAL OF 40 STONE AXE GRINDING GROOVES WERE SAID TO BE RECORDED WITHIN THIS SITE**

**AN EXAMPLE OF A LARGE MUDSTONE FLAKE CORE FOUND AT THE GRINDING GROOVE SITE**

**ANOTHER PICTURE OF STONE AXE GRINDING GROOVES**

# 7 RESULTS

## 7.1 DOCUMENTING WHAT WAS FOUND

In total 69 Aboriginal relic Sites were recorded in the study area, including 2 Grinding Groove Sites.

The Site types are mainly small to large Tool Production Centres were individual or Groups of people have sat down and made or re-touched Stone Points and Blades for Hunting and Gathering Practices. Most of what we have recorded is what has been left behind after the Tools have been made. Spear Points for hunting Kangaroo or Emu and long Blades for cutting up meat etc.

There is quite a large number of Aboriginal Sites or Visible Evidence to suggest that this landscape has been used frequently over the past 2000 year's or more. It is an over statement for me to say that individual or Group Tool Production Centres are only found in the Hunter Valley, because of the erosion problem that exists we believe that there are a lot more sites located across the landscape, but cannot be found because of the vegetation cover.

In this report I was unable to visit and see each Aboriginal Site individually but there were 4 Aboriginal field workers present. At least one person was present during the Archaeological Recording of each Aboriginal Site.

The Archaeologists from AMBS will supply all the National Parks and Wildlife Service Site Cards for this report.

## 7.2 DOCUMENTING SIGNIFICANCE to the ABORIGINAL COMMUNITY

Aboriginal Sites and Places are still important to today's generation of people, therefore these areas still need protection

According to the National Parks and Wildlife Service Policy Aboriginal Elders or community groups are included in the recording and management of Aboriginal relics with the state of New South Wales.

The significance of a site is mostly determined by the values placed upon them by the local Aboriginal community.
The main aim of Cultural Heritage Management should be the Conservation and Protection of Aboriginal Heritage Sites, which should include the landscape within the area.

To the people who have Tribal Associations with the country, a site's significance will be a result of a number of factors. These may include continuing Traditional and Visual Links with the Historic Landscape or Landscape Features and also very deep concerns for the protection of the open camping sites, scared trees, canoe trees, ceremonial grounds and burial places and seasonal camping grounds.

The Traditional Custodians of the Country value their sites as tangible links with the lifestyle and values of their ancestors. The Wonnarua Traditional Owners voice their opinions through the Upper Hunter Wonnarua Council, which is based in Singleton, NSW.

Historical information has revealed that the current Mining Lease Extension is 2km to the east of a known Ceremonial Area where Carved Trees were recorded.**
I must flag with CNA that theses Initiation Grounds and the surrounding areas must be Protected from further development. A meeting between the developer and ourselves needs to be held in order to gain an understanding about the future of this Important Site.

Therefore the following Recommendations and Management Conditions have been based on the filed assessment and our historical knowledge of the area.

Also the Upper Hunter Wonnarua Council has Authority to Represent the Wonnarua Nation on all Cultural Heritage Matters within the Upper Hunter Area. Therefore our Recommendations are supported by this group.

***1999 Wonnarua Cultural Heritage Assessment for Mt Thorley Operations*
*by Junburra Aboriginal Consultancy Services*
*Carved Trees pages 33 to 37*

# 8 RECOMMENDATIONS

The following Recommendations and Conditions have been based upon a clear understanding of this development taking into consideration what the Consulting Archaeologist has advised concerning the Test Pits and Geomorphologic Assessment.

Please see the following;

***Recommendation 1***
That the Upper Hunter Wonnarua Council would not oppose any application for Consent to Destroy for Aboriginal Heritage Sites within the development if the company agrees to the following Recommendations made by the Upper Hunter Wonnarua Council as the Representing Body.

***Recommendation 2***
That the Upper Hunter Wonnarua Council be funded to carry out an Historical Video of the entire Lease Area prior to Coal Mining to add to our Historical Library.
This video is to be carried out by Upper Hunter Council personnel only.

***Recommendation 3***
That an Aboriginal Collection and Salvage Program be drawn up by the Upper Hunter Wonnarua Council for all the affected Aboriginal Sites recorded inside the area of Mining for Warkworth Mine.

***Recommendation 4***
That representatives of the Upper Hunter Wonnarua Council be employed to develop a strategy to be incorporated within the Environmental Management Plan for possible identification of Aboriginal Remains, during the top soil stripping process. Should remains be found, the Upper Hunter Wonnarua Council must be immediately contacted prior to any further work processing. NPWS will also be contacted.

***Recommendation 5***
That representatives of the Upper Hunter Wonnarua Council be employed to assist in the removal of the 9 northern Stone Axe Grinding Grooves that are to be affected by this development.

***Recommendation 6***
It is the opinion of the Upper Hunter Wonnarua Council that once the Grinding Grooves have been removed then they should be either placed close to the larger set of southern Grinding Grooves located or placed in a cultural heritage centre.

***Recommendation 7***
That Relics recovered by the Upper Hunter Wonnarua Council are to be cleaned and catalogued by the Upper Hunter Wonnarua Council representatives and that a report developed by the Upper Hunter Wonnarua Council detailing this activity is to be supplied to the developer and NPWS once finished.
Care and Control of all the Aboriginal Relics, salvaged by the Upper Hunter Wonnarua Council will be applied for by the Upper Hunter Wonnarua Council.
All expenses are to be paid for by the developer.

***Recommendation 8***
That the Upper Hunter Wonnarua Council be able to fence off the Ceremonial Site at the developers expense.

# BIBLIOGRAPHY

References; Warkworth Mine Western Extension
Archaeological Assessment of Aboriginal Heritage

DRAFT Report for Coal & Allied

By Australian Museum Business Services
12th July 2002

# TABLE 1

## Minark Data Base Search

# BULGA

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = BULG4S Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0145 | Nine Mile Creek; | AMG | 56 | 324349 | 6383450 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0146 | Saxonvale; | AMG | 56 | 323418 | 6384347 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0147 | Loders Creek; | AMG | 56 | 322504 | 6384330 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0148 | Loders Creek; | AMG | 56 | 322504 | 6384330 | None | ☐ | ☐ | Grinding Groove | Axe Grinding Groove | | 1 |
| 37-6-0149 | Saxonvale; | AMG | 56 | 322624 | 6377930 | None | ☐ | ☐ | Grinding Groove | Axe Grinding Groove | | |
| 37-6-0156 | Mt Thorley;Warkworth Mine 2; | AMG | 56 | 320600 | 6388120 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0160 | Mt Thorley;Mt Thorley J; | AMG | 56 | 316600 | 6388200 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0162 | Mt Thorley;Mt Thorley L; | AMG | 56 | 318200 | 6388200 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0287 | Mt Thorley;MT 1; | AMG | 56 | 320870 | 6384950 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0288 | Mt Thorley;MT 2; | AMG | 56 | 320500 | 6385020 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = BULG4S Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0289 | Mt Thorley;MT 3; | AMG | 56 | 320520 | 6385830 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0290 | Mt Thorley;MT 4; | AMG | 56 | 320400 | 6386160 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0291 | Mt Thorley;MT 5; | AMG | 56 | 320380 | 6386800 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0292 | Mt Thorley;MT 6; | AMG | 56 | 320150 | 6387080 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0293 | Mt Thorley;MT 7; | AMG | 56 | 320060 | 6387650 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0294 | Mt Thorley;MT 8; | AMG | 56 | 320020 | 6387180 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0295 | Mt Thorley;MT 9; | AMG | 56 | 320150 | 6386770 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0296 | Mt Thorley;MT 10; | AMG | 56 | 320200 | 6387430 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0297 | Mt Thorley;MT 11; | AMG | 56 | 320380 | 6386070 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0298 | Mt Thorley;MT 12; | AMG | 56 | 319340 | 6386440 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = BULG4S Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0429 | Bulga 7; | AMG | 56 | 317910 | 6383310 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0441 | Bulga | AMG | 56 | 312750 | 6387020 | None | ☐ | ☐ | Earth Mound<br>Hearth | Mound (Oven) | | 1 |
| 37-6-0442 | Bulga; | AMG | 56 | 314400 | 6385600 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0458 | Doctors creek; | AMG | 56 | 318630 | 6388560 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0474 | Bulga 8; | AMG | 56 | 321450 | 6383400 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0475 | Bulga 9; | AMG | 56 | 321750 | 6383800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0476 | Bulga 10; | AMG | 56 | 322260 | 6383570 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0477 | Bulga 11; | AMG | 56 | 322060 | 6384360 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0478 | Bulga 12; | AMG | 56 | 321780 | 6384250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0479 | Bulga 13; | AMG | 56 | 322300 | 6383180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |

Number of Sites : 261

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = BULG4S Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0660 | B 77; | AMG | 56 | 322210 | 6385110 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0661 | W5; | AMG | 56 | 317980 | 6385100 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0662 | F1; | AMG | 56 | 319340 | 6388070 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0663 | F2; | AMG | 56 | 319480 | 6388010 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0664 | F3; | AMG | 56 | 319730 | 6388010 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0665 | F4; | AMG | 56 | 320100 | 6387800 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0667 | F16/17; | AMG | 56 | 320570 | 6388550 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0669 | MT 37; | AMG | 56 | 317270 | 6387730 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0757 | IF 1 Bulga Sth.; | AMG | 56 | 324600 | 6382100 | None | ☐ | ☐ | Artefact | Isolated Find | | 2 |
| 37-6-0804 | Broke Road 1 | AMG | 56 | 321850 | 6379850 | None | ☐ | ☐ | Artefact | Open Camp Site | | 4 |

Number of Sites : 261

# SINGLETON

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-3-0082 | GCC20;Caswell; | AMG | 56 | 326220 | 6402600 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-3-0094 | SGCD 1;Obanvale; | AMG | 56 | 327710 | 6402190 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0095 | SGCD 2;Obanvale; | AMG | 56 | 327610 | 6402270 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0096 | SGCD 3;Obanvale; | AMG | 56 | 327650 | 6402350 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0097 | SGCD 4;Obanvale; | AMG | 56 | 327650 | 6402420 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0098 | SGCD5;Obanvale; | AMG | 56 | 327650 | 6402460 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0099 | SGCD 6;Obanvale; | AMG | 56 | 327640 | 6402580 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0104 | SGCD 11;Obanvale; | AMG | 56 | 327620 | 6400560 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-3-0150 | A; | AMG | 56 | 327580 | 6402600 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-4-0038 | Wambo 2;Warkworth; | AMG | 56 | 312400 | 6394230 | None | ☐ | ☐ | Artefact | Open Camp Site | | 8 |

Number of Sites : 367

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-5-0083 | Red Bank Creek 51; | AMG | 56 | 312350 | 6396600 | None | ☐ | ☐ | Artefact | Open Camp Site | | 4 |
| 37-5-0084 | Red Bank Creek 34; | AMG | 56 | 331090 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | 4 |
| 37-5-0104 | Red Bank Creek 21; | AMG | 56 | 312250 | 6396550 | None | ☐ | ☐ | Artefact | Open Camp Site | | 4 |
| 37-5-0170 | Gliding club 1; | AMG | 56 | 314025 | 6397520 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-5-0179 | NW 1; | AMG | 56 | 318720 | 6395100 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-5-0254 | HVS 30 | AMG | 56 | 313720 | 6399050 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-5-0255 | HVS 31 | AMG | 56 | 313530 | 6401640 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-5-0256 | HVS 32 | AMG | 56 | 313500 | 6400800 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-5-0257 | HVS 33 | AMG | 56 | 312500 | 6400480 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-5-0258 | HVS 34 | AMG | 56 | 312450 | 6400220 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0018 | Wylies Flat; | AMG | 56 | 320753 | 6394723 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0019 | Gouldsville;Wylies Flat; | AMG | 56 | 320845 | 6394725 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0020 | Mt Thorley; | AMG | 56 | 321936 | 6390173 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0029 | Long Point;Singleton; | AMG | 56 | 325497 | 6395361 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0030 | Glengowan; | AMG | 56 | 325591 | 6390333 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0031 | Dunolly; | AMG | 56 | 325940 | 6396101 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0040 | Combo; | AMG | 56 | 330499 | 6396827 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0044 | Wylie's Flat; | AMG | 56 | 324153 | 6393873 | None | ☐ | ☐ | Artefact | Shelter with Deposit | | |
| 37-6-0045 | Singleton;Dunolly; | AMG | 56 | 324286 | 6396527 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0046 | Curlewis; | AMG | 56 | 316290 | 6398663 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0047 | Wylies Flat;Singleton; | AMG | 56 | 325057 | 6394438 | None | ☐ | ☐ | Artefact | Shelter with Deposit | | |
| 37-6-0056 | Wollombi Brook; | AMG | 56 | 313258 | 6389643 | None | ☐ | ☐ | Ceremonial Ring (Stone or Earth)<br>Modified Tree (Carved or Scarred) | Bora/Ceremonial<br>Carved Tree | | |
| 37-6-0098 | Barney's Gully; | AMG | 56 | 321200 | 6397300 | None | ☐ | ☐ | Art (Pigment or Engraved) | Shelter with Art | | |
| 37-6-0108 | Warkworth 1 | AMG | 56 | 319560 | 6390750 | None | ☐ | ☐ | Modified Tree (Carved or Scarred) | Scarred Tree | | |
| 37-6-0113 | Wollombi Brook;Warkworth; | AMG | 56 | 314932 | 6397906 | None | ☐ | ☐ | Modified Tree (Carved or Scarred) | Carved Tree | | |
| 37-6-0130 | Agip 7;Warkworth; | AMG | 56 | 312584 | 6396307 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0131 | Agip 6;Warkworth; | AMG | 56 | 313133 | 6396318 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0132 | Agip 10;Warkworth; | AMG | 56 | 313129 | 6396501 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0133 | Warkworth;Agip 8; | AMG | 56 | 313500 | 6396233 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0134 | Agip 9;Warkworth; | AMG | 56 | 313499 | 6396325 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0135 | Wambo 5;Warkworth; | AMG | 56 | 313550 | 6393582 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0136 | Wambo 6;Warkworth; | AMG | 56 | 313157 | 6395038 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0150 | Combo; | AMG | 56 | 327593 | 6395766 | None | ☐ | ☐ | Burial<br>Artefact | Burial/s<br>Open Camp Site | | |
| 37-6-0151 | Mt Thorley;Warkworth Mine 6; | AMG | 56 | 317150 | 6392250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0152 | Mt Thorley;Mt Thorley B; | AMG | 56 | 316900 | 6390000 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0153 | Mt Thorley C; | AMG | 56 | 318726 | 6390661 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0154 | Mt Thorley;Mt Thorley D; | AMG | 56 | 320503 | 6393438 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0155 | Mt Thorley;Warkworth Mine 4; | AMG | 56 | 320820 | 6389900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0157 | Mt Thorley;Mt Thorley G; | AMG | 56 | 319658 | 6389764 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0158 | Mt Thorley;Mt Thorley H; | AMG | 56 | 318761 | 6388832 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions Gender | General | Location | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37-6-0265 | BBC 7;Jerrys Plains;Lemington Coal Mine; | AMG | 56 | 314710 | 6400600 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0266 | BBC 8;Jerrys Plains;Lemington Coal Mine; | AMG | 56 | 314850 | 6400550 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0272 | Red Bank Creek 12; | AMG | 56 | 313200 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0273 | Wambo 1;Warkworth Colllery; | AMG | 56 | 312690 | 6394290 | None | ☐ | ☐ | Artefact | Open Camp Site | | 8 |
| 37-6-0274 | Wambo 2;Warkworth; | AMG | 56 | 312400 | 6394230 | None | ☐ | ☐ | Artefact | Open Camp Site | | 8 |
| 37-6-0275 | Red Bank Creek 10; | AMG | 56 | 313250 | 6396250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 4 |
| 37-6-0281 | Combo;Wonarua Park Council Reserve; | AMG | 56 | 329212 | 6397169 | None | ☐ | ☐ | Burial | Burial/s | | |
| 37-6-0323 | Redbank Creek;No.45; | AMG | 56 | 312750 | 6396450 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0324 | Redbank Creek;N0.46; | AMG | 56 | 312650 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0325 | Redbank Creek;No.47; | AMG | 56 | 312600 | 6396400 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0326 | Redbank Creek;No.48; | AMG | 56 | 312500 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0327 | Redbank Creek;No.49; | AMG | 56 | 312500 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0328 | Redbank Creek;No.50; | AMG | 56 | 312350 | 6396500 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0329 | Redbank Creek;No.44; | AMG | 56 | 312800 | 6396400 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0330 | Redbank Creek;No.42; | AMG | 56 | 313100 | 6396450 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0331 | Redbank Creek;No.43; | AMG | 56 | 313000 | 6396350 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0371 | Apex Lookout;Singleton; | AMG | 56 | 325440 | 6395860 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0372 | SH1;Singleton Heights; | AMG | 56 | 329900 | 6400200 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0373 | SH2;Singletons Heights; | AMG | 56 | 329900 | 6399450 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0374 | SH3;Singleton Heights; | AMG | 56 | 330120 | 6399800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0396 | SH24; | AMG | 56 | 328630 | 6400800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0397 | SH25; | AMG | 56 | 328700 | 6400950 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0398 | SH26; | AMG | 56 | 329080 | 6401200 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0399 | SH27; | AMG | 56 | 329100 | 6400790 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0400 | SH28; | AMG | 56 | 329600 | 6401110 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0401 | WB4; | AMG | 56 | 315660 | 6395250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0402 | WB1; | AMG | 56 | 316050 | 6395820 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0403 | WB2; | AMG | 56 | 316800 | 6395400 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0404 | WB3; | AMG | 56 | 315810 | 6395210 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0405 | SH29; | AMG | 56 | 329600 | 6401130 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |

Number of Sites : 367

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0416 | SH40; | AMG | 56 | 329210 | 6399610 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0417 | SH41; | AMG | 56 | 329190 | 6399500 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0418 | SH42; | AMG | 56 | 328720 | 6399530 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0419 | SH43; | AMG | 56 | 329590 | 6400640 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0420 | SH 44;Singletons Heights; | AMG | 56 | 329880 | 6400680 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0421 | SH45; | AMG | 56 | 330050 | 6401010 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0444 | Warkworth Dune.; | AMG | 56 | 314520 | 6394400 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0550 | Warkworth Mine 3; | AMG | 56 | 320900 | 6388900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0566 | Lemington 8;LC 8;LEMINGTON MINE; | AMG | 56 | 314500 | 6400800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0567 | Lemington 13;LC 13;Lemington Mine; | AMG | 56 | 313650 | 6399500 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0578 | Lemington 2;LC 2;Lemington Coal Mine; | AMG | 56 | 313850 | 6401250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0579 | BBC3;Jerrys Plains;Lemington Coal Mine; | AMG | 56 | 313990 | 6400900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0580 | BBC4;Jerrys Plains;Lemington; | AMG | 56 | 314000 | 6400110 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0581 | BBC5;Jerrys Plains;Lemington; | AMG | 56 | 313850 | 6401350 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0582 | BBC9;Jerrys Plains;Lemington; | AMG | 56 | 313770 | 6401030 | None | ☐ | ☐ | Artefact | Open Camp Site | | 1 |
| 37-6-0589 | warkworth mines 7; | AMG | 56 | 316940 | 6391310 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0590 | warkworth mines 8; | AMG | 56 | 316860 | 6391290 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0591 | warkworth mines 9; | AMG | 56 | 316770 | 6390780 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0592 | warkworth mines 10; | AMG | 56 | 316960 | 6390940 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0593 | warkworth mines 11; | AMG | 56 | 316980 | 6391050 | None | ☐ | ☐ | Artefact | Open Camp Site | | |

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0608 | Sh47; | AMG | 56 | 330220 | 6398850 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0610 | Jerry's Plains Road 1; | AMG | 56 | 318000 | 6393350 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0611 | Jerry's Plains Road 2; | AMG | 56 | 318050 | 6393150 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0612 | Jerry's Plains Road 3; | AMG | 56 | 318650 | 6393250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0613 | Long Point Rd 16; | AMG | 56 | 318750 | 6393700 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0614 | Isf2-Lpr; | AMG | 56 | 319000 | 6393700 | None | ☐ | ☐ | Artefact | Isolated Find | | 2 |
| 37-6-0615 | Long Point Rd_2; | AMG | 56 | 318850 | 6393800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0616 | ISF1-LPR; | AMG | 56 | 319000 | 6393700 | None | ☐ | ☐ | Artefact | Isolated Find | | 2 |
| 37-6-0617 | ISF3-LPR; | AMG | 56 | 318050 | 6393350 | None | ☐ | ☐ | Artefact | Isolated Find | | 2 |
| 37-6-0618 | Long Point Rd 1a; | AMG | 56 | 318650 | 6393700 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |

AHIMS Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0641 | ISF 4;Lemington Mine Lease; | AMG | 56 | 317450 | 6393150 | None | ☐ | ☐ | Artefact | Isolated Find | | 2 |
| 37-6-0642 | Haulage Road_1;Lemington Mine Lease;WB 11 (Haulage Road); | AMG | 56 | 314900 | 6396550 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0643 | Haulage Road_2;Lemington Mine Lease;WB 6 (Haulage Road 2); | AMG | 56 | 314900 | 6396050 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0644 | Wollombi Brook Dam;Lemington Mine Lease; | AMG | 56 | 314850 | 6395700 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0645 | Wollombi Brook Trench;Lemington Mine Lease; | AMG | 56 | 314950 | 6395700 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0648 | Wattle Ponds Rd 2; | AMG | 56 | 328320 | 6399990 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0649 | Wattle Ponds Rd 1; | AMG | 56 | 328700 | 6400220 | None | ☐ | ☐ | Artefact | Open Camp Site | | 2 |
| 37-6-0666 | F5/15; | AMG | 56 | 321400 | 6388900 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0668 | F18; | AMG | 56 | 320570 | 6388700 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0672 | Hambledon Hill 7 | AMG | 56 | 325350 | 6395650 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0673 | Hambledon Hill 6 | AMG | 56 | 329400 | 6395400 | None | ☐ | ☐ | Artefact | Isolated Find | | 3 |
| 37-6-0674 | Hambledon Hill 8 | AMG | 56 | 325300 | 6395650 | None | ☐ | ☐ | Artefact | Isolated Find | | 3 |
| 37-6-0675 | Hambledon Hill 3 | AMG | 56 | 325350 | 6395250 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0677 | Wark-1; | AMG | 56 | 321500 | 6390800 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0681 | Scarred Tree; | AMG | 56 | 325480 | 6398500 | None | ☐ | ☐ | Modified Tree (Carved or Scarred) | Scarred Tree | | |
| 37-6-0682 | Wark-2; | AMG | 56 | 321100 | 6391000 | None | ☐ | ☐ | Artefact | Isolated Find | | 3 |
| 37-6-0687 | MTCL2; | AMG | 56 | 322260 | 6388900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0688 | Mount Thorley Coal Loader; | AMG | 56 | 322260 | 6388900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0689 | MTCL1; | AMG | 56 | 322250 | 6388900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0697 | Rixs Creek 1; | AMG | 56 | 323220 | 6398140 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0698 | Granbalong; | AMG | 56 | 323440 | 6399900 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0699 | Rixs Creek 2; | AMG | 56 | 323140 | 6398280 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0700 | Granbalong 1; | AMG | 56 | 323060 | 6399760 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0701 | Granbalong 2; | AMG | 56 | 323030 | 6399880 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0702 | Granbalong 4; | AMG | 56 | 323380 | 6400240 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0703 | WB 21; | AMG | 56 | 315350 | 6395000 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0704 | WB 20; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0705 | WB 19; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0706 | WB 17; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0707 | WB 18; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |

AHIMS
Aboriginal Heritage Information Management System

List of Sites ( Partial )

Grid Reference Type = AMG Zone = 56 Map Sheet = SING4N Feature Search Type = AHIMS Features

| Site Id | Site Name | Grid Ref. Type | Zone | Easting | Northing | Access Restrictions | | | Site Features | Site Types (recorded prior to June 2001 ) | Further Info. Contact | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Gender | General | Location | | | | |
| 37-6-0708 | WB 16; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0709 | WB 15; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0710 | WB 14; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0711 | WB 13; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0712 | WB 12; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0713 | WB 10; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0714 | WB 8; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0715 | WB 7; | AMG | 56 | 315690 | 6394180 | None | ☐ | ☐ | Artefact | Open Camp Site | | 3 |
| 37-6-0753 | Maquella 4; | AMG | 56 | 327970 | 6399880 | None | ☐ | ☐ | Artefact | Open Camp Site | | |
| 37-6-0754 | Maqella 3; | AMG | 56 | 327950 | 6399780 | None | ☐ | ☐ | Artefact | Isolated Find | | |

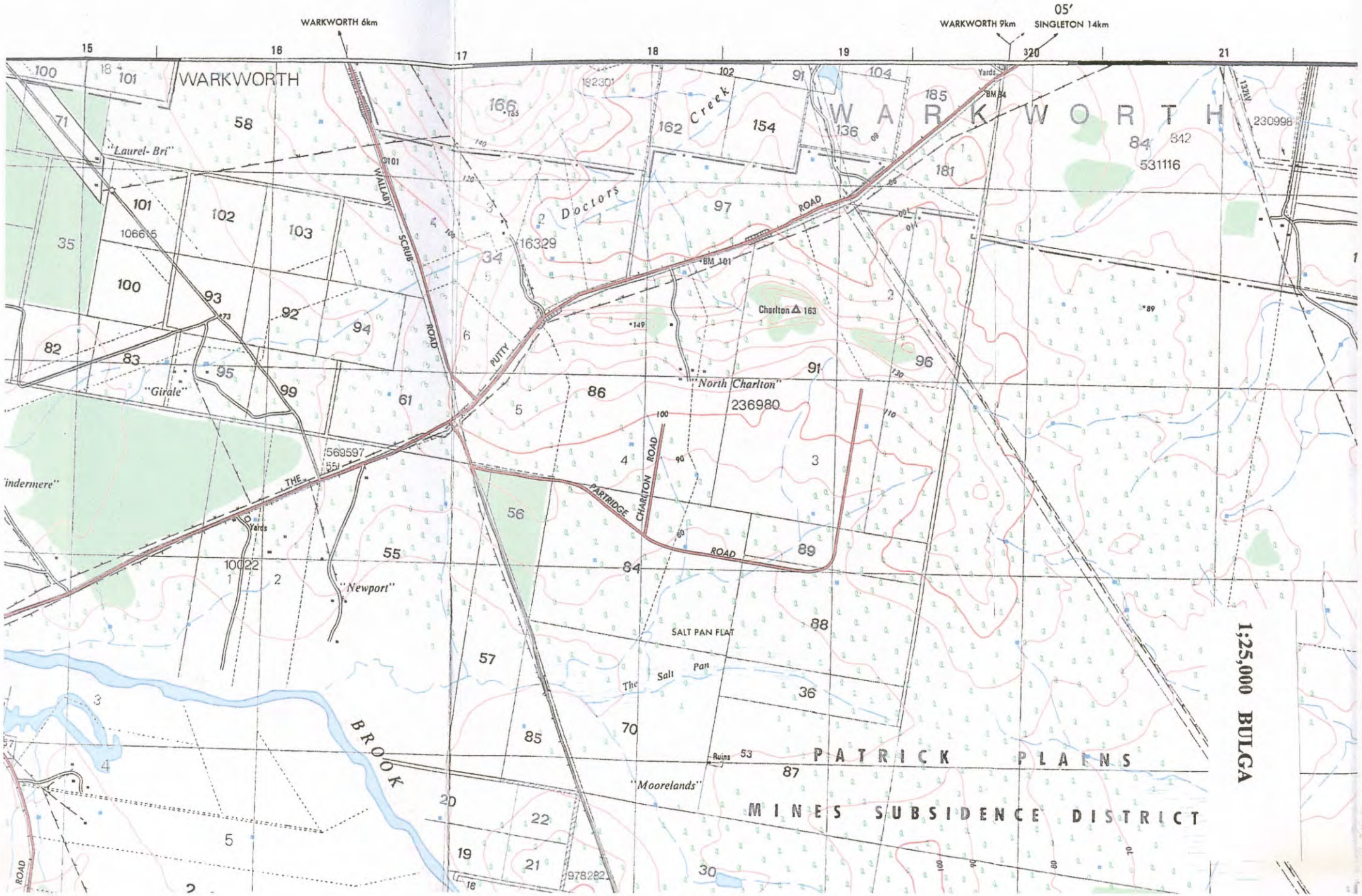
# Appendix 1

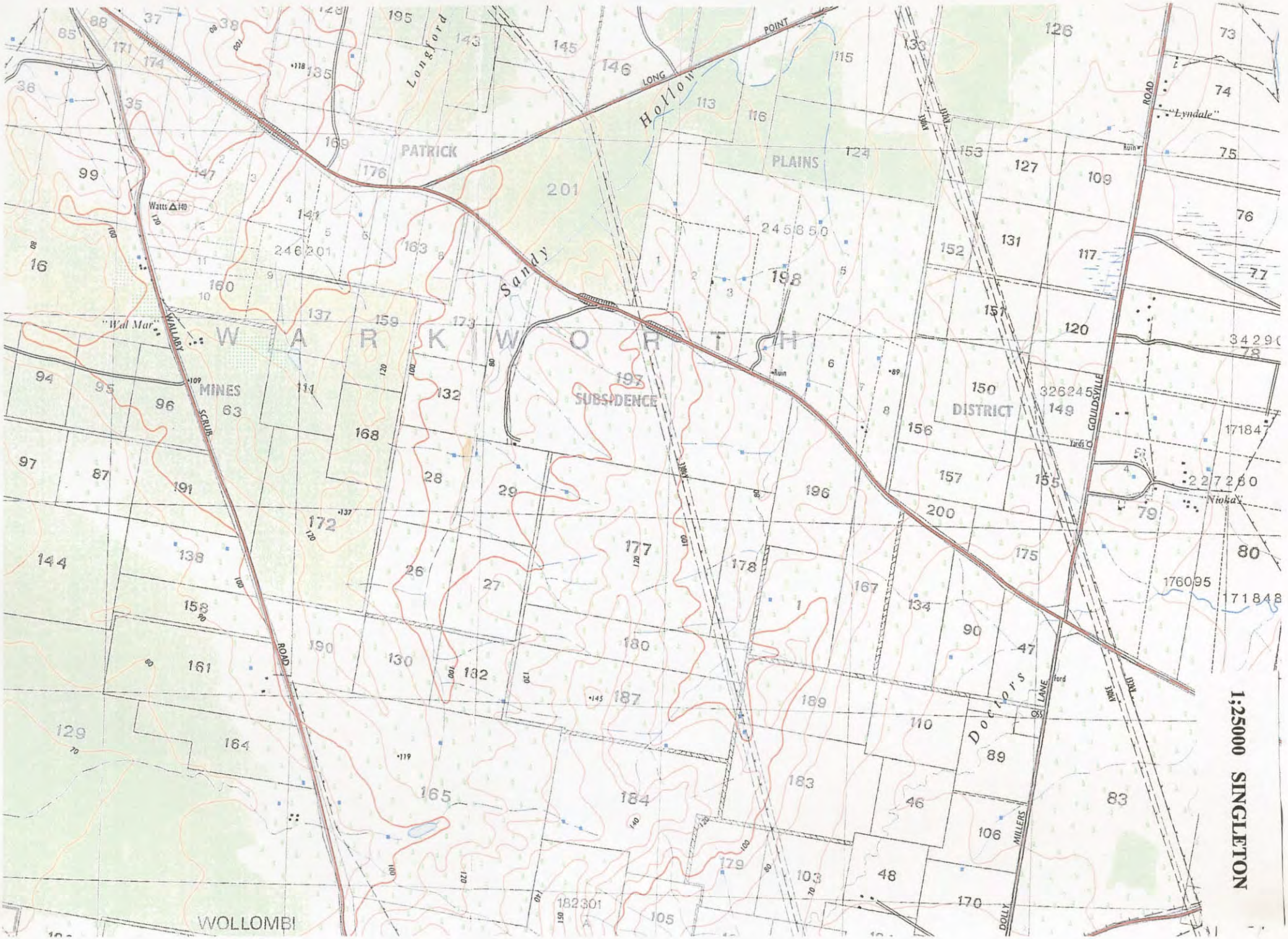
## Locality Plan

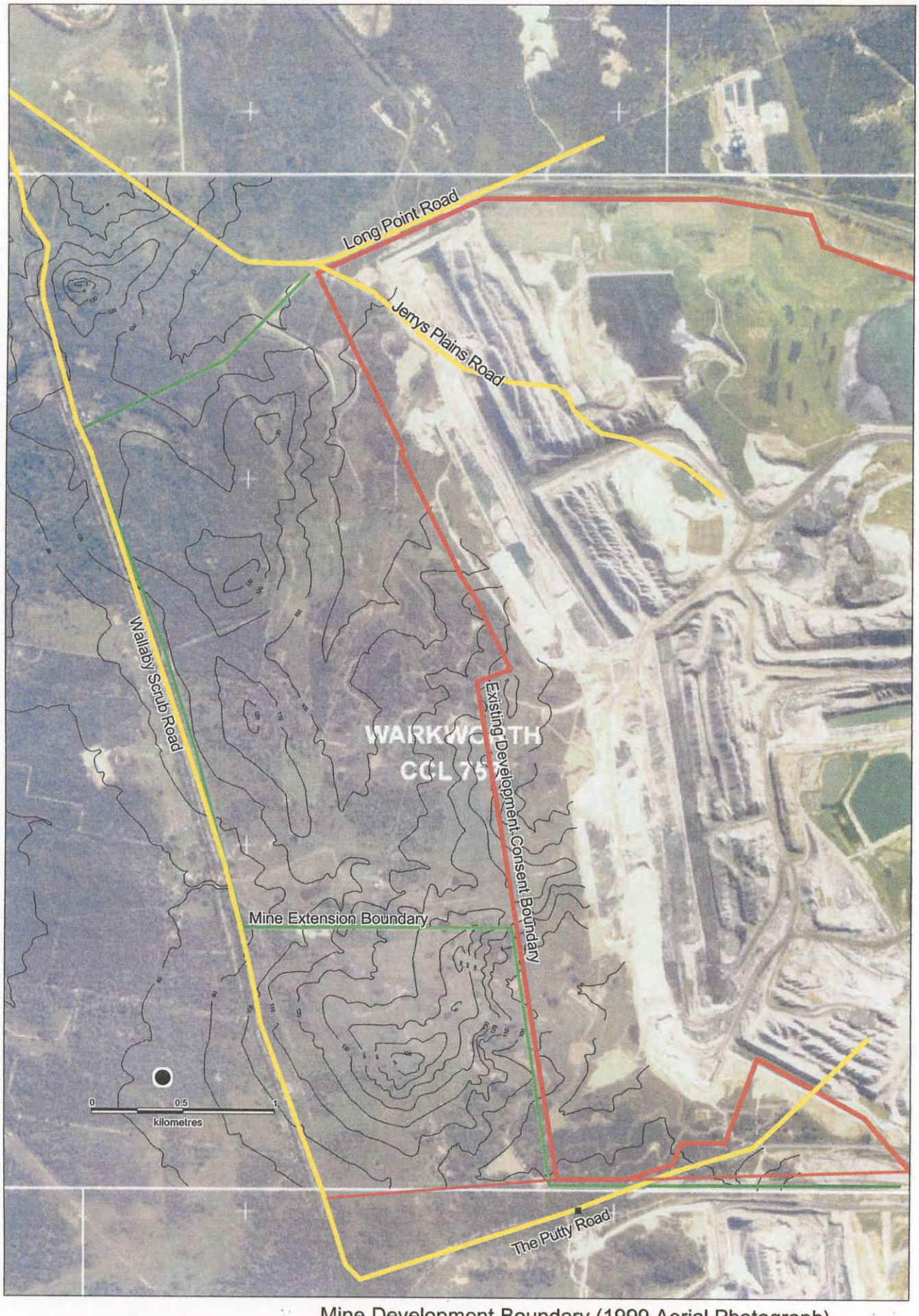

WARKWORTH MINE AREA

# Appendix 2

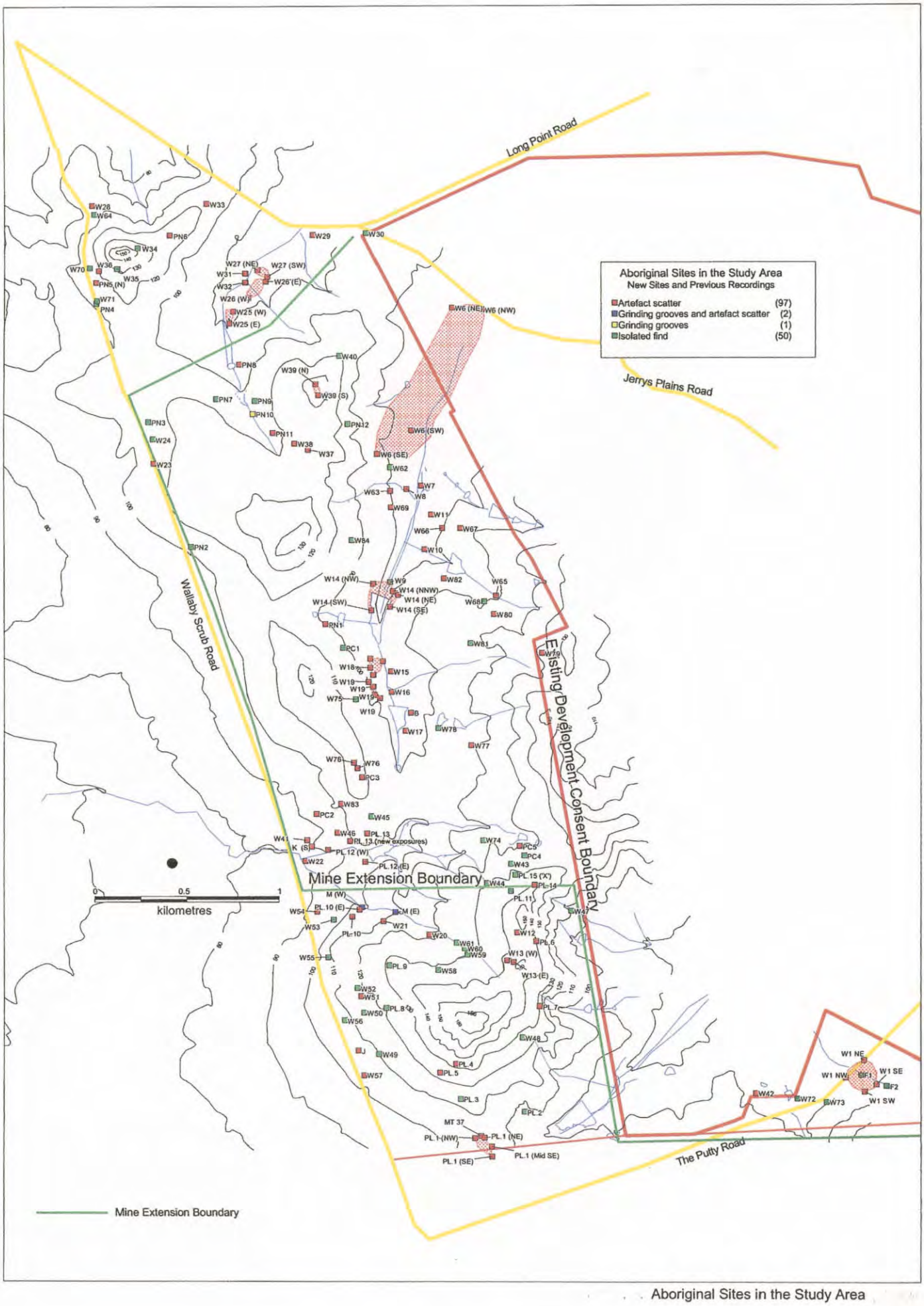
## 1:25,000 Map of Study Area


WARKWORTH 6km
WARKWORTH 9km
SINGLETON 14km
05′
WARKWORTH
WARKWORTH
"Laurel- Bri"
"Girale"
"Newport"
"Moorelands"
"North Charlton"
Charlton 163
Doctors Creek
WALLABY SCRUB ROAD
PUTTY ROAD
THE PARTRIDGE ROAD
CHARLTON ROAD
ROAD
BROOK
SALT PAN FLAT
The Salt Pan
PATRICK PLAINS
MINES SUBSIDENCE DISTRICT
1;25,000 BULGA

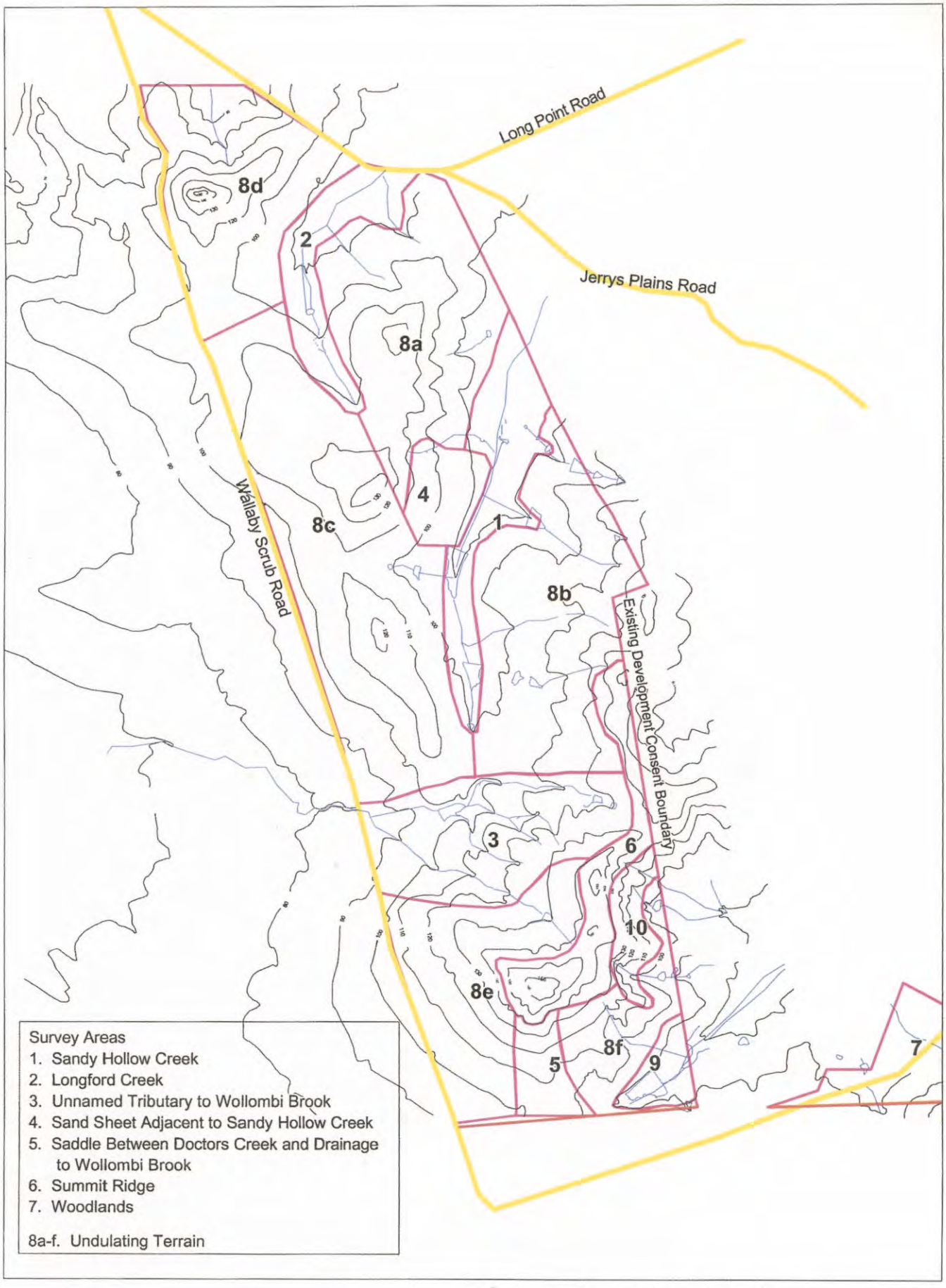

1:25000 SINGLETON
WARKWORTH
PATRICK
PLAINS
DISTRICT
MINES
SUBSIDENCE
WOLLOMBI
Longford
Sandy
Hollow
LONG
POINT
WALLABY
SCRUB
ROAD
GOULDSVILLE
ROAD
Doctors
LANE
MILLERS
DOLLY
"Wal Mar"
"Lyndale"
"Niokd"
Watts △140




Mine Development Boundary (1999 Aerial Photograph)




Aboriginal Sites in the Study Area




. Survey Areas/Landform Zones

# Appendix 3

## Community Endorsement

WONNARUA TRIBAL COUNCIL INC
PO Box 184
Unit 17 / 174 JOHN st
SINGLETON NSW 2330
Phone 02 6571 4888 Mobile 0408 225521
Fax 02 6571 4889 Mobile 0428 174946
TRADITIONAL LAND OWNERS
**ABN 85 204 598 641**

Upper Hunter Wonnarua Council
9 Argyle st
Singleton NSW 2330

**RE: LETTER of ENDORSEMENT for MR VICTOR PERRY as our WONNARUA CULTURAL HERITAGE CONSULTANT for OUR TRADITIONAL WONNARUA HOMELAND.**

To Whom it may concern

The Koori Consultant, Mr Victor Perry is fully endorsed by the Koori Community as our Wonnarua Cultural Heritage Consultant.

The Wonnarua Tribal Council as the Traditional Land Owners and the Native Title Clamant Group, who's membership is made up from the Wonnarua Koori people from across the Hunter Valley, fully endorse the actions of Mr Victor Perry as our Cultural Heritage Consultant.

Mr Perry plays an active role in the Koori Community as our Cultural Heritage Consultant and has done so over the past 10 years.

R. Perry

Rhoda Perry (Elder)
Executive Director
Wonnarua Tribal Council Inc

T Miller

Tom Miller (Elder)
Executive Director
Wonnarua Tribal Council Inc

# Letters from
# Lower Wonnarua Tribal Council
# and
# Wanaruah Local Aboriginal Land Council

*Lower Wonnarua Tribal Council*

31 ST ANDREWS STREET
Maitland NSW 2320
*Telephone (02) 4934 8106*
*facsmile (02) 4934 8107*
*Mobile 0417 403 153*
*lowerwonnarua.tc@bigpond.com*
ABN: 29 609 494 979

19th August 2002

Mick Lovely
Environmental Specialist - Licences, Approvals & Reporting
Coal & Allied Operations Pty Ltd
Lemington Road,
Ravensworth via Singleton
NSW 2330

RE: Draft Warkworth Western Extension Eis- Archaeological & Cultural Heritage Report
Dear Mick,
Please include this in your EIS.
We the LWTC FULLY APPOSE to this proposed mine extension at the Warkworth mine Mt Thorley via Singleton NSW.
As to total Destruction of our Cultural & Heritage and the Significances of the amount of Aboriginal Archaeological Sites that will be Destroyed by this proposal if it is approved.

We will be applying to NPWS to have this area placed on the Aboriginal Places Declaration under section 84 of the Act 1974. TO PROTECT OUR CULTURAL & HERITAGE FOR OUR FUTURE GENERATIONS AND THE CULTURAL & HERITAGE SIGNIFICANCE TO THE WHOLE OF THE ABORIGINAL COMMUNITY

As to the letter of endorsement for Mr Victor Perry of the UHWC you sent to us it is not an original it has no date on it when it was signed, I have spoken to Uncle Tom Miller about this letter and he informed me he did not sign any letter of endorsement for this project, further more there is no letter of endorsement from the Wonnarua Nation either so who is Mr Victor Perry endorsed by !

Regards
Barry Anderson
Co ordinator
LWTC

cc: AMBS, NPWS, UHWC, Wonnarua Nation, WLALC

LOCAL ABORIGINAL LAND COUNCIL
WANARUAH

P.O. BOX 127
19 MAITLAND STREET,
MUSWELLBROOK 2333

PH.: (02) 6543 1288
(02) 6543 1962
FAX: (02) 6542 5377

Dianne Markham
Environmental Officer - Licences & Approvals
Coal & Allied

Ph: 02 6570 0093
Fax: 02 6570 0377
E-mail: dianne.markham@cna.riotinto.com.au

Re: Warkworth Western Extension EIS-Archaeological & Cultural Heritage Report

Dear Dianne,

The Wanaruah Local Aboriginal Land Council was constituted in 21st March 1984 in accordance with the provisions of the Aboriginal Land Rights Act of 1983, as amended in 1990, and administers the relevant provisions of the Act as they apply to the functions listed under Objectives. Of those the following apply to Cultural Heritage

1. Acquire, manage, use, and control, of lands of cultural significance.

2. To protect the interests of Aboriginal Community Members (in relation to 1) in this area.

3. Act in the best interest of Aboriginal owners of the land.

4. Increase cultural awareness.

To that end where we are unable to Acquire, manage, or control lands of cultural significance, the Wanaruah Local Aboriginal Land Council must use other means and has developed the following policies for Culturally Significant sites.

1. We the Wanaruah Local Aboriginal Land Council are the caretakers and keepers of the culture of the original inhabitants of this area.

2. Wanaruah Local Aboriginal Land Council considers all Aboriginal sites within its constituted boundaries important to the local Aboriginal community.

3. Wanaruah LALC does not agree to the destruction of any Aboriginal sites within its constituted boundaries and all sites should be considered as a constraint to develop and that development proposals be designed recognising these constraints.

4. Wanaruah LALC strongly opposes the issuing of "Consents to Destroy" by the Director of NPWS.

Beyond these polices we also have the following comments

1. Aboriginal Cultural Heritage is not limited to the relics and art that have survived the impact of European settlement. It is a living culture and includes landforms, water holes vegetation zones, habitats, and peoples.

2. For the preservation, protection and management of Aboriginal sites within the constituted boundaries of Wanaruah Local Aboriginal Land Council, it is of the utmost importance for archaeological consultants and developers to consider the knowledge and wishes of Wanaruah Local Aboriginal Land Council.

3. Wanaruah Local Aboriginal Land Council also recognises that although a large number of sites have been recorded over the years, very little is commonly known about these sites. Archaeologists who have proven quite skilled at recording sites and quite freely state that they are ignorant of the sites that they record.

4. Wanaruah LALC requires that all Aboriginal surveys conducted within its constituted boundaries, must be undertaken in the presence of, at least, two representatives of the Wanaruah LALC.

5. Wanaruah LALC requires that Archaeologists provide a copy of their draft report prior to finalisation; Wanaruah LALC comments must be included in their entirety in the final report.

Before considering any consents, Wanaruah Local Aboriginal Land Council has a duty to fully explore and compare all the negative impacts that such action will have against the benefits of the development, to the Land, Aboriginal Culture and the Community.

Having read the Warkworth Western Extension EIS-Archaeological & Cultural Heritage Report, Wanaruah Local Aboriginal Land Council is both alarmed and concerned by the number and types of sites listed for destruction. We do not agree with or consent to the destruction of any Aboriginal Sites within this project.

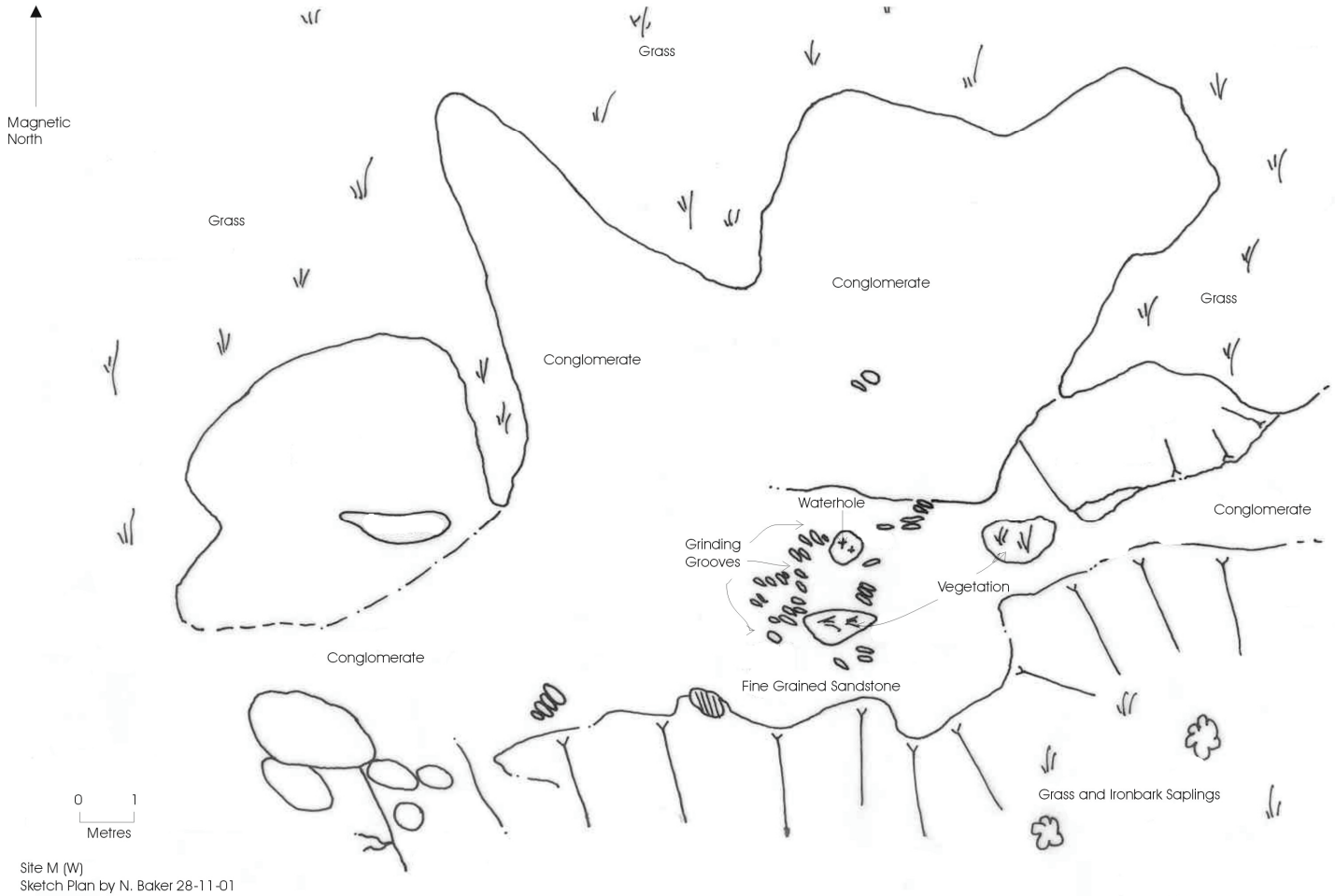
We would also like it noted that at no time in any of the survey work or consultation process has either Mr Barry French or Mr John Matthews been representing Wanaruah Local Aboriginal Land Council. This error needs to be corrected.

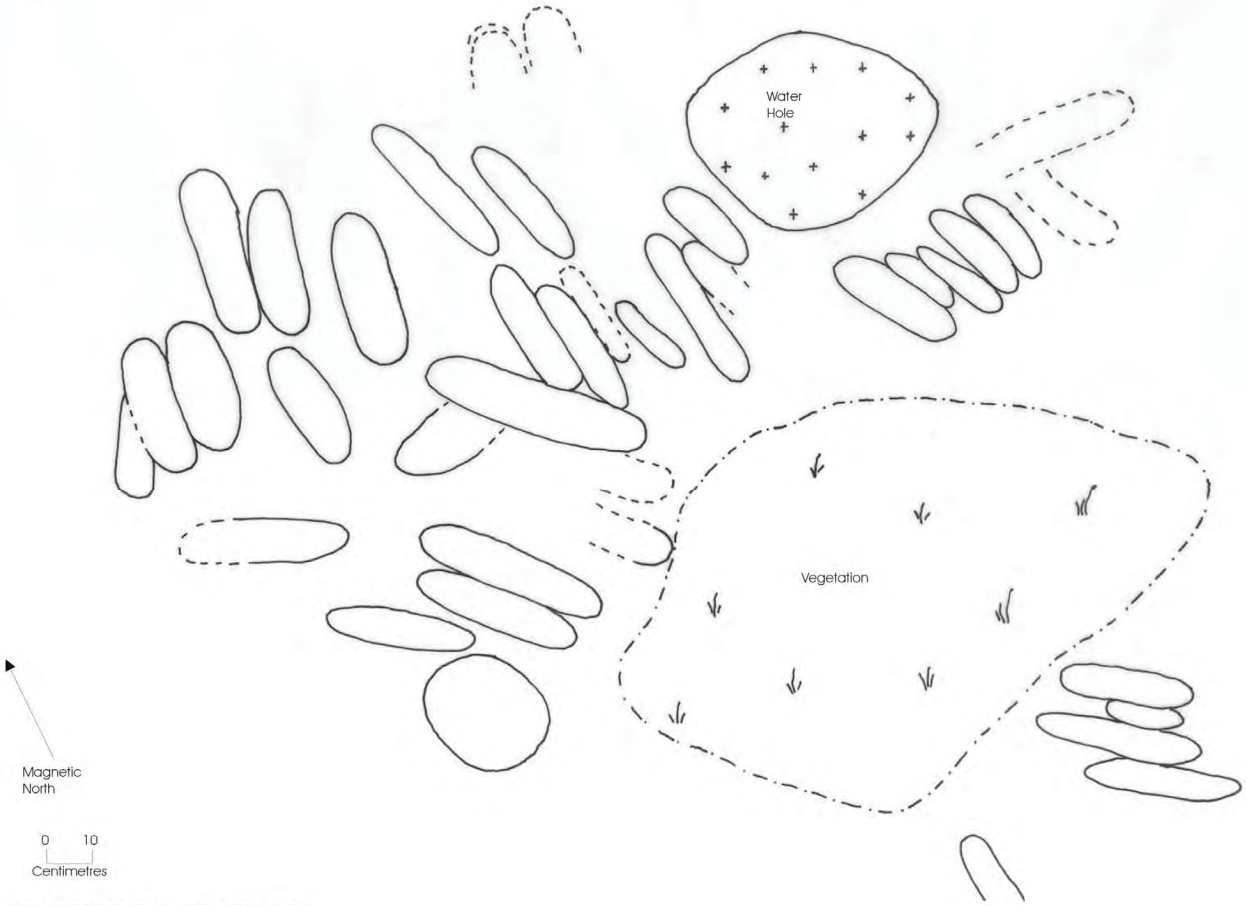
Thank you for this opportunity for input,

Noel Downs
Co-Ordinator

# Appendix B

## Site M (W) Sketch Plans






Site M (W) Sketch Map of Grinding Groove Cluster
Drawing by G. Martin and J. Allen 24-11-02

- - - - - = faint outline of groove

——— = distinct outline of groove

# Appendix C

## Artefact Details

Abbreviations

| Raw Material: | | Artefact Type: | |
|---|---|---|---|
| IM | Indurated mudstone | BF | Broken flake |
| S | Silcrete | C | Core |
| Q | Quartz | F | Flake |
| PW | Petrified wood | FP | Flaked piece |
| IG | Igneous | RF | Retouched flake |
| SS | Sandstone | HTSH | Heat shatter |
| PC | Porcellanite | HS | Hammerstone |
| QZT | Quartzite | HSF | Hammerstone fragment |
| | | GS | grindstone |

| Site Name | Raw Material | Size (cm) | Artefact Type | Comment |
|---|---|---|---|---|
| **1. Sandy Hollow Creek** | | | | |
| Dyall Site B | IM | 2-3 | BF | |
| Dyall Site B | IM | 2-3 | BF | |
| Dyall Site B | IM | 4-5 | BF | |
| Dyall Site B | IM | 3-4 | BF | |
| Dyall Site B | IM | 1-2 | BF | |
| Dyall Site B | S | 3-4 | BF | |
| Dyall Site B | S | 3-4 | BF | |
| Dyall Site B | S | 3-4 | BF | |
| Dyall Site B | IM | 5-6 | C | |
| Dyall Site B | IM | 7-8 | C | Tabular split, 12 mm thick, retouched edges |
| Dyall Site B | IG | 8-9 | C | Hatchet head? Small flat cobble |
| Dyall Site B | S | 6-7 | C | Partial heat shatter |
| Dyall Site B | IM | 4-5 | F | |
| Dyall Site B | IM | 4-5 | F | |
| Dyall Site B | IM | 4-5 | F | |
| Dyall Site B | IM | 4-5 | F | |
| Dyall Site B | IM | 4-5 | F | |
| Dyall Site B | IM | 6-7 | F | |
| Dyall Site B | IM | 2-3 | F | |
| Dyall Site B | IM | 2-3 | F | |
| Dyall Site B | IM | 2-3 | F | |
| Dyall Site B | IM | 3-4 | F | |
| Dyall Site B | IM | 3-4 | F | |
| Dyall Site B | IM | 3-4 | F | |
| Dyall Site B | IG | 5-6 | F | |
| Dyall Site B | Q | 2-3 | F | |
| Dyall Site B | Q | 2-3 | F | |
| Dyall Site B | S | 1-2 | F | |
| Dyall Site B | S | 4-5 | F | |
| Dyall Site B | S | 3-4 | F | |
| Dyall Site B | S | 4-5 | F | |
| Dyall Site B | IM | 3-4 | FP | |
| Dyall Site B | IM | 3-4 | FP | |
| Dyall Site B | IM | 3-4 | FP | |
| Dyall Site B | IM | 3-4 | FP | |
| Dyall Site B | IM | 2-3 | FP | |
| Dyall Site B | S | 2-3 | FP | |

| | | | | |
|---|---|---|---|---|
| W14 | S | 4-5 | BF | |
| W14 | IM | 4-5 | BF | |
| W14 | IM | 4-5 | F | |
| W14 | IM | 6-7 | F | |
| W14 | IM | 1-2 | F | |
| W14 | IM | 2-3 | F | |
| W14 | IM | 3-4 | F | |
| W14 | IM | 3-4 | F | |
| W14 | S | 7-8 | BF | |
| W14 | IM | 1-2 | BF | |
| W14 | IM | 2-3 | BF | |
| W14 | IM | 5-6 | C | |
| W14 | PW | 8-9 | C | Small cobble, primary cortex |
| W14 | IM | 5-6 | C | |
| W14 | IM | 2-3 | F | |
| W14 | IM | 1-2 | F | |
| W14 | IM | 5-6 | RF | |
| W14 | IM | 4-5 | F | |
| W14 | IM | 1-2 | F | |
| W14 | SS | 5-6 | GS | Dimensions: 6x3.5x2.5 |
| W14 | IM | 10-11 | RF | |
| W15 | IM | 1-2 | BF | |
| W15 | IM | 3-4 | F | |
| W15 | IM | 2-3 | F | |
| W15 | IM | 2-3 | F | |
| W15 | IM | 1-2 | F | |
| W15 | IM | 1-2 | F | |
| W15 | S | 3-4 | F | |
| W15 | IM | 2-3 | F | |
| W15 | IM | 3-4 | F | |
| W15 | IM | 2-3 | F | |
| W15 | IM | 3-4 | F | |
| W15 | IM | 3-4 | F | |
| W16 | IM | 2-3 | BF | |
| W16 | IM | 1-2 | BF | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 2-3 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 2-3 | F | |
| W16 | IM | 1-2 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 5-6 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 1-2 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 1-2 | F | |
| W16 | IM | 5-6 | F | |
| W16 | IM | 4-5 | F | |
| W16 | IM | 2-3 | F | |
| W16 | IM | 3-4 | F | |
| W16 | IM | 1-2 | FP | |
| W16 | IM | 1-2 | FP | |
| W17 | IM | 1-2 | BF | |
| W17 | IM | 2-3 | F | |

| | | | | |
|---|---|---|---|---|
| W17 | S | 3-4 | F | |
| W17 | IM | 1-2 | FP | |
| W17 | IM | 1-2 | RF | Geometric |
| W18 | IM | 3-4 | BF | |
| W18 | S | 1-2 | BF | |
| W18 | IM | 4-5 | BF | |
| W18 | IM | 4-5 | BF | |
| W18 | IM | 1-2 | BF | |
| W18 | IM | 1-2 | BF | |
| W18 | IM | 1-2 | BF | |
| W18 | S | 3-4 | BF | |
| W18 | IM | 3-4 | C | |
| W18 | S | 3-4 | C | |
| W18 | S | 4-5 | C | |
| W18 | IM | 2-3 | F | |
| W18 | IM | 1-2 | RF | Tip of Bondi point flaked off during retouch |
| W18 | S | 2-3 | F | |
| W18 | IM | 4-5 | F | |
| W18 | IM | 2-3 | F | |
| W18 | IM | 1-2 | F | |
| W18 | IM | 3-4 | F | |
| W18 | IM | 3-4 | F | |
| W18 | IM | 2-3 | F | |
| W18 | IM | 1-2 | F | |
| W18 | IM | 6-7 | F | |
| W18 | S | 10-11 | F | |
| W18 | S | 1-2 | F | |
| W18 | S | 1-2 | F | |
| W18 | S | 1-2 | F | |
| W18 | S | 1-2 | F | |
| W18 | S | 1-2 | F | |
| W18 | S | 3-4 | F | |
| W18 | S | 1-2 | FP | |
| W18 | S | 1-2 | FP | |
| W19 | IM | 3-4 | BF | |
| W19 | IM | 4-5 | BF | |
| W19 | IM | 1-2 | BF | |
| W19 | IM | 1-2 | BF | |
| W19 | IM | 4-5 | BF | |
| W19 | IM | 10-11 | C | |
| W19 | IM | 3-4 | F | |
| W19 | IM | 4-5 | F | |
| W19 | S | 1-2 | F | |
| W19 | IM | 4-5 | F | |
| W19 | IM | 3-4 | F | |
| W19 | IM | 3-4 | F | |
| W19 | IM | 3-4 | F | |
| W19 | IM | 1-2 | FP | |
| W63 | IM | 8-9 | C | Primary flaking - unidirectional, contains cortex |
| W63 | IM | 4-5 | F | |
| W66 | S | 2-3 | F | |
| W66 | S | 5-6 | F | |
| W9 | S | 2-3 | BF | |
| | | | | |
| **2. Longford Creek** | | | | |
| PN9 | S | 2-3 | BF | |

| | | | | |
|---|---|---|---|---|
| W25 | IM | 1-2 | BF | Edge damage |
| W25 | S | 7-8 | C | |
| W25 | S | 5-6 | C | |
| W25 | S | 3-4 | F | |
| W25 | IM | 2-3 | F | |
| W25 | QZT | 2-3 | F | |
| W25 | IM | 1-2 | F | |
| W25 | IM | 1-2 | F | |
| W25 | S | 2-3 | F | |
| W25 | S | 0-1 | F | |
| W25 | IM | 1-2 | F | |
| W25 | S | 2-3 | F | |
| W25 | IM | 1-2 | F | |
| W25 | IM | 1-2 | F | |
| W25 | IM | 2-3 | F | |
| W25 | IM | 3-4 | F | |
| W25 | S | 0-1 | F | |
| W25 | IG | 4-5 | HSF | |
| W25 | IM | 2-3 | BF | |
| W25 | IM | 3-4 | RF | |
| W25 | S | 2-3 | BF | |
| W25 | S | 2-3 | BF | |
| W25 | S | 7-8 | C | Secondary cortex (pebble) |
| W25 | S | 3-4 | C | |
| W25 | S | 2-3 | F | |
| W25 | QZT | 3-4 | F | Secondary cortex (pebble) |
| W25 | IM | 1-2 | F | |
| W25 | IG | 4-5 | F | |
| W25 | IM | 2-3 | F | |
| W25 | IM | 4-5 | F | |
| W25 | IM | 1-2 | F | |
| W25 | IM | 2-3 | F | |
| W25 | IM | 2-3 | F | |
| W25 | IM | 2-3 | F | Secondary cortex |
| W25 | S | 4-5 | F | |
| W25 | S | 3-4 | F | |
| W25 | IM | 4-5 | F | |
| W25 | IM | 3-4 | F | |
| W25 | IM | 4-5 | F | |
| W25 | S | 3-4 | F | |
| W25 | IM | 2-3 | F | |
| W25 | IM | 3-4 | F | Secondary cortex |
| W25 | IM | 2-3 | F | |
| W25 | IM | 3-4 | F | |
| W25 | IM | 4-5 | F | Secondary cortex |
| W25 | IM | 1-2 | F | |
| W25 | S | 3-4 | F | |
| W25 | S | 2-3 | F | |
| W25 | S | 2-3 | F | |
| W25 | S | 2-3 | F | |
| W25 | S | 2-3 | F | |
| W25 | S | 3-4 | F | |
| W25 | S | 1-2 | F | |
| W25 | IM | 1-2 | FP | |
| W26 | S | 2-3 | BF | |
| W26 | S | 2-3 | BF | |

| | | | | |
|---|---|---|---|---|
| W26 | IM | 2-3 | BF | Usewear |
| W26 | IM | 2-3 | BF | Usewear |
| W26 | IM | 1-2 | BF | |
| W26 | IM | 1-2 | BF | |
| W26 | IM | 3-4 | C | |
| W26 | IM | 4-5 | F | Secondary cortex |
| W26 | IM | 3-4 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 4-5 | F | |
| W26 | IM | 2-3 | RF | |
| W26 | IM | 2-3 | F | |
| W26 | S | 2-3 | F | |
| W26 | S | 1-2 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 4-5 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 1-2 | F | |
| W26 | S | 3-4 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 4-5 | F | |
| W26 | IM | 3-4 | F | |
| W26 | S | 1-2 | F | |
| W26 | IM | 1-2 | F | |
| W26 | S | 1-2 | F | |
| W26 | IM | 0-1 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 1-2 | F | |
| W26 | Q | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 2-3 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 3-4 | F | |
| W26 | IM | 1-2 | F | |
| W26 | IM | 3-4 | RF | |
| W26 | IM | 4-5 | FP | |
| W26 | IM | 1-2 | FP | |
| W26 | IM | 2-3 | FP | |
| W26 | IM | 0-1 | FP | |
| W26 | IM | 2-3 | FP | |

| | | | | |
|---|---|---|---|---|
| W27 | IM | 1-2 | BF | |
| W27 | IM | 1-2 | BF | |
| W27 | IM | 1-2 | BF | |
| W27 | IM | 1-2 | BF | |
| W27 | S | 1-2 | BF | |
| W27 | IM | 1-2 | F | |
| W27 | IM | 0-1 | F | |
| W27 | IM | 3-4 | F | |
| W27 | IM | 2-3 | F | |
| W27 | IM | 2-3 | F | |
| W27 | IM | 2-3 | F | |
| W27 | IM | 3-4 | F | |
| W27 | IM | 3-4 | F | |
| W27 | S | 3-4 | F | |
| W27 | IM | 3-4 | F | |
| W27 | IM | 2-3 | F | |
| W27 | IM | 3-4 | F | |
| W27 | IM | 2-3 | F | |
| W27 | S | 2-3 | F | |
| W27 | IM | 1-2 | F | |
| W27 | IM | 3-4 | F | |
| W27 | IM | 1-2 | FP | |
| W27 | IM | 1-2 | FP | |
| W27 | IM | 1-2 | RF | Backed |
| W27 | IM | 2-3 | HTSH | |
| W27 | IM | 1-2 | HTSH | |
| W27 | IM | 2-3 | HTSH | |
| W27 | IM | 2-3 | HTSH | |
| W29 | S | 3-4 | C | |
| W29 | IM | 4-5 | F | |
| W29 | IM | 1-2 | F | |
| W29 | IM | 1-2 | F | |
| W31 | S | 2-3 | BF | |
| W31 | IM | 2-3 | BF | |
| W31 | IG | 4-5 | BF | |
| W31 | IM | 2-3 | BF | |
| W31 | PW | 1-2 | BF | |
| W31 | IM | 4-5 | C | |
| W31 | PC | 3-4 | C | Blade core |
| W31 | IM | 3-4 | F | |
| W31 | IM | 2-3 | F | |
| W31 | PW | 3-4 | F | |
| W31 | IM | 2-3 | F | |
| W31 | IM | 5-6 | F | |
| W31 | IM | 4-5 | F | |
| W31 | IM | 4-5 | F | |
| W31 | IM | 3-4 | F | |
| W31 | IM | 3-4 | F | |
| W31 | IM | 3-4 | F | |
| W31 | IM | 2-3 | F | |
| W31 | IM | 1-2 | F | |
| W31 | IM | 2-3 | F | |
| W31 | IM | 1-2 | F | |
| W31 | IM | 1-2 | F | |
| W31 | IM | 3-4 | F | |
| W31 | IM | 2-3 | F | |

| | | | | |
|---|---|---|---|---|
| W31 | IM | 2-3 | FP | |
| W31 | IM | 2-3 | FP | |
| W31 | IM | 2-3 | FP | |
| W31 | IM | 2-3 | FP | |
| W32 | S | 3-4 | F | |
| W32 | S | 4-5 | F | |
| W32 | IM | 4-5 | F | |
| W32 | S | 4-5 | F | |
| W32 | S | 2-3 | F | |
| W32 | IM | 4-5 | F | |
| W32 | S | 5-6 | F | |
| W32 | S | 4-5 | F | |
| W32 | IM | 3-4 | FP | |
| | | | | |
| **3. Unnamed Tributary to Wollombi Brook** | | | | |
| Dyall Site K | IM | 1-2 | F | |
| Dyall Site K | IM | 1-2 | F | |
| Dyall Site K | IM | 4-5 | F | |
| Dyall Site K | IM | 3-4 | F | |
| Dyall Site K | IM | 3-4 | F | |
| Dyall Site K | IG | 4-5 | F | |
| Dyall Site K | IM | 4-5 | F | |
| PL.15 ('X') | IM | 2-3 | F | |
| PL10 | IM | 2-3 | BF | |
| PL10 | IM | 2-3 | BF | |
| PL10 | IM | 1-2 | BF | |
| PL10 | IM | 3-5 | BF | |
| PL10 | IM | 4-5 | C | |
| PL10 | IM | 2-3 | F | |
| PL10 | IM | 6-7 | RF | |
| PL11 | S | | | |
| PL13 | S | 1-2 | BF | |
| PL13 | IM | 3-4 | BF | |
| PL13 | IM | 3-4 | BF | |
| PL13 | IM | 4-5 | BF | |
| PL13 | IM | 1-2 | BF | |
| PL13 | S | 5-6 | C | |
| PL13 | S | 2-3 | F | |
| PL13 | IM | 3-4 | F | |
| PL13 | IM | 3-4 | F | |
| PL13 | Q | 2-3 | F | |
| PL13 | IM | 5-6 | F | |
| PL13 | S | 3-4 | F | |
| PL13 | IM | 1-2 | RF | Medial section of a Bondi Point |
| PL13 | S | | | |
| PL13 | S | | | |
| W20 | IM | 3-4 | F | |
| W20 | IM | 3-4 | F | |
| W20 | IM | 3-4 | F | |
| W21 | IM | 3-4 | BF | |
| W21 | IM | 1-2 | F | |
| W21 | IM | 4-5 | F | |
| W21 | IM | 2-3 | F | |
| W21 | IM | 2-3 | F | |
| W21 | IM | 3-4 | F | |
| W21 | IM | 2-3 | F | |

| | | | | |
|---|---|---|---|---|
| W21 | S | 3-4 | F | |
| W21 | IM | 1-2 | F | |
| W22 | S | 3-4 | BF | |
| W22 | S | 1-2 | BF | |
| W22 | IM | 3-4 | BF | |
| W22 | S | 3-4 | BF | |
| W22 | IM | 1-2 | BF | |
| W22 | IM | 2-3 | BF | |
| W22 | IM | 3-4 | C | Blade core |
| W22 | S | 2-3 | C | |
| W22 | S | 2-3 | C | |
| W22 | IM | 4-5 | C | Blade core |
| W22 | IM | 3-4 | F | |
| W22 | IM | 3-4 | F | |
| W22 | IM | 2-3 | F | |
| W22 | IM | 5-6 | F | |
| W22 | IM | 1-2 | F | |
| W22 | IM | 1-2 | F | |
| W22 | IM | 4-5 | F | |
| W22 | IM | 2-3 | F | |
| W22 | IM | 2-3 | F | |
| W22 | IM | 2-3 | F | |
| W22 | IM | 2-3 | F | |
| W22 | IM | 11-12 | RF | Elouera (dimensions: 3x2x12) |
| W43 | S | 5-6 | F | |
| W44 | IM | 2-3 | BF | |
| W53 | IM | 6-7 | F | Broken into two conjoinable pieces |
| W54 | S | 4-5 | FP | |
| W54 | IM | 4-5 | RF | |
| W74 | IM | | F | |
| | | | | |
| **4. Sand Sheet** | | | | |
| W69 | IM | 1-2 | BF | |
| W69 | S | 5-6 | F | |
| W69 | IM | 2-3 | F | |
| W84 | CH | | F | |
| | | | | |
| **6. Summit Ridge** | | | | |
| PL14 | IM | 3-4 | F | |
| PL14 | IM | 2-3 | F | |
| PL14 | Q | 2-3 | F | |
| PL14 | Q | 1-2 | F | |
| PL14 | IM | 4-5 | F | |
| W13 | IM | 1-2 | F | |
| W13 | Q | 1-2 | FP | |
| | | | | |
| **7. Woodlands** | | | | |
| W42 | S | 3-4 | F | |
| W42 | S | 3-4 | F | |
| W72 | IM | 4-5 | F | |
| W73 | IM | 3-4 | F | |
| | | | | |
| **8a. Undulating Terrain** | | | | |
| W28 | IM | 3-4 | F | |
| W28 | IM | 1-2 | F | |
| W30 | IM | 3-4 | BF | |

| | | | | |
|---|---|---|---|---|
| W37 | IM | 3-4 | BF | |
| W37 | S | 8-9 | C | Tertiary cortex |
| W37 | S | 3-4 | F | |
| W37 | S | 3-4 | F | |
| W37 | IM | 1-2 | F | |
| W37 | Q | 1-2 | F | |
| W37 | IM | 2-3 | F | |
| W37 | IM | 2-3 | F | |
| W37 | S | 1-2 | F | |
| W37 | IM | 1-2 | F | |
| W37 | IM | 1-2 | F | |
| W37 | S | 2-3 | F | |
| W37 | CH | 2-3 | F | |
| W37 | IM | 4-5 | F | |
| W37 | S | 5-6 | F | Primary cortex |
| W37 | S | 1-2 | FP | |
| W37 | IM | 5-6 | HS | |
| W37 | S | 2-3 | RF | Bondi Point |
| W38 | Q | 3-4 | F | Primary cortex |
| W38 | IM | 1-2 | F | |
| W38 | IM | 4-5 | F | |
| W39 | IM | 7-8 | C | Primary cortex - rectangular pebble |
| W39 | CH | 5-6 | F | |
| W39 | IM | 2-3 | F | |
| W39 | IM | 3-4 | F | |
| W39 | S | 2-3 | F | |
| W39 | IM | 2-3 | F | |
| W39 | IM | 3-4 | FP | |
| W40 | IM | 5-6 | F | |
| | | | | |
| **8b. Undulating Terrain** | | | | |
| W65 | IM | 8-9 | C | Primary flaking - unidirectional, contains cortex |
| W65 | IM | 4-5 | F | |
| W65 | Q | 1-2 | F | |
| W65 | IM | 5-6 | F | |
| W65 | S | 4-5 | F | |
| W67 | IM | 2-3 | F | |
| W67 | Q | 2-3 | F | |
| W68 | S | 6-7 | F | |
| W77 | S | 2-3 | F | |
| W77 | S | 3-4 | F | |
| W78 | S | 3-4 | F | |
| W79 | IM | 1-2 | F | |
| W79 | IM | 3-4 | F | |
| W79 | IM | 1-2 | F | Usewear |
| W80 | S | 5-6 | F | |
| W80 | S | 4-5 | FP | |
| W81 | IM | 1-2 | F | |
| W82 | IM | 3-4 | F | |
| W82 | IM | 3-4 | F | |
| W82 | PW | 3-4 | F | |
| W82 | PW | 2-3 | RF | Backed artefact with usewear |
| W82 | PW | 1-2 | RF | Backed artefact with usewear |
| | | | | |
| **8c. Undulating Terrain** | | | | |
| PC1 | IM | 1-2 | F | |

| | | | | |
|---|---|---|---|---|
| PC2 | IM | 4-5 | F | |
| PC2 | S | 11-12 | FP | |
| PC3 | IM | 1-2 | BF | |
| PC3 | IM | 1-2 | BF | |
| PC3 | IM | 2-3 | BF | |
| PC3 | IM | 4-5 | F | |
| PC3 | IM | 1-2 | FP | |
| PC3 | IM | 1-2 | FP | |
| PC3 | IM | 2-3 | FP | |
| PN1 | IM | 1-2 | F | |
| W23 | IM | 4-5 | F | |
| W23 | IM | 4-5 | F | Usewear |
| W24 | IM | 3-4 | F | |
| W41 | IM | 5-6 | C | |
| W41 | IM | 3-4 | F | |
| W41 | IM | 1-2 | F | |
| W41 | IM | 2-3 | F | |
| W41 | IM | 2-3 | F | |
| W45 | S | 10-11 | C | |
| W46 | S | 5-6 | BF | |
| W46 | S | 3-4 | F | |
| W76 | IM | 3-4 | F | |
| W76 | IM | 3-4 | F | |
| W76 | IM | 4-5 | C | |
| W76 | | | FP | |
| W83 | IM | 6-7 | F | |
| W83 | IM | 6-7 | F | |
| W83 | S | 4-5 | F | |
| | | | | |
| **8d. Undulating Terrain** | | | | |
| PN5 | IM | 3-4 | F | |
| PN6 | IM | 1-2 | F | |
| PN6 | IM | 4-5 | F | |
| W64 | IM | 3-4 | C | |
| W71 | IM | 5-6 | FP | |
| W33 | IM | 3-4 | BF | Secondary cortex |
| W33 | IM | 3-4 | F | |
| W34 | IM | 2-3 | F | |
| W35 | IM | 4-5 | C | Broken into two conjoinable pieces |
| | | | | |
| **8e. Undulating Terrain** | | | | |
| W49 | IM | 3-4 | FP | |
| W50 | S | 5-6 | F | |
| W51 | IM | 2-3 | F | Usewear |
| W51 | IM | 2-3 | HS | |
| W52 | IM | 2-3 | F | |
| W55 | IM | 1-2 | F | |
| W56 | IM | 1-2 | HTSH | |
| W57 | IM | 7-8 | C | |
| W57 | S | 2-3 | F | |
| W57 | IM | 3-4 | F | |
| W57 | S | 4-5 | FP | |
| W58 | S | 4-5 | F | |
| W59 | IM | 2-3 | F | |
| W60 | IM | 5-6 | F | |
| W61 | IM | 4-5 | BF | |

| | | | | |
|---|---|---|---|---|
| W62 | S | 2-3 | BF | |
| | | | | |
| **8f. Undulating Terrain** | | | | |
| W48 | IM | 11-12 | RF | |
| PL2 | S | | C | |
| | | | | |
| **10. Steep Slopes Facing Doctors Creek** | | | | |
| W47 | IM | 2-3 | BF | |
| | | | | |

# Appendix D

## Glossary of Terms

**artefact class -** broad categories used to divide artefacts into. These classes were defined according to diagnostic features and were: flake, core, retouched flake (of which backed artefact is a sub-class) and flaked piece.

**assemblage** - the name given to encompass the entire collection of artefacts recovered by archaeologists, invariably classified into diagnostic items used to describe the material culture.

**backed** - when one margin of a flake is retouched at a steep angle, and that margin is opposite a sharp edge. The steep margin is formed by bi-polar or hammer and anvil knapping. Also used to describe artefacts with backing. E.g. backed artefact.

**backed artefact** - a class of artefact employed by archaeologists to describe artefacts which are backed. Divided in to sub-classes based on general form : Asymmetric and Geometric.

**bipolar** - a flaking technique where the object to be reduced is rested on an anvil and struck. This process is identified by flakes with platform angles close to 90 degrees as well as apparent initiation from both ends. Some crushing may also be visible.

**burinate -** a class of flake which is technically retouched with the removal of small elongated flakes either longitudinally or laterally (see also Hiscock, 1993).

**chert** - a cryptocrystalline siliceous sedimentary stone.

**conjoin analysis** - the process of physically (re-) fitting artefacts back together.

**core** - an artefact which has technologically diagnostic features. Generally this class of artefact has only negative scars from flake removal, and thus no ventral surface, however, for the purposes of this research core has been employed to encompass those artefacts which were technically flakes but served the function of a core (i.e. the provider of flakes).

**cortex -** the weathered outer portion of a stone, often somewhat discoloured and coarser compared with the unweathered raw material.

**decortication** - the process of removing cortex from a stone (generally by flaking). The extent of decortication was recorded by classifying the presence or absence of cortex where: Primary (100% cortex), Secondary (1-99% cortex) and Tertiary (no cortex).

**diversity** - a gauge of the evenness of distribution of artefact occurrence within the assemblage's richness. While there are many measures of assemblage diversity, only the Shannon-Wiener Diversity Index is used in this research. Predominantly this index is a measure of the likelihood that the next individual artefact will be of the same class as the previous sample.

**flake** - an artefact which has technologically diagnostic features and a ventral surface.

**flaked piece** - an artefact which has technologically diagnostic features but has no discernible ventral or dorsal surface and hence is unidentifiable as either a flake or a core.

**heat shatter** - stone which has been reduced by exposure to heat. This stone can be identified by a number of features which include among others discolouration, texture changes and pot-lidding.

**mudstone**: a fine-grained siliceous sedimentary rock ideal for the manufacture of stone tools. Mudstone has been variously identified as indurated mudstone, and rhyolitic or silicified tuff (e.g. Hiscock and Shawcross 2000, Kuskie and Kamminga 2000, White 1999). The material is variable but these terms probably reflect archaeologist's preferred name as much as the petrology of the material. As mudstone or indurated mudstone is most commonly used to describe this raw material and is a more inclusive term, mudstone is used here.

**knapping event** - part of a knapping floor. Ideally this is where reduction of particular cobbles can be distinguished (also referred to as a reduction event).

**knapping floor** - a concentrated identifiable area where flaking (reduction) has taken place (also referred to as a reduction floor or reduction area).

**manuport** - an object which has been carried to carried by humans to the site.

**offsite scatter** - low density artefact distributions not associated with ostensible knapping or reduction events. As this density value will vary from site to site, for the purposes of this research, offsite scatter was classed as being equal to or less than the median density value over the site.

**procurement** - the process of obtaining raw material for reduction.

**quartz** - a crystalline form of silica.

**raw material** - the kind of stone the artefacts were manufactured from.

**reduction** - the process of removing stone flakes from another pieces of stone. Generally this is performed by striking (hard hammer percussion) one rock with another to remove a flake.

**retouch** - retouch is when a flake is removed after the manufacture of the original flake. This sequence can be observed when a flake scar is present and encroaches over the ventral surface and thus must have been made after the initial flake removal. Recorded whether retouch was absent or present on the artefact.

**richness -** referring to the assemblage richness or number of different artefact classes and raw materials found within a site.

**silcrete** - a silicified sedimentary rock, often with fine inclusions or grains in a cryptocrystalline matrix. Silcrete is sometimes heat treated to improve its flaking quality (Flenniken and White 1983). Heat treatment and heat exposure will also affect the stone in terms of colour (which may become red) and lustre (surfaces knapped after heat treatment are more lustrous) and surface quality (potlidding crenation and crazing may occur). Heat treatment can not be easily distinguished from heat exposure (Rowney and White 1997, Mercieca 2000).

**size class -** Measured in the Summary Analysis in 10 mm increments.

**taphonomy** - the study of the processes (both natural and cultural) which effect the deposition and preservation of both the artefacts and the site itself.

**technology** - a form of artefact analysis which is based upon the knapping/ manufacturing process, commonly used to subsequently infer behaviour patterns, cultural-selection and responses to raw material or the environment.

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