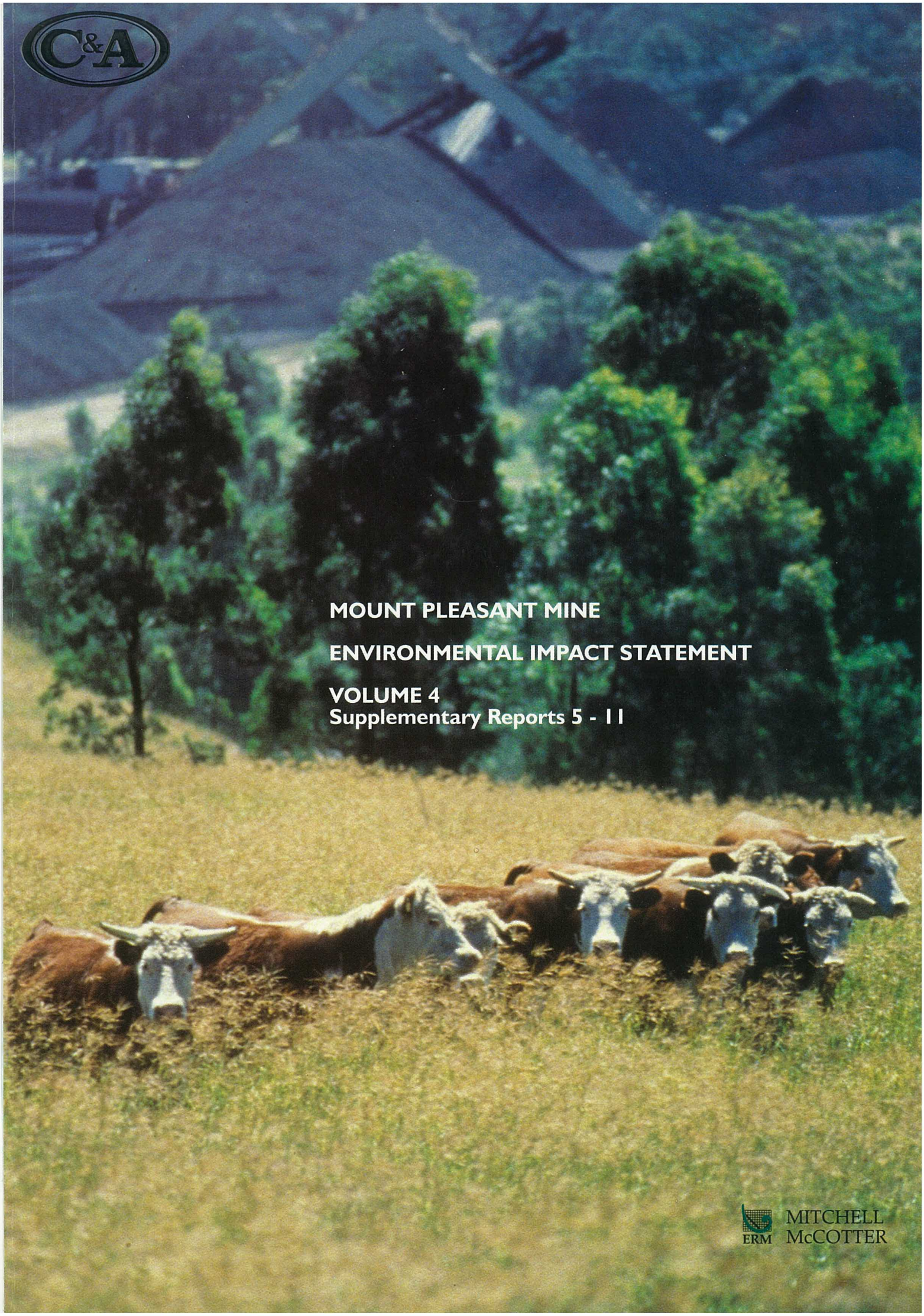
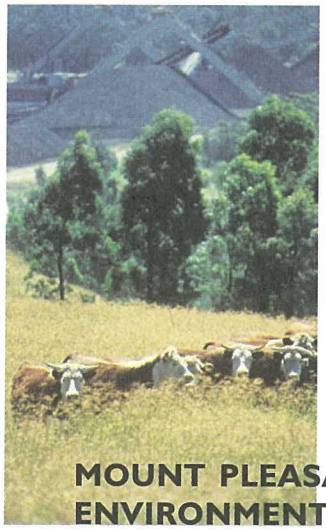


MOUNT PLEASANT MINE

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 4
Supplementary Reports 5 - 11

ERM MITCHELL McCOTTER



MOUNT PLEASANT MINE
ENVIRONMENTAL IMPACT STATEMENT
For
COAL & ALLIED OPERATIONS Pty Ltd

94019
September, 1997

VOLUME 4 OF 4 - ISBN 095929225X

SET OF 4 VOLUMES ISBN 0959292268

Report No. 94019

This report was prepared in accordance with the scope of services set out in the contract between ERM Mitchell McCotter Pty Ltd ACN 002 773 248 (ERMMM) and the Client. To the best of our knowledge, the proposal presented herein accurately reflects the Client's intentions when the report was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In preparing the report, ERMMM used data, surveys, analyses, designs, plans and other information provided by the individuals and organisations referenced herein. While checks were undertaken to ensure that such materials were the correct and current versions of the materials provided, except as otherwise stated, ERMMM did not independently verify the accuracy or completeness of these information sources.

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5. ARCHAEOLOGICAL SURVEY FOR ABORIGINAL SITES

   - Mount Pleasant Coal Lease Archaeological Survey for Aboriginal Sites
   - Fine Rejects Emplacement Area Archaeological Investigations
   - North West Emplacement Area Archaeological Investigations

6. AIR QUALITY ASSESSMENT

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ARCHAEOLOGICAL SURVEY FOR ABORIGINAL SITES

5

MT PLEASANT COAL LEASE,

NEAR MUSWELLBROOK, NSW:

Archaeological survey for Aboriginal sites

June 1995

Prepared for

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and

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1.0 INTRODUCTION & SUMMARY

The Mt Pleasant coal lease is located on the west side of the Hunter River some 2-9km north-west of Muswellbrook in the Hunter valley (see Maps 1 and 2). Coal and Allied Operations Pty Ltd are proposing to develop an open cut coal mine and associated infrastructure within the lease. This report describes an archaeological survey of the lease, assesses the archaeological resource, and makes management recommendations. A draft of this report was prepared as an archaeological audit of the lease and general advice provided on sensitive archaeological areas for development design purposes.

1.1 THE COAL LEASE

The Mt Pleasant coal lease extends from Wybong Road in the south to Dorset Road in the north. The lease extends slightly beyond Dorset Road - from 0-300m in the north-east corner of the lease - but this narrow strip of cultivated or otherwise disturbed land was excluded from the survey. The western boundary was an imaginary straight line, passing just west of Mt Pleasant; the far south-west corner of the lease was excluded from the survey. The eastern boundary was also an imaginary line, bent slightly, and crossing the Hunter River only in the north-east corner (see Maps 1 and 2).

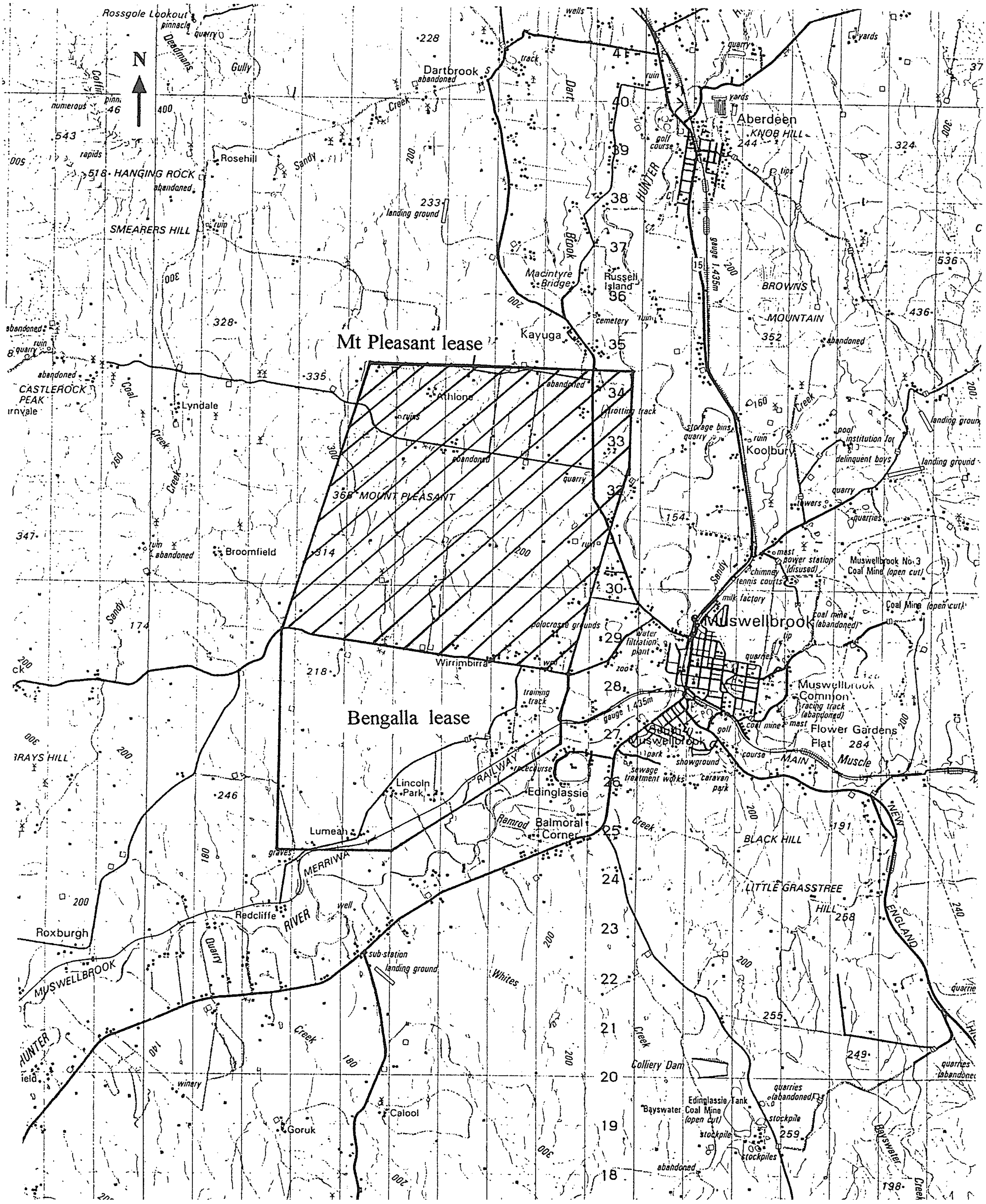
The lease covers approximately 3,300 hectares. Access to much of the lease (92%) was obtained; only some 250 ha was excluded from the survey and this was considered too disturbed to warrant investigation.

Most of the lease covers undulating hilly country below Mt Pleasant; ie. predominantly upper and middle catchments of 10 drainage lines. The lower catchments were also included around the margins of the lease. The eastern edge of the lease fronts onto the Hunter River flats, and a small area (c.72ha) of the flats were included in the survey area.

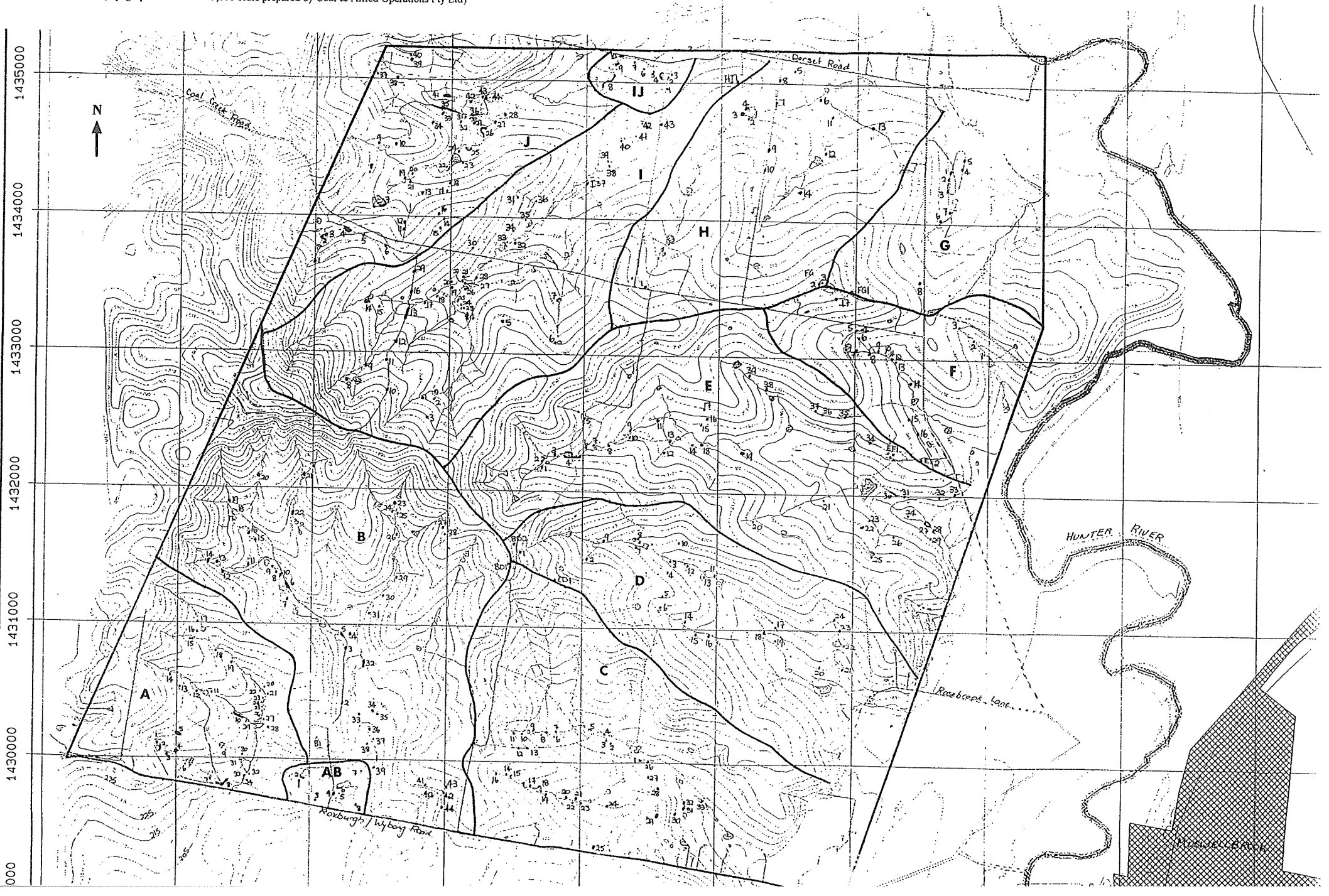
Air photo evidence suggests that much of the lease has been cleared and ploughed. It is likely that archaeological resources, particularly within the eastern part of the lease, have been substantially affected by previous land uses.

Map 1: Locality Map

(from Muswellbrook 1:100,000 topographic sheet)



Map 2: The Mt Pleasant coal lease
(topographic sheet at 1:25,000 scale prepared by Coal & Allied Operations Pty Ltd)



The Mt Pleasant lease adjoins the Bengalla lease, immediately to the south, which was recently surveyed (Rich 1993). The area to the immediate north was surveyed some time ago (Brayshaw 1981a).

1.2 STUDY BRIEF

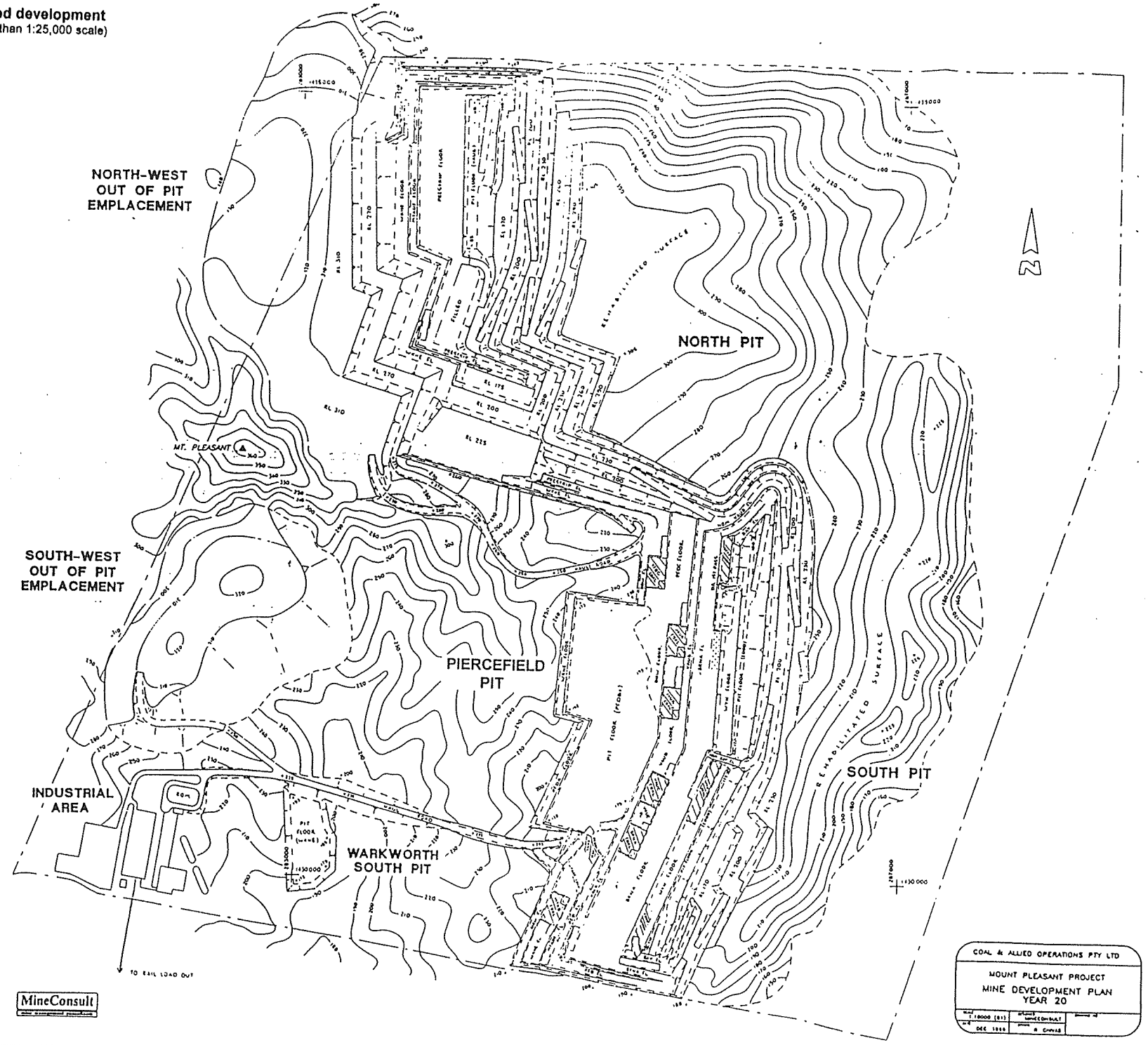
The brief for the archaeological survey was to carry out an "even spread" survey, visiting the whole lease as was reasonable in archaeological terms; ie. very heavily disturbed areas were excluded. Areas to be affected occuring outside the lease are the subject of separate archaeological study. The Wanaruah Local Aboriginal Land Council participated in the survey and both the Land Council and the Wonnarua Tribal Council have been involved in discussions since that time.

1.3 THE PROPOSED DEVELOPMENT

The proposed open cut operations would mine coal seams of the lower part of the Wittingham Coal Measures. Coal would be mined from the Warkworth south pit and then from the Piercefield, South and North pits (Map 3). Overburden and unwanted rock would be used as fill for preparation of coal handling facilities, haul roads, tailing pond construction and screening bunds. Most overburden would be returned to the pits but additional out-of-pit emplacements would be sited in and beyond the north-west and south-west parts of the survey area. The infrastructure, including coal stockpiles, a washery, maintenance centres, staff amenities and administration building, would be located in the south-west of the area. Coal would be removed from the infrastructure area via an overland conveyor to a rail loop to be built in the north-west corner of the Bengalla site. Other works will include construction of haul roads, settling ponds, and other dams to control drainage leaving the site.

Most of the study area would be affected by the development as currently designed. Not currently effected are an irregularly shaped area along the east side of the area and Mt Pleasant in the central west. An area south-east of Mt Pleasant is shown on Map 3 as having few works, but this area may be effected by construction of settling ponds, dragline construction or other works.

Map 3: The proposed development
(slightly larger than 1:25,000 scale)



1.4 SUMMARY OF RESULTS

A total of 327 artefact locations having 1,408 artefacts, were recorded. Most (180 being 55%) consisted of single isolated finds, and another 67 locations (20%) had 2-3 artefacts. Only 26 locations (8%) had more than 10 artefacts. To some extent, artefact identification was constrained by available ground exposures on which artefacts could be found. Total exposures searched for artefacts covered approximately 1.3% of the lease. It is considered that more sites and finds are likely to be present in the lease, hidden by thick grass and buried in uneroded soils; but compared to some other parts of the Hunter lowlands, the Mt Pleasant lease appears to have a fairly sparse archaeological record.

Overall, the lease had a surface artefact density of only 36 artefacts/hectare of exposure (ie. only 3-4 artefacts/1,000m^2). Artefact density along gullies tended to be higher than on hillslopes: c.55 artefacts/hectare of exposure along gullies (4-6 artefacts/1,000m^2), and c.17 artefacts/hectare on hillslopes and ridges (1-2 artefact/1,000m^2). The highest artefact densities occurred within the north-west part of the lease. Catchments I and J had densities of c.60/ha overall with artefact densities along gullies not uncommonly exceeding 100/hectare. The I-J confluence had an artefact density of c.1,000/hectare (or c.1 artefact/10m^2). No artefacts were found on the slopes of Mt Pleasant above 300m asl, and none were found on the Hunter flats.

Variation in artefact density across the lease could be attributed to a variety of factors, including the nature of the archaeological record and the adverse effects of land disturbance. It is likely that artefact density within the eastern part of the lease was originally higher than indicated by current surface conditions. Land disturbance has probably resulted in the dispersal and destruction of archaeological material closer to the Hunter River.

On the whole, artefact assemblages within the Mt Pleasant lease appear similar to those reported within the Bengalla lease to the south. Artefact assemblages included backed blades and associated knapping debris, cores, a variety of retouched and/or used flakes and pieces, and larger pebble tools and axes (hatchet heads) of igneous materials.

All but one of the backed blades found within the Mt Pleasant lease were reported from the I and J catchments, and all were adjacent to drainage lines. The backed blades were either backed flakes or fragments, or recognisable as geometrics. Only two Bondi points

and pieces there of (i.e. assymetric backed pieces) were recorded. In contrast to the restricted distribution of backed pieces, pebble tools and stone axes appeared to have a much more random distribution, occurring in most catchments and variously along gullies or on hillslopes. Other retouched/used flakes and pieces, and cores, occurred across most of the lease.

Surface survey within the lease provided an indication of the nature and range of archaeological material; enabled identification of potentially sensitive areas, and also enabled identification of areas which were too disturbed to warrant further consideration. Test excavation for EIS stage is not necessary. However, some sensitive areas within the lease do warrant additional archaeological work prior to development impact.

1.5 SUMMARY OF RECOMMENDATIONS

A statement of development impact is given on page 49. Formal recommendations are given on page 54. In summary, four measures should be adopted to mitigate against impact should the proposed Mt Pleasant mine proceed. These measures are:

- The development, dam construction or other works should be designed so as to avoid impact on Aboriginal sites, and particularly avoid impact within the less disturbed area in catchment B as shown on Map 9.
- A plan of management should be prepared to ensure the protection of sites which would not be destroyed by the proposed development.
- Sites or areas adjacent to works should be protected, e.g. by fencing, to ensure that they are not accidentally damaged or destroyed during construction or operation of the mine.
- An archaeological salvage program should be implemented to recover material and information from sensitive areas which would be affected by the development (see Table 18 and Map 9).

Consent to destroy known artefacts which would be effected must be obtained from the National Parks and Wildlife Service prior to works.

1.6 VIEWS OF THE WANARUAH LALC and WONNARUA TRIBAL COUNCIL

Reports prepared by the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council Inc are included as Part 4 of this volume.

1.7 STRUCTURE OF THE REPORT

This report is in four parts. Part 1 sets out the archaeological context for the project (section 2.0), the field and analytical methods used during the study (section 3.0), describes the environment of the area (section 4.0), and analyses and discusses the results of the study (sections 5.0 and 6.0). A statement of archaeological significance of the project area is given (section 7.0). A statement of development impact and recommendations for salvage archaeology are given in section 8.0. Management recommendations are given in section 9.0. A list of references is given at the end of Part 1. Part 2 of the report includes descriptions and analysis of each catchment within the lease. Part 3 includes a photographic record (Appendix A), data on sites and exposures (Appendix B), descriptions of individual focussed sites (Appendix C), an artefact record (Appendix D), and long tables (Appendix E). Part 4 presents the reports prepared by the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council Inc.

PART 1: OVERVIEW

2.0 ARCHAEOLOGICAL CONTEXT

2.1 LOCAL AREA

Numerous archaeological surveys have been carried out in the Muswellbrook area over the past 14 years. The Bengalla coal lease adjoining the south side of the Mt Pleasant lease and leases to the north have been surveyed (Brayshaw 1981a; Rich 1993). Previous survey within the Mt Pleasant lease has been carried out parallel to Wybong Road for the route of an optical fibre cable (Jill Ruig, personal communication), and through the central part of the lease for the route of a transmission line (Barry French, Wanaruah Local Aboriginal Land Council, personal communication). Neither of these surveys found archaeological sites within the Mt Pleasant lease.

Archaeological survey north of the Mt Pleasant lease and west of Aberdeen reported a range of archaeological material in largely disturbed contexts (Brayshaw 1981a; Dean-Jones 1989a, 1989b). Artefacts were of a wide variety of raw materials, including chert, "local indurated mudstone", petrified wood, quartz, silcrete and "silicified conglomerate". Artefact assemblages included flakes, blade flakes, backed blades, scrapers and several cores. Of interest were a tula, and an artefact of indurated sandstone with an incised crosshatch pattern; both artefacts were similar to some items from western NSW (Brayshaw 1981a; Dean-Jones 1989a, 1989b). The silicified conglomerate is similar to that found at a silcrete source in the Bengalla lease (see Plates in Brayshaw 1981a).

Survey within the Bengalla lease reported an extensive archaeological resource, also in largely disturbed contexts (Rich 1993). Notable in that lease was a silcrete extraction site associated with Tertiary ridge gravels. Boulders (up to 1m across) of grey-pink conglomeritic silcrete, and some petrified wood, were found eroding from a long low ridge above the Hunter flats over a distance of c.1.3km. Igneous and siltstone rocks up to 50cm across were also present. Artefact assemblages on that site indicated that initial flaking of cobbles was carried out, probably to test the quality of the raw material and to produce large flakes and pieces suitable for further reduction. Those pieces were then knapped to produce smaller flakes and pieces, probably for the preparation of cores suitable for removal from the site, as well as production of small tools and pieces suitable for immediate use. A petrified wood backed blade knapping event (in poor condition) was also found, and indurated mudstone which was foreign to the site had been imported and

flaked. An igneous pebble tool had also been discarded. Silcrete artefacts within the Mt Pleasant lease were generally of conglomeritic silcrete and may have originated from the silcrete source within the Bengalla lease.

Elsewhere in the Bengalla lease, artefacts were concentrated along the banks of the main drainage line; being the downstream end of catchments A & B within the Mt Pleasant lease. Backed blade knapping events were recorded from several sites along the banks of that stream, and other isolated knapping events with items of a small flake tool industry (RU flakes & pieces) were recorded from along smaller gullies and rarely on hillslopes and ridge tops. Large tools (pebble tools) were recorded from all parts of the landscape (Rich 1993).

2.2 REGIONAL CONTEXT

A number of large-scale EIS surveys, salvage projects, and overview studies have been prepared for the Hunter valley.

2.2.1 Distribution of sites across the landscape

Most archaeological material in the Hunter lowlands is concentrated along streams, and artefact and site density tends to decrease along upper tributary gullies and away from stream banks. This tends to be the case, despite extensive survey on hillslopes away from creeks and gullies (eg, Haglund 1991; Hughes and Silcox 1983). [Beyond the Hunter lowlands (north of Singleton) quite dense archaeological sites have been found on ridges above steep gullies at "Wattle Ponds" and "The Retreat" (Dallas and McDonald 1986).]

The nature and structure of archaeological material in a number of project areas shows some variation, eg. Narama, Doctors Creek and Bengalla leases. There appears to have been some differences in the way Aboriginal people used different parts of the landscape in the Hunter lowlands.

Detailed archaeological investigations along Doctors Creek (south of the Hunter River and west of Singleton) found that this intermittent drainage line was probably occupied repeatedly and by small groups of people. Here a wide variety of activities took place, and backed blades were produced on small knapping workshops. Only rare sparse finds, rather than focussed sites, were found on adjacent hillslopes (Haglund *et al.* 1992).

In areas close to the Hunter River low density scatters of artefacts were sometimes found on slopes and ridges. This was the case above the Hunter River west of Singleton (McCarthy and Davidson 1943; Moore 1970), below Mt Thorley (Brayshaw 1981), at Hunter Valley No.1 (Brayshaw 1985), and in the Narama project area (Rich 1992). In the Bengalla lease, high artefact density was recorded on gentle rises above the Hunter flats but steep bluffs had very low artefact density (Rich 1993).

At Narama, backed blade knapping floors were concentrated along Bayswater Creek and around soaks along a tributary gully, while cores and other tools had a wider distribution, occurring in most parts of the landscape. These differences in the distribution of archaeological material may have reflected behavioural differences. It was suggested that the concentration of workshops along streams may have been part of a "gearing up" behaviour of the microblade industry which contrasted with generalised site occupation on slopes above the Hunter River and lower Bayswater Creek (Baker 1992a; Rich 1992) - although such ideas warrant further consideration.

2.2.2 Stone knapping & reduction strategies

Baker (1992a) advocated two basic types of core reduction: opportunistic and specialised strategies. He argued that the opportunistic strategies included reduction of cobble cores, and cores of indeterminate core body. The specialised strategies employed an alternating flaking technique, which included preparation of platform surfaces, and were sometimes used to make backed blades. This specialised strategy included silcrete blade cores which had a shatter core body, and RAS (Redbank A Strategy) flake cores (Baker 1992a). However, alternating flaking was also used to bifacially reduce cobble cores which are not thought to be associated with backed blade production; indicating that there was not a simple one-to-one correlation between core form, flaking pattern and reduction strategy.

Hiscock (1993) reported that RAS flake reduction was an important reduction strategy by which backed blades had been knapped at Redbank Creek. In contrast, RAS flake reduction at Narama was rare (Baker 1992a); overall rare on Doctors Creek but with a localised concentration (Haglund *et al.* 1992), and rare at Bulga (Koettig 1994). This suggests that RAS flake reduction was used unevenly across the Hunter lowlands; and backed blades were produced more often from other knapping sequences.

Heat shattering of silcrete cobbles and knapping of suitable pieces of stone was also a reduction process used to make backed blades. At Narama this was predominant over RAS flake reduction.

2.2.3 Site function

Relatively little work has been carried out on the functions of open sites in the Hunter valley. It appears that the following activities may have been carried out:

- The production of backed blades (Bondi points or geometric backed blades, but not both forms on the one knapping floor);
- The production of flakes and pieces suitable for non-backed blade tasks - these may have been produced as occasionally struck flakes, or less frequently on (non-backed blade) knapping floors; at times suitable pieces were also selected from blade debitage on backed blade knapping floors;
- A range of activities on and off campsites, characterised by the discard of pebble tools or axes, and of a variety of flake tools (RU pieces) and debitage, and with or without specific stone working areas.

There has been little investigation of the retouched/utilised component of artefact assemblages in the Hunter valley. An analysis of the morphological attributes of flakes and pieces with macroscopic retouch/usewear was carried out for the Narama project (Gorman 1992). This analysis considered technological attributes of the RU pieces, and edge attributes of retouch and usewear. Information on the production and selection of pieces suitable for use showed that RU pieces were drawn from all stages of reduction, in contrast to backed blades which were produced late in reduction sequences. Variation in edge characteristics suggested some possible functional variation across that study area.

Laboratory analyses of residues on utilised flakes and retouched tools was carried out for the Doctors Creek (Haglund *et.al* 1992), Camberwell and Bulga projects (Koettig 1992, 1994). Both animal and plant residues were found, and plant residues on backed blades suggests those tools may have been multi-purpose knives rather than (only) spear barbs.

2.2.4 How old?

Most archaeological material in the Hunter valley appears to be of Holocene age and probably less than 5,000 years old. Only one Pleistocene site has been found (beyond the Hunter lowlands along Glennies Creek) (Koettig 1990).

Radio-carbon dates from shelter and open sites indicate that the Hunter valley was occupied continuously throughout the later Holocene. A hypothesised decrease in occupation over the past 800 years (Hiscock 1986) has not been supported by more recent age determinations from the Narama project area (Rich 1992) and Doctors Creek (Haglund *et al.* 1992).

The Doctors Creek project demonstrated the usefulness of geomorphological investigations, coupled with radiocarbon and thermoluminescence dating, for providing a relative chronological framework as well as assisting with site interpretation. However, radiocarbon and thermoluminescence dates rely on the availability of suitable datable materials; charcoal in association with cultural material and undisturbed sandy deposits.

Hiscock (1986) suggested that it might be possible to place open sites in the Hunter valley within a relative chronological sequence by identifying technological components which could also be found in dated assemblages from shelter sites. Analysis of the Sandy Hollow 1 shelter assemblages revealed the presence of RAS flake reduction in a phase spanning the period >1,300 - c.800 years ago (Hiscock 1993). Open sites with this technology might then be dated to this period (Hiscock 1986).

A similar approach has been used by Baker (1992b) in the analysis of flake assemblages from shelter sites and open sites. However, otherwise undated assemblages from Narama, Doctors Creek and Glennies Creek (ie. most of the open site flake assemblages used in the analysis) were still undated by comparison with flake assemblages from shelter sites. Baker (1992b) suggested that those assemblages were associated with heat treated stone.

Other changes in artefact assemblages through time have been identified and described as the Eastern Regional Sequence for the wider Sydney Basin. In summary the following changes have been identified (Koettig 1985):

- **Pre-Bondaian**: Earlier than 4-5,000 years. Assemblages included uniface pebble tools, horsehoof cores, retouched "scrapers", hammerstones, "burins", "dentated saws", relatively larger artefacts than in later phases, and a few bipolar artefacts.

- **Early Bondaian**: Dated between c.4-5,000 and c.3,000 BP. Backed blades first appeared, fine grained siliceous materials predominated, ground implements first appeared, and elements of the Pre-Bondaian continued.
- **Middle Bondaian**: Dated between c.3,000 and 1,500 BP. Backed blades become more frequent and occurred in higher frequencies than bipolar artefacts, and the frequency of quartz increased.
- **Late Bondaian**: Backed blades occurred in low numbers or were absent, quartz was the predominant material, the frequencies of edge-ground artefacts and bipolar artefacts increased.

However, it is not possible to date open sites by simple comparison with this sequence. Variation between individual sites has been found, and in some areas quartz was always a minor raw material. At Sandy Hollow 1 shelter in the Goulburn valley, the change from the Middle Bondaian to the Late Bondaian has been dated to c.800 BP; ie. substantially later than c.1,500 BP suggested by the Eastern Regional Sequence.

As yet, the comparison of artefact assemblages from open sites with those from shelter sites has met with only limited success.

3.0 METHODS

3.1 FIELD SURVEY

The field survey was carried out over 8 days between 25th May 1994 and 3rd June 1994. A total of 50 person days were spent in the field. The area to be covered each day was approximately equivalent in extent. The field team was divided into three sub-teams of two persons each. Each sub-team then walked parallel transects (see Map 4), recording all exposures, artefact finds and sites as they were encountered. Each sub-team had a colour copy of a 1992 air photo, as well as topographic and land holding maps, which could be used to target to exposures and assist with site recording. Recordings were made on standardised forms.

At the start of fieldwork team members were given instructions on how to complete the recording forms. Team members discussed recording methods, and attempted to come to terms with workable definitions of what constitutes a site, how to record the extent of exposures, and how to estimate ground visibility. To assist with maintaining consistency of definition, each person worked, on different days, with every other person. It was generally concluded that estimates of ground visibility and extent of exposures (which were usually of irregular shape) must be regarded as indicative only.

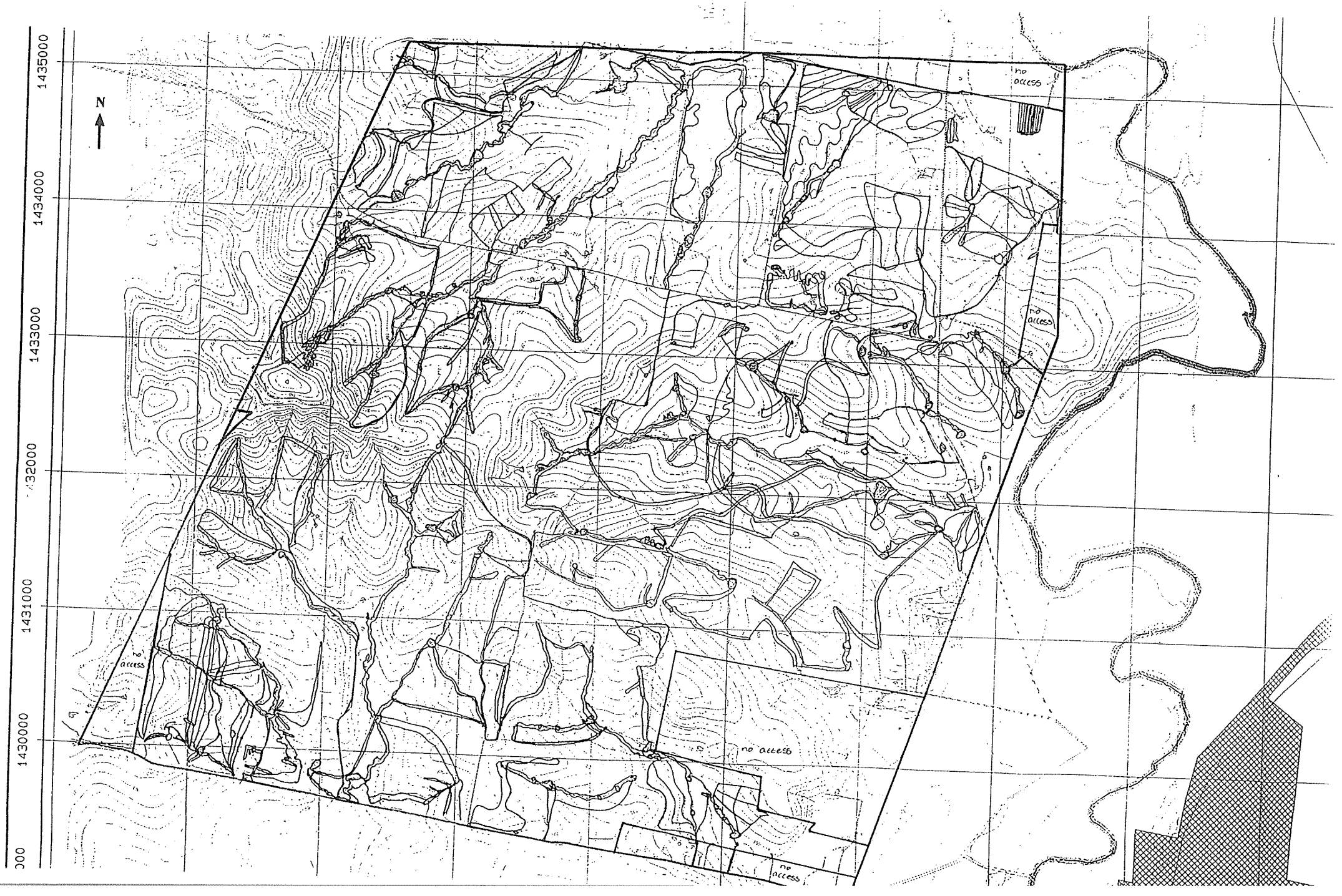
3.2 ANALYSIS

Field notes were collated and exposure data, together with the number of associated finds, and approximate height above sea level in 5m intervals, was entered into a computer data base for analysis (Appendix B). A separate record of artefact data was also made (Appendix D). Air photos (1953 b/w, 1982 b/w and 1992 colour) were examined to clarify the extent of past land disturbance.

3.3 ABORIGINAL CONSULTATION

Mr Barry French from the Wanaruah Local Aboriginal Land Council took part in the survey on all days, and management of Aboriginal finds were discussed. He reported no knowledge of sites of special significance to the Land Council. Following the survey the Wanaruah Land Council had a change of personnel, and the Wonnarua Tribal Council was established. An on-site inspection of the lease was carried out on the 4th and 5th of July 1996, with representatives of both organisations. Copies of the summary report and the draft final technical report were given to both organisations. Reports from the Land Council and Tribal Council are presented here as Part 4 of this report.

Map 4: Survey transects
(1:25,000 scale topographic map, prepared by Coal & Allied Operations Pty Ltd)



4.0 ENVIRONMENT

4.1 GENERAL

Most of the study area consists of undulating slopes and ridges extending westward from the Hunter River flats. In elevation the study area varies from c.150m above sea level (asl) on the Hunter flats, to 368m asl on Mt Pleasant in the western side of the lease. As in the Bengalla lease to the south, the ridges above the flats tended to end abruptly in low but steep bluffs, except in the north-east corner where ridges sloped more gently.

The study area is drained by several catchments. These vary in orientation, draining towards the south, south-east, east and north-east (see Map 4). The lease was subdivided into these catchments, to assist with analysis of archaeological variation across the lease. For this exercise each catchment was ascribed a letter. The confluences of catchments "A" and "B" and catchments "I" and "J" were mapped separately. The relative extent of these catchments varied (see Figure 1, Table 1).

Generally, the upper catchments of gullies tended to be steep, with gullies sometimes eroded to a depth of 4m or more. Profiles generally became more gentle downstream.

Figure 1: Extent of catchments within the study area (by % frequency of total extent)

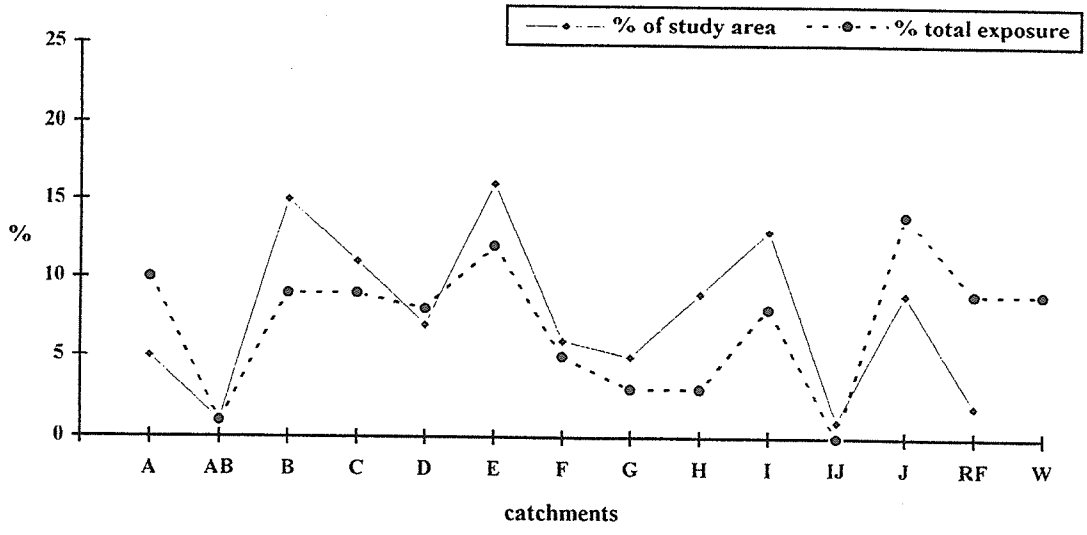


Table 1: Land units in the study area (approximate extent in hectares - areas available for survey only*)

Catchment	Hunter flats	Gullies 0.5km from Hunter flats	Bluffs & hillslopes 0.5km from flats	Gullies generally & confluences	Hillslopes generally	Total	%
A				37	111	100	*5%*
AB				21		20	*1%*
B				116	328	436	*15%*
C		4.5	24	53	224	306	*11%*
D		0.5	13	41	163	218	*8%*
E		8	60	71	328	467	*16%*
F		9	30	15	106	160	*6%*
G		5	62	4	80	151	*5%*
H			17	44	215	276	*9%*
I				73	304	377	*13%*
IJ				25		25	*1%*
J				54	194	248	*9%*
River flats	72					72	*2%*
West of Mt Pl.					10	10	*0%*
TOTAL	**72**	**27**	**206**	**543**	**2054**	**2,913***	
% frequency	*2%*	*1%*	*7%*	*19%*	*71%*		*100%*

4.2 SURFACE GEOLOGY

The lease occurs on the Wittingham Coal Measures of the Singleton Group of sedimentary deposits. Occasional volcanics occur but no associated evidence for Aboriginal stone-working was found. Gravels occur in Catchment F in the vicinity of the intersection of Kayuga Road and Coal Creek Road (Castle Rock Road) and on "Kayuga" but again, no associated evidence of Aboriginal stone working was found. No natural occurrences of silcrete or petrified wood were found.

4.3 SOILS

Soils across the study area were derived largely from the *in situ* weathering of bedrock and most of the study area has been mapped as "Hillslope" soils with alluvium on the Hunter flats. Alluvial deposits along drainage lines were not extensive; most gullies being flanked by colluvium and hillslope soils. Volcanically-derived hillslope soils were restricted in extent (Veness & Associates 1994). Archaeological material was found associated with the A horizon of soils or lagged on underlying clay deposits.

4.4 LAND UNITS

The lease was also subdivided into land units to investigate archaeological distributions in relation to landscape features (Map 5). These land units were the same as used for the

Bengalla lease to the south. They were defined from 1:25,000 scale topographic mapping (prepared by Coal & Allied) and their extent roughly estimated using a clear 1ha grid overlay. This form of estimating extent provides a reasonable estimate, rather than an accurate measure. When the total extents of the various land units within each catchment, together with areas not available for survey, were summed the total extent of the lease came to 3,178 hectares rather than 3,300ha; a discrepancy of only 122 hectares, or 3.7% of the lease.

4.4.1 Hunter flats

The alluvium of the Hunter flats was mapped as a separate unit. Survey of areas of the Hunter flats for the Bengalla project found artefacts in two locations; although those finds may have washed down the main stream within that lease.

4.4.2 Land units adjacent to the Hunter flats

Bluffs and hillslopes above the Hunter flats and gullies flowing onto the flats were identified as separate units. They were defined arbitrarily as being within 500m of the Hunter flats.

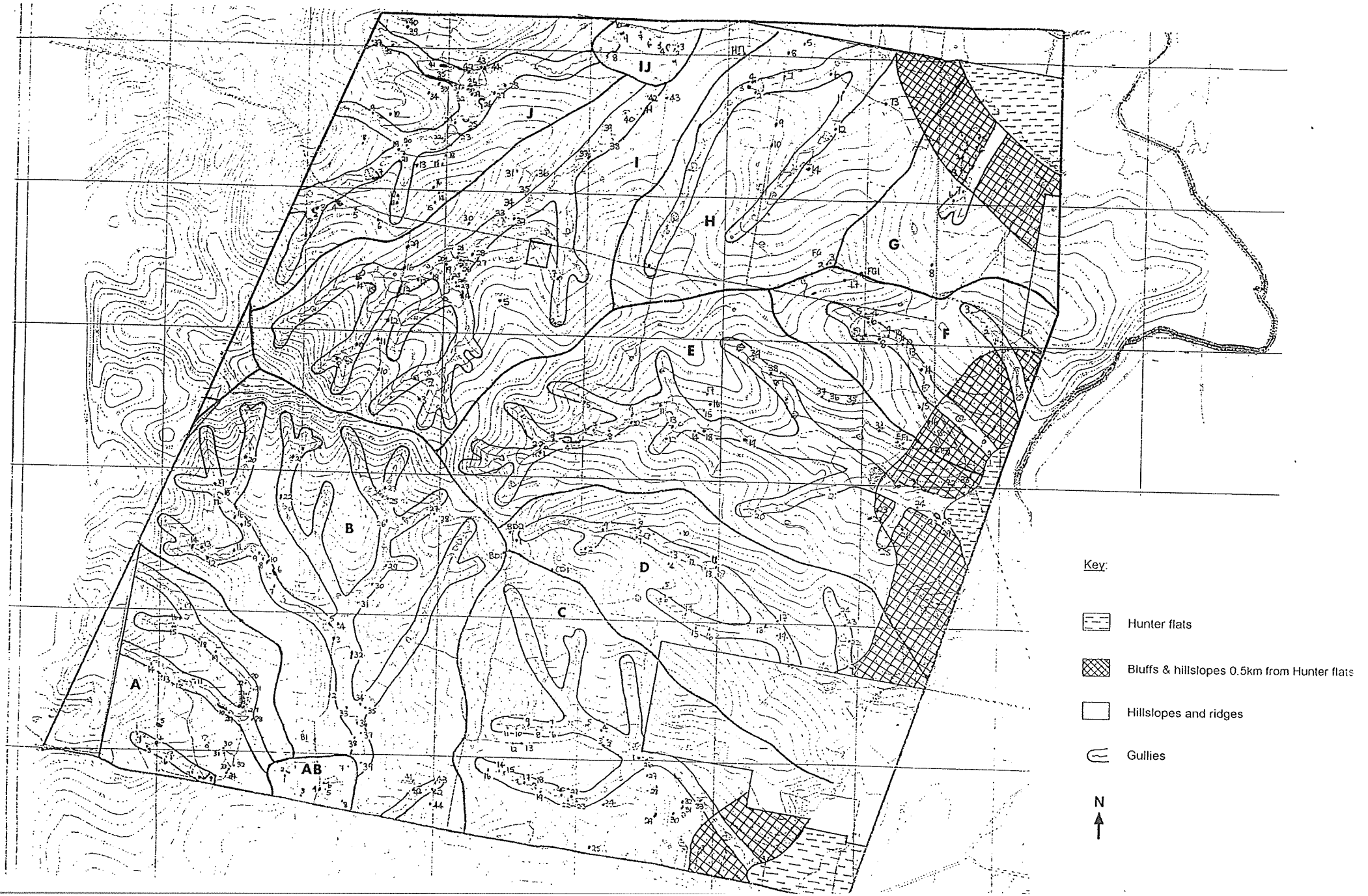
The distribution of archaeological material in proximity to the Hunter River appears to have varied considerably along its course. In the Jerrys Plains - Lemington - Bayswater Creek area (west of Singleton) extensive complexes of archaeological material have been reported (Brayshaw 1985; Rich 1992, 1993b). It has been considered that the Hunter River may have provided year-round resources (water, game, aquatic resources) and that slopes and bluffs above the flats would have provided camping locations with vantage points and safety above flood level.

In contrast to these theories and observations, field survey of bluffs in proximity to the Hunter flats within the Bengalla coal lease resulted in the identification of only occasional artefacts on this unit; an average density of 4 artefacts/hectare. Gullies in proximity to the Hunter flats had a higher average artefact density at 35/hectare.

A third unit was identified within the Bengalla lease: low rises above the Hunter flats. This unit had very gentle slopes and was relatively rich in finds (see Rich 1993a:17). No comparable unit was identified within the Mt Pleasant lease area.

Map 5: Land units

(1:25,000 scale topographic map, prepared by Coal & Allied Operations Pty Ltd)



4.4.3 Gullies generally

Previous archaeological work in the Hunter lowlands has found that drainage lines are generally the most archaeologically sensitive unit. Within the Bengalla lease small gullies had an average artefact density of 96/hectare, while a more substantial creek (the downstream end of catchments A and B within the Mt Pleasant lease) had an average artefact density of 354/hectare; the highest artefact density within that lease.

For the purpose of describing gullies as a land unit the same definition of "gullies" was used for the Mt Pleasant project as was used for the Bengalla project: a strip of land extending for a distance of 50m on either side of a gully. In the case of meandering drainage lines the 50m was measured from the outermost extremity of the meander curve, so in some areas (eg. catchments I and J) this unit was sometimes more than 100m wide.

4.4.4 Hillslopes and ridge tops

This unit made up the remainder of the study area. It was by far the most extensive unit, covering 71% of the study area overall, and always more than 50% of individual catchments.

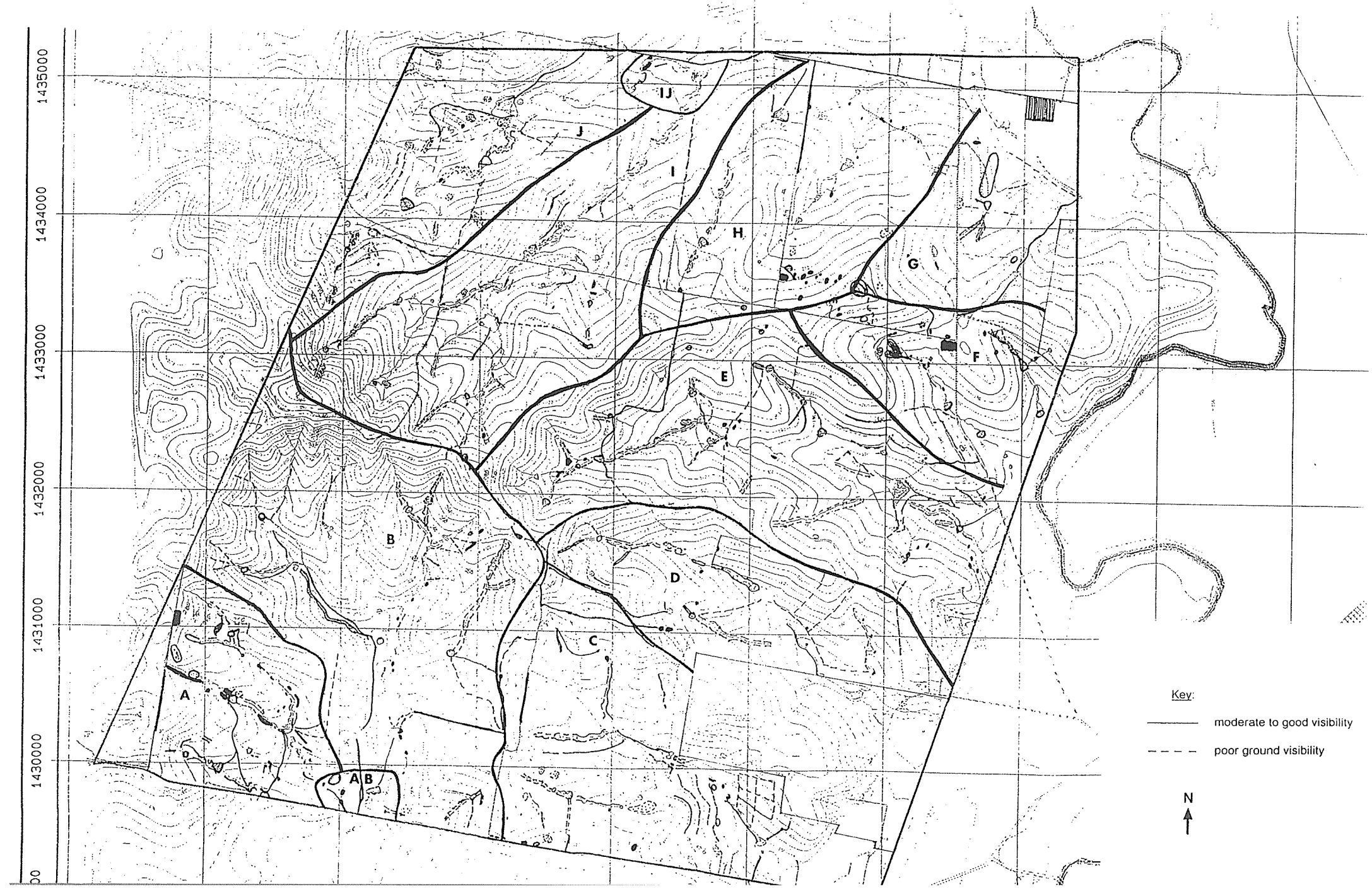
4.5 GROUND EXPOSURE

Most of the study area was thickly grassed at the time of the survey, and only 1.3% of the study area had recorded ground exposures on which artefacts could be found (Table 1, Map 6). Many more sites and finds are likely to be present in the lease, buried by soil and hidden by grass. The implications of limited ground exposure are discussed in section 5.0.

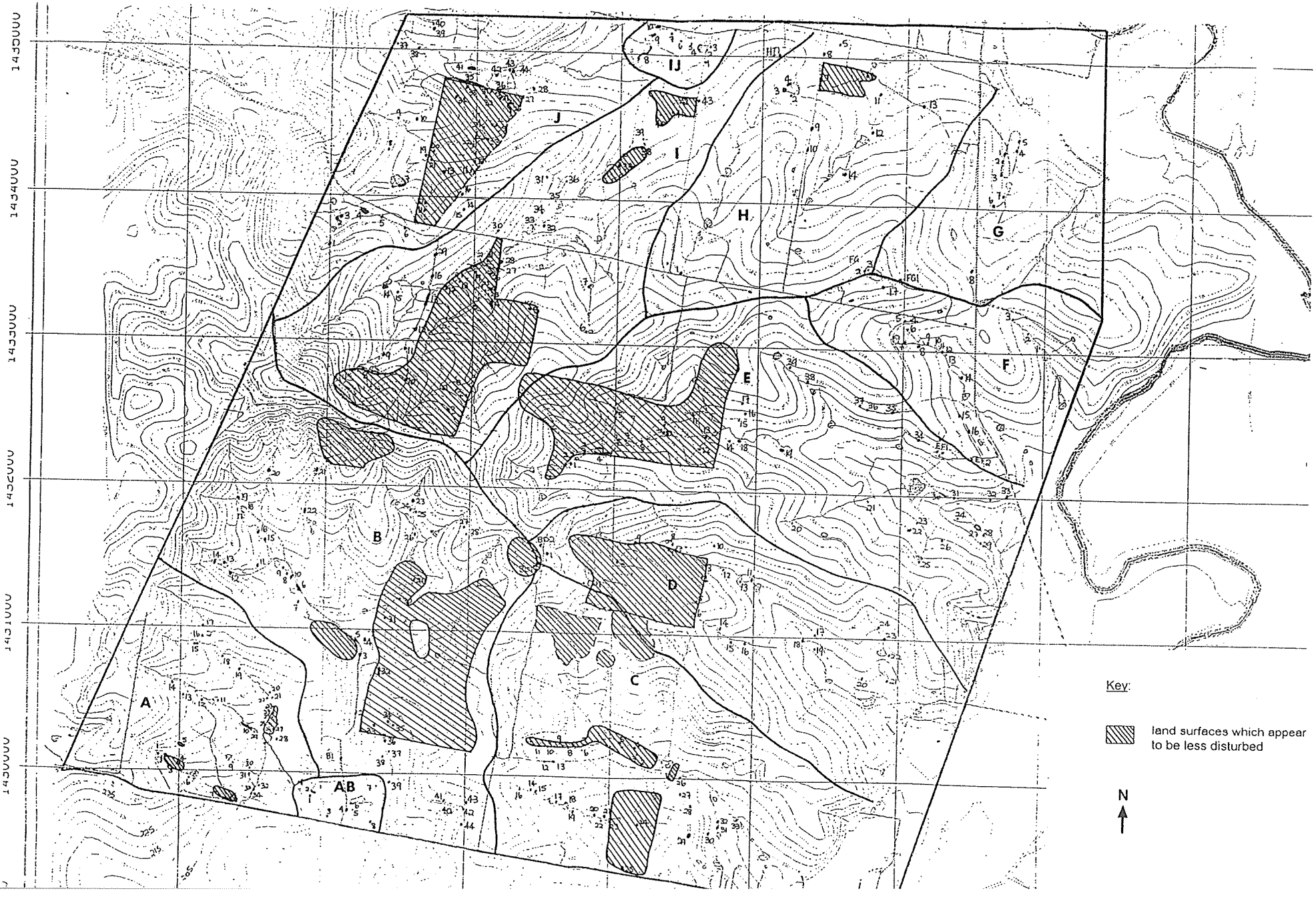
4.6 LAND DISTURBANCE

Air photo and ground inspection reveals that most of the lease had been ploughed. Some tracts in the western part of the lease appear to have survived with less disturbance, and occasionally narrow strips of land along the banks of gullies also appeared to be relatively less disturbed (Map 7).

Map 6: Recorded ground exposures
(1:25,000 scale topographic map, prepared by Coal & Allied Operations Pty Ltd)



Map 7: Relatively less disturbed land surfaces
(1:25,000 scale topographic map, prepared by Coal & Allied Operations Pty Ltd)



5.0 SAMPLING THE LANDSCAPE

The results of the field survey are dependant on the location and extent of ground exposures on which artefacts could be found. Recorded ground exposures made up only 1.3% of the lease available for survey. How well do the results of the field survey describe the archaeology of the study area?

- How much of each catchment was sampled?
- How much of each land unit was sampled?
- Did the type of exposure affect the appearance of the distribution of finds?
- Did ground visibility affect the appearance of the distribution of finds?

5.1 SAMPLING OF CATCHMENTS & ARTEFACT DISTRIBUTION

In summary (see Table 2):

- The highest densities of artefacts occurred within catchments I and J, and within the IJ confluence.
- Most catchments generally had low surface artefact density; c.20-40 artefacts/ha.
- Catchment H was under-sampled, with 1 hectare of exposure making up 0.4% of that area. Ground exposure in catchment B also made up <1% of that area, but with 3.4 hectares of exposure some confidence can be placed in the survey results.
- Catchment F, which drains into the Hunter River, had relatively low artefact density, as did catchment G; although little exposure occurred in the latter catchment. Most of the finds in catchment F occurred high up in that catchment (see Part 2 section 6).
- Artefact density on catchment watersheds (ie. ridge tops) was very low.
- No artefacts were recorded on the Hunter River flats, despite higher sampling frequency.

Gross artefact distribution was probably related to both the nature of Aboriginal occupation, and to the effects of modern land use. The higher densities of artefacts in the I and J catchments may be associated with the north-easterly aspect of those drainage lines; the high ridge of Mount Pleasant may have provided some shelter from westerly and south-westerly winds. The dramatically higher artefact density around the confluence of these two catchments suggests a variation in the nature of occupation; eg. the presence of microblade workshops or knapping floors.

Lower artefact density in catchments closer to the Hunter River requires explanation; since it is at odds with the possible increased stability of resources associated with this river. Modern land use has been most intensive close to the River (see Map 7) and it is likely that much archaeological material has been dispersed or destroyed.

Table 2: Sampling of catchments

Catchment	Total extent	Extent of exposures	% of catchment exposed	No. of finds	Average artefact density/ha
A	138	4.05	2.9%	179	44/ha
AB	21	0.24	1.1%	18	78/ha
B	444	3.43	0.8%	131	38/ha
C	306	3.50	1.1%	91	26/ha
D	218	3.09	1.4%	57	18/ha
E	467	4.72	1.1%	139	30/ha
F	160	2.03	1.3%	29	14/ha
G	151	1.06	0.7%	14	13/ha
H	276	1.07	0.4%	29	27/ha
I	377	3.30	0.9%	213	65/ha
IJ	25	0.16	0.6%	170	1,063/ha
J	248	5.40	2.2%	327	61/ha
Hunter R. flats	72	3.65	5.1%	0	0
Watersheds	0	3.32		11	3/ha
West of Mt Pls	10	0	0%	0	0
Total	**2,913**	**39.02**	**1.3%**	**1408**	**36/ha**

5.2 SAMPLING OF LAND UNITS & ARTEFACT DISTRIBUTION

Artefact density along gullies generally, on bluffs and hillslopes close to the Hunter River flats and along gullies close to the Hunter flats were generally similar (ie. 30-60 artefacts/hectare) (see Table 3). The relative extent of exposure in these units varied, however, and bluffs and hillslopes close to the River flats were (relatively) under sampled.

Hillslopes and gullies had similar extents of exposure (>16 and >17 hectare respectively). This suggests that the lower artefact density on hillslopes is not a function of lower sampling frequency on that unit.

Table 3: Sampling of land units

Land unit	Total extent in ha	Extent of exposures	% of unit exposed	No. of finds	Average artefact density/ha
River flats	72	3.66	5.1%	0	0
Gullies 0.5km	27	0.30	1.1%	12	41/ha
Bluffs 0.5km	206	0.77	0.4%	25	32/ha
AB & IJ major confluences	46	0.39	0.8%	188	482/ha
Gullies	508	16.05	3.2%	886	55/ha
Hillslopes & ridges	2054	17.85	0.9%	297	17/ha
Total	**2913**	**39.02**	**1.3%**	**1408**	**36/ha**

5.3 TYPE OF EXPOSURE

During the survey a wide range of exposures and land disturbance effects were examined for artefacts. To what extent might the results of the survey be biased by the nature of exposures? Different types of exposures varied in extent across the various land units (Table 4). The most significant discrepancies are that gully erosion occurred most extensively along gullies, and that tracks occurred most extensively on hillslopes and ridges.

Table 4: Type of exposure & land units (by % frequency of total exposure)

Type of exposure	River flats	Gullies 0.5km	Bluffs 0.5km	AB & IJ confluence	Gullies	Hillslopes & ridges	Total
Ants nests				0.0%	0.1%	0.1%	0.1%
Dam		0.4%		0.1%	3.9%	0.4%	4.8%
Drain			0.7%		1.5%	5.8%	7.9%
Drill hole						0.1%	0.1%
Feed area/trough				0.1%	0.0%	0.0%	0.1%
Gateway/shed				0.0%	0.0%	0.3%	0.3%
Grassy area			0.3%		3.1%	9.3%	12.7%
Gully erosion		0.3%		0.5%	24.7%	1.3%	26.8%
Ploughed area	9.1%						9.1%
Quarry						1.6%	1.6%
Sheet erosion			0.1%	0.0%	4.3%	9.0%	13.5%
Track	0.4%	0.0%	0.9%	0.3%	3.5%	15.5%	23.1%
Total	**9.5%**	**0.7%**	**2.0%**	**1.0%**	**41.2%**	**45.2%**	**100%**

Was there an associated pattern of artefact distribution? More than one third of artefacts were associated with gully erosion along gullies (Table 5); ie. there was a general association between larger numbers of artefacts and more extensive gully erosion along

gullies. Was the paucity of finds on hillslopes and ridges, then, associated with the paucity of gully erosion as a form of exposure on hillslopes?

When the extent of exposure and number of artefacts are both taken into account (ie. as artefact density) it can be seen that gully erosion along gullies did **not** have an unduly high artefact density. Most types of exposure revealed higher artefact densities along gullies than on hillslopes/ridges (see Table 6). However, variation in actual densities between different types of exposures (eg. gully erosion vs tracks beside gullies) suggests that variation in artefact density should be regarded as providing a relative indication, not an absolute statement of surface artefact density.

On the whole, given the somewhat "opportunistic" recording during the survey it is considered that indicative trends (such as increased artefact density near gullies compared to hillslopes, variations in artefact density between upper and lower parts of catchments, relative variations in artefact density between different catchments, and high artefact density within the IJ confluence) can be observed in the data but not too much weight should be attached to the actual density calculations.

Table 5: Type of exposure & artefact distribution (by % frequency of total artefacts)

Type of exposure	River flats	Gullies 0.5km	Bluffs 0.5km	AB & IJ confluence	Gullies	Hillslopes & ridges	Total
Ants nests				1.6%	3.3%	0.7%	5.5%
Dam		0.6%		0.5%	5.8%		7.0%
Drain			0.1%		4.3%	1.6%	6.1%
Drill hole							0
Feed area/trough				0.1%	0.1%		0.1%
Gateway/shed					0.4%	0.2%	0.6%
Grassy area					1.7%	4.8%	6.5%
Gully erosion				10.7%	35.2%		45.9%
Ploughed area							0
Quarry							0
Sheet erosion			0.2%	0.2%	1.4%	3.2%	4.8%
Track		0.2%	1.5%	0.3%	10.9%	10.5%	23.2%
Total	**0%**	**0.9%**	**1.8%**	**13.4%**	**62.9%**	**21.1%**	**100%**

Table 6: Type of exposure & artefact distribution
(artefact density/ha of exposure; exposures summing to >100m^2 only)

Type of exposure	River flats	Gullies 0.5km	Bluffs 0.5km	AB & IJ confluence	Gullies	Hillslopes & ridges	Total
Ants nests				>100/ha	c.2000/ha	45/ha	1,500/ha
Dam		63/ha		117/ha	53/ha	0	52/ha
Drain			4/ha		104/ha	11/ha	28/ha
Drill hole						0	0/ha
Feed area/trough				50/ha	-	-	±70/ha
Gateway/shed					>100/ha	10/ha	55/ha
Grassy area			0		20/ha	18/ha	19/ha
Gully erosion				800/ha	51/ha	0	62/ha
Ploughed area	0						0/ha
Quarry						0	0/ha
Sheet erosion			33/ha	200/ha	11/ha	13/ha	13/ha
Track	0	100/ha	65/ha	36/ha	112/ha	31/ha	36/ha
Total	**0/ha**	**40/ha**	**32/ha**	**482/ha**	**55/ha**	**12/ha**	**36/ha**

5.4 GROUND VISIBILITY

Overall, artefact density increased in relation to increasing ground visibility (ie. in relation to the amount of ground on exposures which could be seen) and this was the case for drains and gully erosion, and generally for tracks (see Table 7). It should be noted that areas with poor visibility (<20%) sometimes showed higher artefact density; probably because survey transects with poor visibility tended to not be recorded as "exposures". No consistent pattern in relation to improving ground visibility can be discerned for dams or grassy areas. Sheet erosion tends to show an inverse relationship of artefact density to improving ground visibility.

Table 7: Type of exposure & estimated ground visibility - artefact density/ha

Type of exposure	<20% poor	20-40% some	40-60% moderate	60-80% good	80-100% good	Total
Ants nests		>1000/ha		>1000/ha	>2000/ha	1,500/ha
Dam		3/ha	80/ha	8/ha	66/ha	52/ha
Drain	4/ha	5/ha	21/ha	34/ha	132/ha	28/ha
Drill hole					0	0/ha
Feed area/trough					-	±70/ha
Gateway			50/ha	75/ha	40/ha	55/ha
Grassy area	11/ha	22/ha	4/ha	11/ha	0	19/ha
Gully erosion	20/ha	22/ha	65/ha	84/ha	220/ha	62/ha
Ploughed area					0	0/ha
Quarry			0		0	0/ha
Sheet erosion	33/ha	12/ha	11/ha	5/ha	67/ha	13/ha
Track	44/ha	8/ha	8/ha	24/ha	71/ha	36/ha
Total	**15/ha**	**16/ha**	**33/ha**	**41/ha**	**62/ha**	**36/ha**

With regard to visibility in relation to land units (Table 8) artefact density tended to increase with improved visibility along gullies, and around the AB and IJ confluences. On hillslopes and ridges, however, artefact density remained more-or-less constant until ground visibility improved substantially.

Table 8: Land units & ground visibility - artefact density/ha

Type of exposure	<20% poor	20-40% some	40-60% moderate	60-80% good	80-100% good	Total
Hunter flats				0	0	0
Gullies 0.5km	0	0	83/ha	0	15/ha	41/ha
Bluffs & hillslopes 0.5km	50/ha	3/ha	0	63/ha	52/ha	32/ha
AB & IJ confluences		150/ha	417/ha	1380/ha	337/ha	482/ha
Gullies generally	25/ha	22/ha	39/ha	52/ha	178/ha	55/ha
Hillslopes & ridges	8/ha	12/ha	12/ha	5/ha	27/ha	17/ha
Total	**15/ha**	**16/ha**	**33/ha**	**41/ha**	**62/ha**	**36/ha**

With regard to the effects of variable ground visibility it is concluded that

- There was a general trend towards more artefacts being found (ie. higher density) with improving ground visibility, but there was no consistent association between ground visibility and artefact density on different types of exposures;
- Variation in artefact density in relation to ground visibility is likely to be due to a complex of factors, including variation between individual archaeologists in the recording of ground visibility, and that artefacts (even relatively dense sites) can be found in areas of poor ground visibility;
- Despite variations in ground visibility the major AB and IJ confluences showed consistently higher artefact density than gullies generally; which in turn showed consistently higher artefact density than hillslopes and ridges.

5.5 CONCLUSIONS

It is considered that variations in type of exposure, length of time that ground surfaces have been exposed to erosion, and variations between individual recorders in identifying and describing exposures/find contexts/artefact types will have contributed variation to the recorded data. On the whole, the results of the field survey are able to provide an indicative description of the distribution of artefacts across the lease. However, care

does need to be taken to regard results as general indications, rather than as conclusive statements regarding the archaeology of the lease.

In that context it should be noted that overall, 1.3% of the Mt Pleasant lease consisted of exposures which were searched for artefacts. This is a lower sampling frequency than the 4.3% achieved for the adjacent Bengalla lease (Rich 1993:33) but a considerable improvement on the 0.024% recently achieved for authorisation A437 - which might also have included transects without exposures (Davidson *et. al* 1993:34).

The following general statements regarding the distribution of artefacts across the Mt Pleasant lease can be made:

1. Catchments I and J had the highest artefact density of all the catchments, and the highest densities were recorded within the confluence of those streams.
2. The AB confluence had a higher artefact density than other catchments.
3. Catchment H had too little ground exposure to describe its archaeology.
4. Modern (post 1820) land use has probably adversely affected the survival of sites closest to the Hunter River.
5. Artefact density along gullies was higher than on hillslopes and ridges.

6.0 ARTEFACT ASSEMBLAGES IN THE LANDSCAPE

6.1 THE NATURE OF ARTEFACT ASSEMBLAGES

The artefact assemblages fall into two groups (see Tables 9 and 10):

- Axes, pebble tools, occasional RU pieces and debitage of igneous and quartzite materials, the items of which tended to be relatively large in size. The modal size for flakes in this assemblage was 3-5cm.
- Fine grained siliceous assemblages of silcrete, indurated mudstone, quartz and other materials, which had considerably smaller artefacts (>90% were less than 5cm in size), and which included backed pieces, the bulk of RU pieces, and the bulk of debitage. Backed pieces were small (all less than 3cm long), while other RU pieces (mostly tools) were variable in size. The modal size for flakes was less than 3cm.

Table 9: Artefact assemblages

Artefact size	Silcrete	IM	Quartz	Other FGS	Igneous	Quartzite	Total
<5cm	734 *92%*	370 *95%*	48 *98%*	65 *96%*	36 *51%*	2	1255
5-10cm	66 *8%*	17 *4%*	1 *2%*	3 *4%*	28 *39%*	4	119
>10cm	2 *<1%*	1 *<1%*			7 *10%*	1	11
Artefact types							
Axe					3		3
Pebble tool					12	2	14
Cores	55	27*	8	3	8	2	103
Backed pieces	9	8					17
RU pieces	35	35	2	2	5	1	80
Bipolar	1	2	3				6
Flakes	310	178	8	13	33		542
Other pieces	392	138	28	50	10	2	620
Total recorded	802	388	49	68	71	7	1385
Not recorded	17	3	2		1		23
Total	819	391	51	68	72	7	1408

NB: Artefacts embedded in deposit were noted and raw materials recorded, but type and size were not recorded. * One core from H6 was re-used as a tool.

Table 10: Artefact types and size

Artefact type	FGS assemblage				Igneous/Quartzite assemblage				Total
	<3cm	3-5cm	5-10cm	>10cm	<3cm	3-5cm	5-10cm	>10cm	
Axe							1	2	3
Pebble tool							10	4	14
Core	28	49	13	3	1		7	2	103
Backed pieces	17								17
RU pieces	35	27	12			3	3		80
Bipolar	5	1							6
Flakes	322	149	38		7	18	8		542
Other pieces	477	107	24		5	4	3		620
Total	**884**	**333**	**87**	**3**	**13**	**25**	**32**	**8**	**1385**

The igneous/quartzite assemblage was statistically in the minority - 5.6% of artefacts by count. It should be noted that there were local reports of axes being collected, so originally axes and pebble tools might have figured more prominently.

Within the FGS assemblage there was some variation with regard to raw materials and artefact types.

- Backed pieces and RU pieces were almost equally of indurated mudstone and silcrete, yet there were more cores and debitage of silcrete than of indurated mudstone.
- Within the debitage categories, there were more indurated mudstone flakes than other pieces of the same material; but there were more silcrete pieces than silcrete flakes. This might suggest that silcrete debitage was more prone to breakage than indurated mudstone debitage.
- Indurated mudstone artefacts tended to be slightly smaller in size than silcrete artefacts, probably reflecting more distant sources of that material.
- Cores were predominantly of silcrete, followed by indurated mudstone (Table 11). A substantial number of cores were of flake body, indicating that initial reduction of cobbles generally occurred beyond the lease; although the presence of cobble cores indicates that this was not always the case. The majority of silcrete cores were of indeterminate core body, indicating that extensive reduction (or the nature or reduction) had removed evidence of the original (flake?) form of many of the cores. Indurated mudstone cores were almost equally of flakes and indeterminate core body. For indurated mudstone it appears that reduction tended to retain evidence of core body. Notably, this group of cores included 4 flake cores of the Redbank A strategy (cf Hiscock 1993); all 4 from catchment J and the IJ confluence.
- No silcrete cores of heat shatter core body were reported, and only one possible heat treatment feature (for petrified wood at site B29) was identified. Silcrete flakes which appear to have been heated were found at A33. The overall paucity of heat treatment could be a function of recorder misidentification, but might also reflect a real paucity of heat shatter technology (cf. Narama - Baker 1992a, Rich 1992).

On the whole, silcrete was the predominant raw material across the study area, for debitage and cores. This material appears to have been most frequently knapped in the lease. There is some evidence to suggest that cores of indurated mudstone were knapped to produce smaller flakes and less broken debitage than resulted in the knapping of silcrete. The more "reckless" use of silcrete may have been associated with the

presence of a silcrete source and extraction site within the Bengalla coal lease to the south of the study area.

Table 11: Cores

Core body	Silcrete	IM	Quartz	Ign/Qzite	Oth.FGS	Total
Cobble	2 *4%*	3 *12%*	3	8		16
Flake	19 *36%*	10 *40%*	1	1		31
Indeterminate	32 *60%*	12 *48%*	3	1	2	50
Not recorded	3	1	1		1	6
<3cm	15 *27%*	7 *27%*	5	1		28
3-5cm	29 *52%*	15 *58%*	3		3	50
5-10cm	10 *18%*	3 *12%*		7		20
>10cm	2 *4%*	1 *4%*		2		5
Total	**56**	**26**	**8**	**10**	**3**	**103**

6.2 ARTEFACT DENSITY

Generally, artefacts within the Mt Pleasant lease were sparse. Overall artefact density was relatively low; on average just 36 artefacts per hectare of exposure (36/ha); or only 3-4 artefacts/1,000m^2 of exposure. However, artefact density within the lease was not even.

A detailed consideration of sampling issues in section 5.0 allows the following general conclusions to be drawn about the distribution of artefacts in the landscape:

1. Catchments I and J had the highest artefact density, particularly around the confluence of those two streams. Half the artefacts (50%) were recorded from this part of the lease, but only one quarter (23%) of exposures were recorded here.
2. Artefact density along gullies was generally higher than on hillslopes and ridges.
3. Modern (post 1820) land use has probably adversely affected the survival of sites especially within the eastern part of the lease closer to the Hunter River.
4. Catchment H had too little ground exposure to be able describe its archaeology.

In addition,

5. Relative increases in artefact density on hillslopes low down in catchments were found to occur catchments A, E, and J, while slight increases in artefact density on hillslopes higher in catchments were noted in catchments B, C, and F, and irregular densities on hillslopes were noted in catchment I (see Part II of report). Artefact discard on hillslopes appears to have been inconsistent.

Generally, artefact density was irregular across the study area, probably reflecting a combination of variation between recorders, irregular ground exposure, irregular artefact distribution, and the irregular effects of modern land use. There was a dramatic increase in artefact density low down in the IJ catchments, compared to lower artefact density higher in those catchments and in the eastern-flowing catchments (see Figure 2 and Appendix E). Artefact densities within the IJ confluence are comparable to densities along the AB stream within the Bengalla lease, and are of such magnitude as to indicate a variation in the nature of activities carried out by Aboriginal people. A likely explanation is an increase in the frequency of microblade knapping floors low down in the AB (in Bengalla lease) and IJ catchments. In contrast, only 5 partially intact knapping events (two each within catchments A and C and one in catchment E) were identified elsewhere in the Mt Pleasant lease.

Low artefact density within the eastern flowing catchments requires explanation. Given the proximity of the Hunter River, with its presumed resources, it could have been expected that artefact density would have increased with increasing proximity to the River. However, this was not the case. A likely explanation is that intensive land use closer to the River over the past 170 years or so has dispersed and destroyed archaeological material.

6.3 THE DISTRIBUTION OF RAW MATERIALS

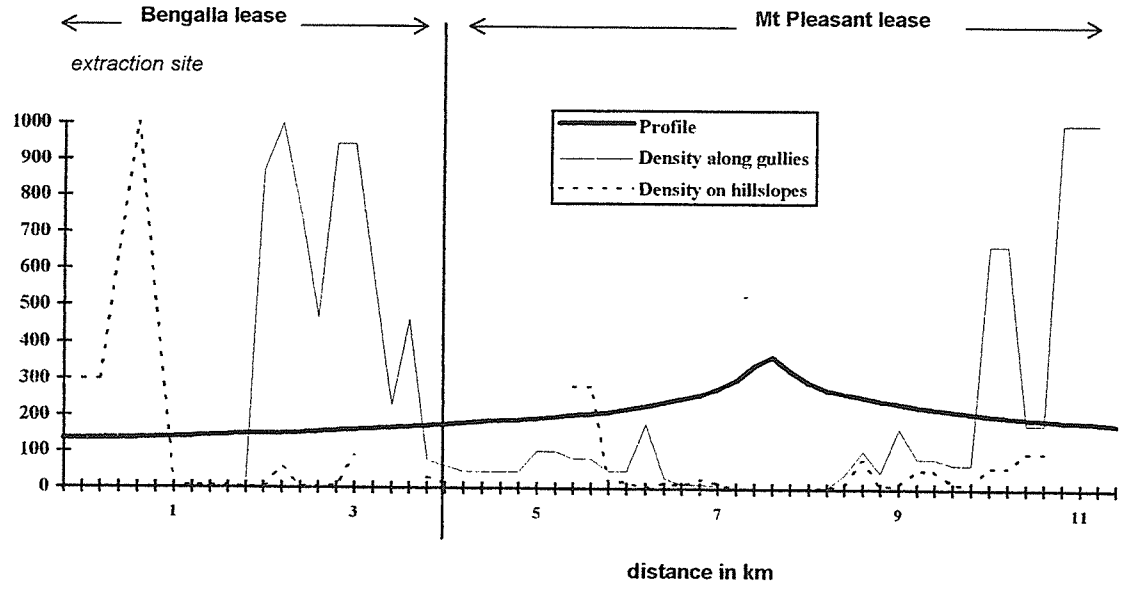
Silcrete was the predominant raw material within the Mt Pleasant lease, with 58% of all artefacts being of this material. This was similar to that within the Bengalla lease where 60% of all artefacts were of silcrete. The frequencies of other raw materials were also similar between the two leases (see Table 12); and between gullies and hillslopes within the Mt Pleasant lease, with a small increase in the frequency of "other" materials along gullies.

Table 12: Raw materials

Raw material	Mt Pleasant lease						Bengalla lease	
	Gully		Hillslope		Total		Total	
	No.	%	No.	%	No.	%	No.	%
Silcrete	620	*57*	198	*62*	818	*58*	1067	*60*
Indurated mudstone	306	*28*	85	*27*	391	*28*	452	*26*
Quartz	37	*3*	14	*4*	51	*4*	65	*4*
Igneous	55	*5*	17	*5*	72	*5*	74	*4*
Other	69	*7*	7	*2*	76	*5*	102	*6*
Total	**1087**	***100%***	**321**	***100%***	**1408**	***100%***	**1760**	***100%***

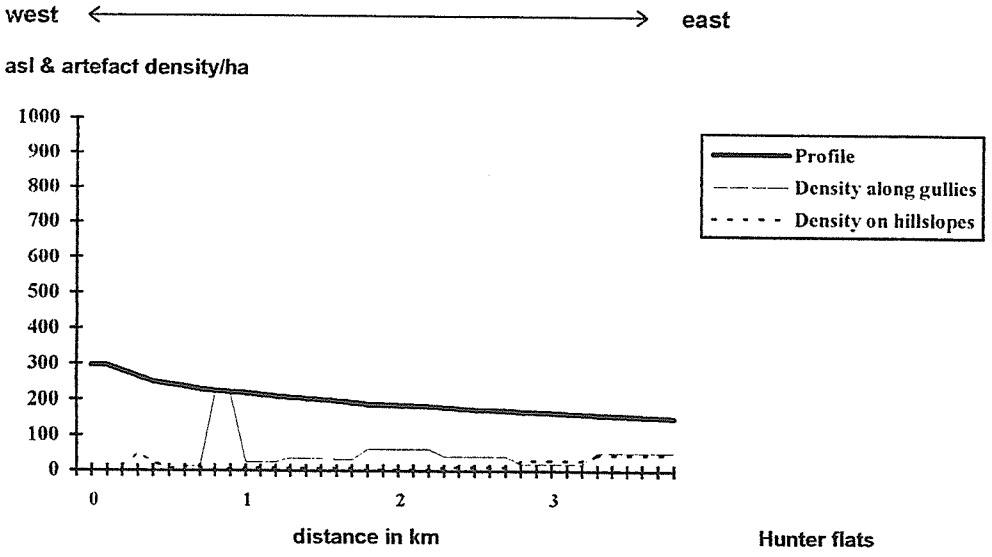
Figure 2: Artefact density across the landscape

a: Artefact distribution from south to north through the Bengalla lease, and through catchments A & B and I & J in the Mt Pleasant lease



b: Artefact distribution from west to east through catchments C, D, E & F

(showing profile through catchment E)



A predominance of silcrete in both leases was expected, given the presence of a silcrete source within the Bengalla lease. However, the close similarity in raw material frequencies between the two leases was surprising. A standard distance-decay model of raw material distributions would have suggested more dissimilarity.

It could have been expected that with increasing distance from the silcrete source artefact density might have decreased, the frequencies of silcrete artefacts amongst assemblages might have decreased, and the overall size of silcrete flakes might have decreased. However, not all of these expectations occurred and factors other than proximity of raw material source are likely to have influenced the distribution and nature of artefact assemblages.

Immediately beyond the silcrete extraction site, the frequency of silcrete drops to c.>50% of assemblages. The frequency of silcrete was then affected by localised knapping of other raw materials (eg. petrified wood feature at site B29 and indurated mudstone at A34 and I19). A clinal decline of silcrete with increasing distance northwards was not evident (see Figure 3).

Consideration of flake size with increasing distance from the silcrete source was constrained by small numbers of recorded flakes (see Appendix E3). The available data does suggest a general trend for an increase in the frequency of small flakes from the silcrete source northwards to c.5.5km on the transect. This trend was then interrupted and lower frequencies of smaller flakes corresponded with the highest elevations in the lease; perhaps small flakes had been selectively removed by erosion from steeper locations. Flake size might include have been influenced by the presence and nature of knapping or tool retouching activities.

Consideration of the size of silcrete cores was also constrained by the small numbers of cores within each interval (Appendix E3). Generally, small silcrete cores (<3cm) were rarely recorded on and near the extraction site, but they became more frequent towards the northern end of the Mt Pleasant lease some 11km from the extraction site (see Figure 5). There was also variation in core size along the transect; due possibly to small sample size and/or the nature of Aboriginal activities across the landscape. High frequencies of small cores in the north-west part of the Mt Pleasant lease may be associated with the production of backed blades as well as being further from the silcrete source.

Silcrete cores with recognisable flake core body occurred without apparent pattern along the transect (Figure 6).

Figure 3: Distribution of silcrete from silcrete source in the Bengalla lease, through catchments A & B and I & J in the Mt Pleasant lease

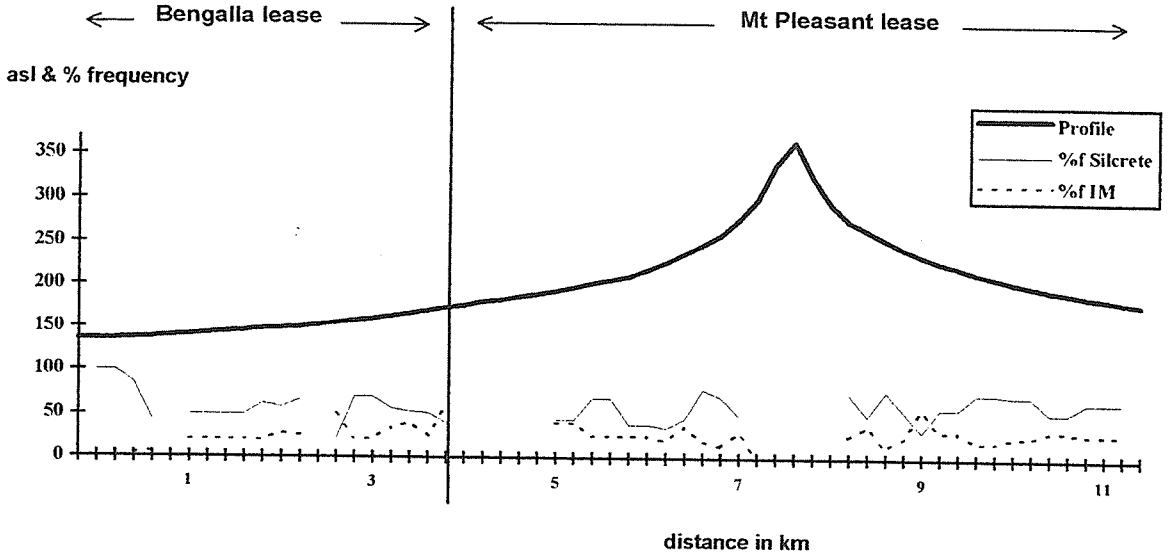


Figure 4: Size of silcrete flakes (by % frequency) from a source in the Bengalla lease, through catchments A & B and I & J in the Mt Pleasant lease

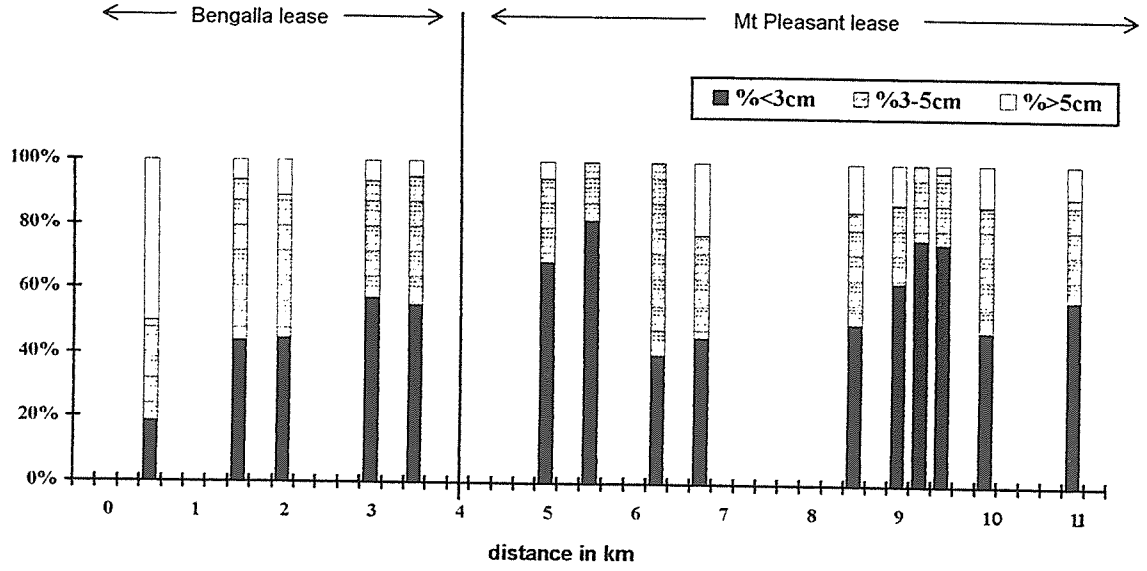


Figure 5: Size of silcrete cores (by % frequency) from a source in the Bengalla lease, through catchments A & B and I & J in the Mt Pleasant lease

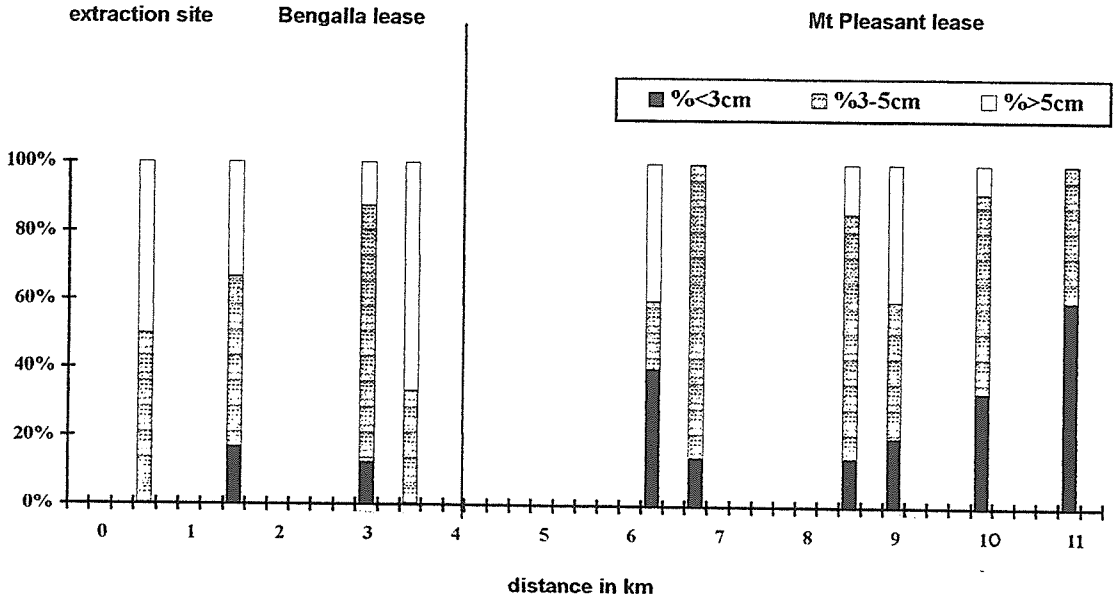
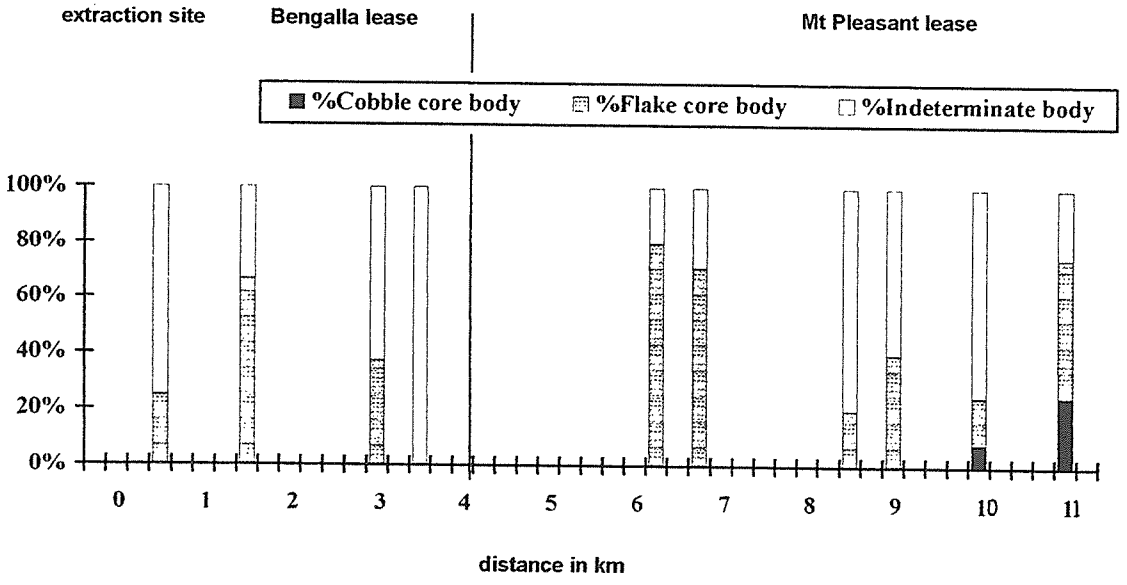


Figure 6: Form of silcrete cores (by % frequency) from a source in the Bengalla lease, through catchments A & B and I & J in the Mt Pleasant lease



In summary, there is some evidence that the size of silcrete flakes and cores decreased with increasing distance from the silcrete source in the Bengalla lease. However, trends in artefact size were not smooth along the transect. This could be due to the small number of flakes and cores considered in the analysis (ie. a sampling problem) and/or distributions could be related to variation in the nature of Aboriginal activities across the landscape.

6.4 ARTEFACT TYPES

There was close similarity in the frequencies of artefact types between the Mt Pleasant and Bengalla leases (Table 13). Within the Mt Pleasant lease there was also close similarity in the distribution of artefact types along gullies and on hillslopes/ridges; except that backed blades were found only along gullies. Notably 16 of the 17 backed pieces occurred within the I and J catchments, where the highest artefact densities were found. If local collections of axes/pebble tools were substantial it appears that they occurred without bias for lease and with little bias for hillslopes vs. gullies.

Table 13: Artefact types

Artefact type	Mt Pleasant lease						Bengalla lease	
	Gully		Hillslope		Total	%	Total	%
	No	%	No	%				
Backed blades	17	*1.6*	0	*0*	17	*1.2*	23	*1.3*
Pebble tools & axes	12	*1.1*	5	*1.6*	17	*1.2*	19	*1.1*
Other RU pieces	61	*5.6*	19	*5.9*	80	*5.7*	125	*7.1*
Cores	82	*7.5*	21	*6.5*	103	*7.3*	150	*8.5*
Debitage	915	*84.2*	276	*86.0*	1191	*84.6*	1443	*82.0*
Total	**1087**	***100***	**321**	***100***	**1408**	***100***	**1760**	***100***

It might be expected that backed blades, being relatively rare items, would be found amongst larger assemblages; ie. the likelihood of finding rare items increases with larger sample size (Kintigh 1989). At Mt Pleasant there was some tendency for samples with larger numbers of artefacts to have more variety of artefacts; although the 3 largest samples were not the most diverse (Table 14).

Table 14: Sample size and diversity (NB. excludes embedded items for which type was not recorded)

No. of categories	1	2	3	4	5	6	7-10	11-19	22-31	42-49	55-62	Total
1	180	16	5	2								203
2		24	17	6	8	3	8	4			1	71
3			5	7	3	4	7	2	3	1		32
4							4	5	1		2	12
5								1	2	3		6
6										1		1
7												0
Total locations	180	40	27	15	11	7	19	12	6	5	3	325

Backed blades occurred more frequently in larger assemblages (Table 15, Figure 7, Appendix E4). However, small-sized assemblages had higher frequencies of cores and retouched/used tools; the variable incidence of pebble tools/axes may have been affected by the activities of a local collector. More than 40% of the axes/pebble tools, RU pieces and cores were recorded amongst locations having only 1-3 artefacts. For debitage,

pieces (ie. pieces of broken flakes and flaked pieces) occurred more frequently amongst larger assemblages than smaller assemblages (Figure 8) - higher rates of flake breakage may have resulted from stone reduction techniques associated with backed blade production.

Table 15: Sample size and artefact types (NB. excludes embedded items)

Type	1	2-3	4-6	7-10	11-19	22-31	42-49	55-62	Total
Axes & pebble tools	5	2	1		2	1	6		17
RU pieces	21	13	7	8	8	8	14		79
Backed pieces		1	1	2	3	4	3	3	17
Cores	23	21	13	13	8	7	8	11	104
Flakes	63	70	84	66	71	51	88	50	543
Bipolar	1	2					2	1	6
Pieces	67	52	51	69	84	81	104	112	620
Total finds	180	161	157	158	176	152	225	177	1386
Total locations	180	67	33	18	12	6	5	3	325

b. Sample size and artefact types - % frequency by column (NB. excludes embedded items)

Type	1	2-3	4-6	7-10	11-19	22-31	42-49	55-62	Total
% Axes & pebble tools	*2.8*	*1.2*	*0.6*	*0*	*1.1*	*0.7*	*2.7*	0	17
% RU pieces	*11.7*	*8.1*	*4.5*	*5.1*	*4.5*	*5.3*	*6.2*	0	79
% Backed pieces	*0*	*0.6*	*0.6*	*1.3*	*1.7*	*2.6*	*1.3*	*1.7*	17
% Cores	*12.8*	*13.0*	*8.3*	*8.2*	*4.5*	*4.6*	*3.6*	*6.2*	104
% Flakes	*35.0*	*43.5*	*53.5*	*41.8*	*40.3*	*33.6*	*39.1*	*28.2*	543
% Bipolar	*0.6*	*1.2*					*0.9*	*0.6*	6
% Pieces	*37.2*	*32.3*	*32.5*	*43.7*	*47.7*	*53.3*	*46.2*	*63.3*	620
% Total finds	180	161	157	158	176	152	225	177	1386
% Total locations	180	67	33	18	12	6	5	3	325

Figure 7: Sample size and artefact types (tools) - % frequency

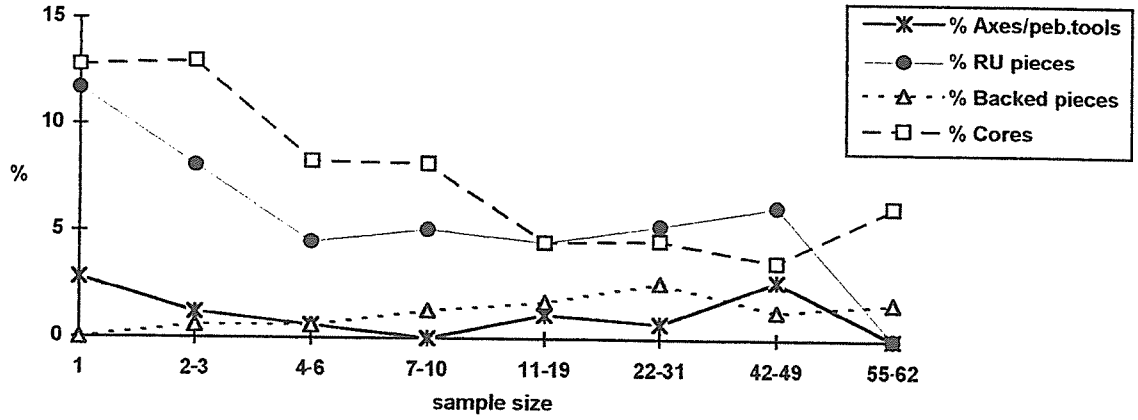
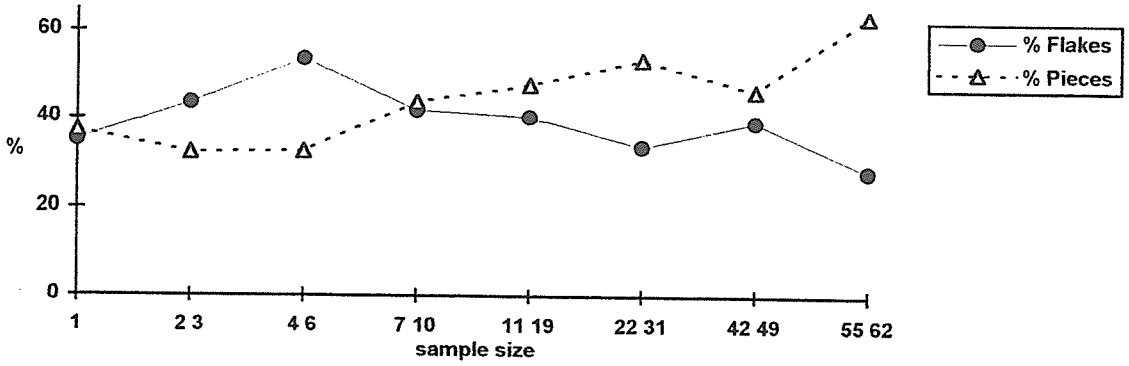


Figure 8: Sample size and artefact types (debitage) - % frequency



6.5 HOW OLD?

The presence of backed pieces generally, the edge-ground axe from E33, and bipolar artefacts of indurated mudstone and silcrete, as well as quartz, suggest occupation of the lease during the past 4-5,000 years, by comparison with the Eastern Regional Sequence (see pages 9-10); but there are no indications as to when Aboriginal people first occupied the lease. It is known that the lease was occupied in recent times:

- A "black" glass retouched/used piece was reported from IJ5. The identification of that item as an a tool, rather than just a damaged piece of glass, was made on the basis of the item having regular and repeated retouch, and because no other European material was found in the vicinity. This item dates an occupation event on the I-J confluence in the north-west part of the lease to the period c.1790-c.1830AD.
- Flake cores (of the Redbank A reduction Strategy) were reported from the north-west part of the lease. These may date to a period of pre-1,300BP to 800 BP [or the contact period (?)] (Hiscock 1986, 1993).

6.6 DISCUSSION & CONCLUSIONS

While the archaeological picture is likely to be distorted by the effects of ground exposure and visibility, and by modern land use, there does appear to be some patterning in the composition of assemblages and the distribution of material across the landscape; particularly indicated by dramatically increased artefact density in the north-west part of the lease, and beyond the lease to the south.

Artefact distribution does not appear to have been controlled by the availability of, or proximity to, the silcrete raw material source. Proximity to the silcrete source in the Bengalla lease had some influence on the size of cores and flakes, but the Aboriginal occupants appear to have given primacy to factors other than stone materials in the location of activities in the landscape.

Backed blades were found only near drainage lines and occurred most frequently within the I and J catchments (north-west part of the lease) with only occasional knapping events reported elsewhere. Backed blades tended to be associated with larger-sized assemblages. Beyond the Mt Pleasant lease, backed blade knapping events are also usually reported along the banks of larger streams and less frequently at waterholes or at confluences of gullies (as at Bengalla and Narama).

At Mt Pleasant, axes/pebble tools, other RU pieces and cores were discarded in similar frequencies along drainage lines and on hillslopes/ridges. RU pieces and cores tended to occur frequently amongst small assemblages, and more than one quarter of axes/pebble tools and RU pieces were recorded as isolated (single) finds.

Archaeological assemblages resulted from discard during activities[1]. Variation in the composition of assemblages and the distribution of material in the landscape implies some variation in the nature and locations of activities which were carried out.

It could be expected that people making use of the Mt Pleasant area might have occupied residential (camping) bases for one or several days. At such places they might have carried out a range of activities including stone tool production and maintenance, use of stone tools to make and maintain other items (eg. wooden tools, skin cloaks), food

[1] Subsequently affected by soil processes and land disturbance.

processing and cooking, and other social/domestic tasks. From these residential bases they might have made trips into surrounding areas to procure food and various materials. Conceivably, stone tools might have been made and/or used and/or discarded away from residential bases during the course of such extractive tasks.

A possible scenario might be that:

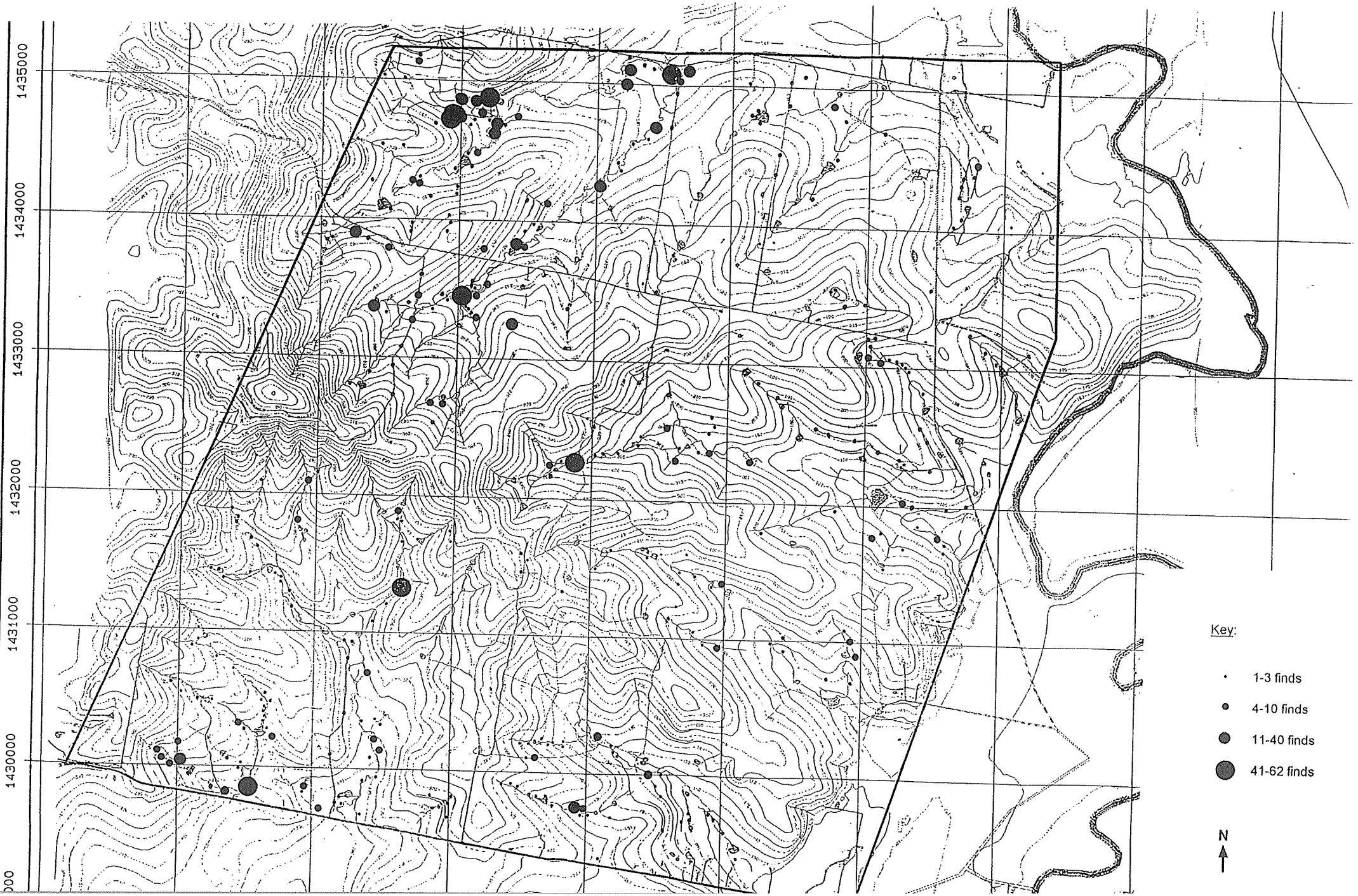
* Small assemblages consisting of one or a few artefacts might have resulted from discard during resource extraction (eg. food procurement), and/or occupation of 'dinner-time' locations during the course of each day.
* More extensive sites with larger numbers of artefacts might have been residential bases at which larger numbers of artefacts were discarded by larger numbers of people carrying out a range of activities, including stone tool production.

The distribution of recorded assemblages by size (numbers of artefacts) is given as Map 8. This distribution is *suggestive* of some patterning in artefact distribution with larger assemblages generally being 1.4km to 1.9km apart, with smaller sites more dispersed. It is tempting to interpret the distribution as residential bases from which daytime resource procurement trips were made; with localities such as the confluence within catchment J being occupied repeatedly.

However, these interpretations are tentative for several reasons:

1. The number of artefacts in an assemblage may be affected by the extent or type of exposure. Other sites with large numbers of artefacts might be present but buried, or some sites with large numbers of artefacts might have been largely eroded, or destroyed (as may be the case in the eastern part of the lease).
2. Assemblage size may be related more to the nature of the activity carried out than to the number of people or length of time a place is occupied. A backed blade knapping event would result in many more artefacts than the production of flake tools or stone tool retouching/maintenance.
3. We don't know what range of activities were carried out at residential bases. It is possible that production and/or maintenance of stone or other tools was carried out away from residences as 'special' tasks, or food processing might have been carried out at/near the places of extraction rather than at the residential base. This has implications for the identification of different "types" of open sites.

Map 8: The distribution of assemblages by size
(1:25,000 scale topographic sheet, prepared by Coal & Allied Operations Pty Ltd)



4. There might have been much variation in the length of time that residential bases were occupied, the frequency particular locations were reoccupied, and the spacing between residential bases.
5. Patterns of landuse might have changed over time. Very small groups of people might have moved their residential base very frequently and perhaps only a few hundred metres, resulting in many small residential sites. Such a pattern might have replaced (or been replaced by) larger residential groups moving less frequently but further apart; resulting in few but substantial residential bases. The archaeology of the lease may be a composite of different organisational systems.
6. Another complicating factor is that the archaeological record provides information on the locations of *discard* which may not have been the places where tools were used. For example, Baker (1992b) has suggested that backed blades may have been used off-site (eg. as spear barbs) and discarded on-site when new replacement items were made (ie. on backed blade knapping floors). In contrast, stone axes and some pebble tools seem to have been used until well worn and perhaps discarded when and where no longer useful.

Data limitations

The data collected during the field survey *suggests* that there was some regularity in the way Aboriginal people organised their activities in the landscape at Mt Pleasant. However, due to limitations on the collected data[2], the survey cannot be regarded as providing a sufficient archive of the archaeology of the Mt Pleasant lease. In particular,

a) Ground exposures on which artefacts might have been found made up only 1.3% of the lease; by implication, 98.7% of the lease was not effectively searched. While the extent and wide spread of exposed ground was sufficient to provide broad indications of artefact distribution, closer consideration of the nature and distribution of assemblages interpretable as the result of past activities may be distorted by accidents of ground exposure.
b) Artefact density (and by implication assemblage size) varied with the type of ground exposure, eg. near gullies, tracks tended to have higher artefact density (112/ha) than did gully erosion (51/ha).
c) Artefact densities tended to increase with improving visibility.
d) Artefact densities recorded from eroded surfaces are usually much lower than densities recovered via excavation of adjacent, more intact, deposits. Surface recording is

[2] As well as current limitations on occupation modelling.

usually an underestimate of the number of artefacts present in adjacent deposits and provides an incomplete record.

e) Geomorphological processes might have varied in different circumstances, eg. the possible preferential removal of small artefacts from steeper localities by erosion (eg. higher in catchments).

f) The coarseness of field survey methods might have contributed to variation in records, eg. in reporting the extent of ground exposures there might have been differences between recorders in determining the limits of ground exposures, and in estimating the extent of exposures. Variation might also be expected in finding artefacts (eg. affected by light conditions or presence of field hazards) and identification of artefact attributes might have varied between recorders.

g) The number of utilised tools may have been underestimated without microscopic identification of residues and usewear, or accidentally damaged items may have been misidentified as tools. Additionally, the survey data has not been able to provide information on the tasks for which tools were used - did tool function vary across the landscape?

The scale and spread of less disturbed parts of the Mt Pleasant lease (see Map 7) indicate the potential to investigate issues of landscape archaeology with some methodological control. The implications for archaeological salvage are discussed in section 8.0.

7.0 STATEMENT OF SIGNIFICANCE

Aboriginal archaeological sites and finds may be of significance in three ways: they may be of archaeological significance, significant to Aboriginal people, or have potential for public interpretation or education.

7.1 ARCHAEOLOGICAL SIGNIFICANCE

Generally, the Mt Pleasant lease does **not** contain a substantial archaeological resource. Most of the lease comprises the upper and middle catchments of drainage lines, and archaeological material is very sparse. The eastern part of the lease fronting onto the Hunter flats, has been substantially disturbed by previous land uses and it appears that archaeological material has been destroyed. The potential of the lease to provide archaeological (scientific) information is restricted to areas of relatively less disturbance within the upper and middle reaches of catchments within the western part of the lease, and smaller areas in the lower reaches of catchments in the north/north-west part of the lease.

The lease appears to have some potential to provide information on the way Aboriginal people organised their activities in the landscape.

Most of the Mt Pleasant coal lease, however, is of low archaeological potential. It is difficult to assess less disturbed locations within the lease, due to limited ground exposure, but these areas also appear to be of low to moderate archaeological potential. Higher densities of archaeological material within the north-west part of the lease indicate that middle and lower reaches of catchments I and J have the potential to provide specific additional information on regional issues of backed blade stone technology.

7.2 ABORIGINAL SIGNIFICANCE

The significance of the Aboriginal finds to the Wanaruah Local Aboriginal Land Council has yet to be determined. In addition to the present report, a summary report outlining the archaeological findings is being prepared for their consideration.

7.3 POTENTIAL FOR PUBLIC INTERPRETATION

Sites A3 and A4, and the complex of finds within the I-J confluence have some limited potential for interpretation. The former group within catchment A appear to have been associated with various activities (possibly some woodworking?), while the latter complex within the I-J complex appears to have been associated with the production of backed pieces. The differences between the two groups of assemblages could have been interpreted for a general audience.

8.0 DEVELOPMENT IMPACT & ARCHAEOLOGICAL SALVAGE

8.1 DEVELOPMENT IMPACT

The extent of the proposed development (as currently designed) in relation to recorded artefact locations is shown on Map 9 and summarised on Tables 16 and 17. In brief, it appears that almost all the recorded artefact locations would be affected except E32, E33, F1-F3 and G1-G8, and these are not representative of the locations which would be affected. Several other locations may or may not be affected, depending on the final design of proposed works: A10, A20-A34, AB3-8, B3-5, B23-B32, B37-B44.

Table 16: Impact on Aboriginal finds

	Total	Axe/ pebble tool	RU piece	Backed piece	Core	Flake	Bipolar pieces	Other piece
Not affected	20	1			1	7		11
Affected*	1,366	16	79	17	103	536	6	609

* +22 embedded

Table 17: Assemblage size and development impact (NB. excludes embedded items)

Type	1	2-3	4-6	7-10	11-19	22-31	42-49	55-62	Total samples
Not affected	8	4	1						12
Affected	172	63	32	19	12	6	5	3	313

8.2 TOWARDS A SALVAGE PROGRAM

Most of the lease has been disturbed by previous land uses, and substantial tracts have been ploughed. Along the banks of some drainage lines some narrow strips appear to have survived without ploughing and may contain important archaeological evidence. Occasional larger areas of several hundred metres in extent also appear to be less disturbed and are known or likely to contain artefacts and knapping features. The archaeological survey allowed a broad assessment of the archaeological resources and potential of the lease, but it cannot be regarded as providing a definitive archaeological archive of the lease (see pages 45-46). While the lease probably has a relatively sparse archaeological record, only a small proportion of the artefacts likely to be present have probably been recorded (since it is estimated that ground exposures revealed only c.1.3% of the lease area).

If the proposed development proceeds it is considered that archaeological salvage, particularly of less disturbed areas of potential (Map 9, Table 18), should be carried out.

Archaeological salvage should aim to recover information able to contribute to an understanding of the landscape context of artefact assemblages (including site function) as well as technological issues of regional concern (see pages 11-12). In this regard it should be noted that salvage projects in the Hunter lowlands have tended to favour recovery of knapping floors (of technological interest) but the archaeological archive of the Hunter lowlands is being biased away from the recovery of smaller artefact assemblages possibly associated with tool maintenance and resource extraction/processing.

Salvage for the Mt Pleasant lease should address the following parameters:

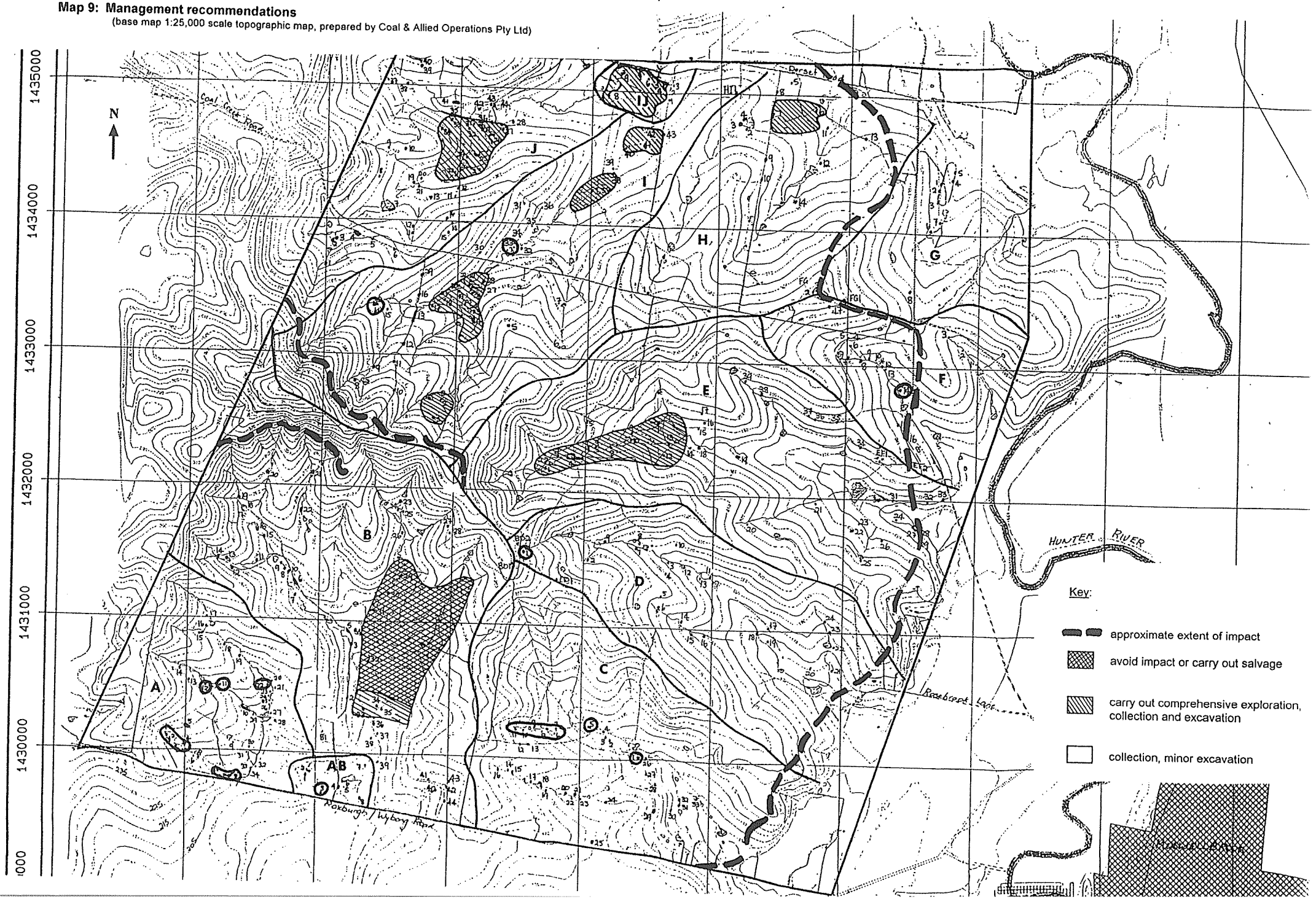
- Adopt/develop field methods suitable for large-scale investigations, as well as using precision recovery techniques as appropriate.
- Concentrate field work in areas thought to be relatively undisturbed - to maximise archaeological information.
- Investigate different landscape contexts as feasible, including lower, middle and upper parts of catchments, catchments having different aspects, and a spread of samples from different parts of the lease;
- Investigate different types of artefact assemblages - high and low density areas, knapping features, assemblages with backed blades, assemblages with cores, retouched/used pieces and pebble tools; in particular ascertain whether there were functional differences in tool use in different parts of the landscape;
- Collect rare axes and pebble tools which would otherwise be destroyed and which occur in areas outside those identified for investigation.

The recommended salvage work would provide a series of assemblages from various landscape settings over a total north-south distance of about 6km, which would complement the limited systematic archaeological work to be carried out within the Bengalla lease to the south.

Table 18: Recommendations for further archaeological investigation

Part of lease	Part of landscape	Gully or hillslope	Locations	Comments
south-west	**upper catchment** 210-240m asl	Gully AA and	• A1-A4 and A7-A8	• Mapping and salvage of spatially discrete locations of tool production, use and maintenance; possibly from specific tasks rather than residential occupation.
	upper-middle catchment c.200-225m	Gully, spur and confluence	• B29-B35 and woodland PAD	• Less disturbed area with little visibility; archaeology not known but potential to provide suite of intact assemblages in landscape setting. Test excavation and salvage as appropriate of affected locations.
	confluence	A and B	• AB3	• Limited excavation of the only known location with a backed blade in the south-west part of lease.
middle-east	**upper catchments** > 190m in C; > 220m in E.	Gully banks & hillslopes high in catchments	• C6-C11 • E2-E4	• Collect low density sparse finds, including RU pieces and cores, possibly from casual & infrequent resource use in upper parts of catchment C • Surface collection & exploratory excavation at E2-E4 to investigate focussed occupation relatively high in catchment E.
	middle catchments 165-190m asl in C; <215m in E.	gully	• C1 & C5 • E6-11	• Recovery of isolated knapping floors C1,C5 • E6-E12 and vicinity - one of the less disturbed parts of the lease (continuous with E2-E4). Work should include surface collection, geomorphological investigations & excavation as appropriate.
north-east part	**lower** c.175m asl	gully	• H6 & vicinity	• The only location in the north-east part of the lease with possible archaeological potential. Exploratory excavation should be carried out to determine the extent of past disturbance with archaeological salvage as appropriate.
north-west part	**upper** 255-280m asl	gully	• I1-I3 • I14	• Collection and exploratory excavation at I1-I3 to determine the extent of past land disturbance with appropriate salvage (including a no-salvage option). • Collect I14 (with backed piece) for reference
	middle 205-240m asl	gully gully, confluence & spur/ hillslope	• I4, I17-I27 • J22-J35	• Surface collection, geomorphological investigations, exploratory excavation and salvage excavation as appropriate. • Archaeological investigations, including surface collection, geomorphological assessment, test excavation & salvage, should be carried out across the confluence of the two arms of drainage line J, and along the right bank of the main drainage line.
	lower 170-185m	gully, flat & footslope	• I38-I42 • I-J confluence (IJ1-9)	• Exploratory testing should be carried out in the vicinity of I38-I42 to assess the potential with salvage as appropriate. • Exploratory excavation (eg. mechanical stripping/trenching) should be carried out across the I-J confluence with archaeological salvage as appropriate.
Other			• A11, A12, A22, B41, D1, F14, I33	Collect other rare axes and pebble tools which would be affected.

Map 9: Management recommendations
(base map 1:25,000 scale topographic map, prepared by Coal & Allied Operations Pty Ltd)



9.0 RECOMMENDATIONS

The archaeological survey identified no archaeological finds, features or areas of sufficient significance to prevent the project proceeding. On the whole, archaeological material within the Mt Pleasant lease was sparse and broadly similar to material within the Bengalla lease to the south. Artefact assemblages which would be affected by the present design of the Mt Pleasant mine are broadly similar to assemblages within the lease which would not be affected (see page 49 and Appendix E7).

THE NATIONAL PARKS AND WILDLIFE ACT

Under s.90 of the National Parks and Wildlife Act it is an offence to knowingly damage, deface or destroy an Aboriginal relic without the prior written consent of the Director of the National Parks and Wildlife Service. A relic is defined as a "deposit, object or material evidence" of Aboriginal occupation. Archaeologists must also obtain written permits from the Director to collect artefacts or to carry out archaeological excavations [ss.86-87].

The National Parks and Wildlife Service may issue consents and permits with or without conditions, or may choose not to issue the consents or permits. It should also be noted that the National Parks and Wildlife Service is not bound by development consents or approvals which may be issued by other local or state government departments.

In addition to these legal requirements the National Parks and Wildlife Service recognises that Aboriginal people have a legitimate interest in the management of the sites of their heritage. It is NPWS policy that the relevant local Aboriginal Land Council or relevant Aboriginal community group be consulted on the management of sites. The Director does not necessarily require that Land Councils or Aboriginal communities concur or give permission for sites to be damaged or destroyed, but the Director seeks their written advice and considers it. Advice from the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council Inc is included as Part 4 of this report.

RECOMMENDATIONS

The following recommendations are based on a archaeological surface survey of the Mt Pleasant lease. Both the Wanaruah Local Aboriginal Land Council and the Wonnarua

Tribal Council have made recommendations, presented as Part 4 of this report, and the reader is referred to that advice, in addition to the archaeological recommendations presented below.

It is recommended that:

1. The development, dam construction or other works should be designed so as to avoid impact on Aboriginal sites, and particularly avoid works within the apparently less disturbed area within the B catchment as shown on Map 9.
2. If the proposed development proceeds the boundaries of the extent of impact from the infrastructure, tailings ponds and other works within catchments A and B and the AB confluence, and in relation to E32 and E33, should be marked out on the ground so that precise details of impact can be ascertained.
3. Sites adjacent to works which would not be affected should be protected, e.g. by fencing, to ensure they are not accidentally damaged or destroyed during construction or operation of the mine.
4. Consent to destroy Aboriginal "relics" (artefacts) within the area of impact should be issued by the National Parks and Wildlife Service, but subject to archaeological salvage. Archaeological salvage should proceed along the lines indicated in section 8.2 (pages 50-51 and Map 9).
5. A plan of management should be prepared which outlines how sites and areas within the lease which will not be affected by the development would be protected. Such a plan should be prepared in consultation with the Wanaruah Local Aboriginal Land Council and the Wonnarua Tribal Council.
6. If the proposed development does not proceed it is considered that continuation of existing land uses would not unduly further damage the archaeological sites and finds in the area. The relatively less disturbed areas identified on Map 7, as well as the I-J confluence, should not be further cleared, ploughed or otherwise disturbed without seeking advice from the National Parks and Wildlife Service.

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PART 2: CATCHMENTS

11.0 CATCHMENT A

11.1 DESCRIPTION

This is the most south-westerly catchment within the study area. It consists of three gullies which drain in a south-easterly direction. Of these, the southern-most gully (along which sites A1-A8 were recorded) drains into the Bengalla lease and technically was not part of the same catchment; it has been designated "gully AA".

Almost all of catchment A had been disturbed by previous land use, particularly by ploughing. Remnant intact profiles survived rarely eg. along the margins of gully AA and in the vicinity of A10, and A24-A25.

11.2 ARTEFACT DISTRIBUTION AND DENSITY

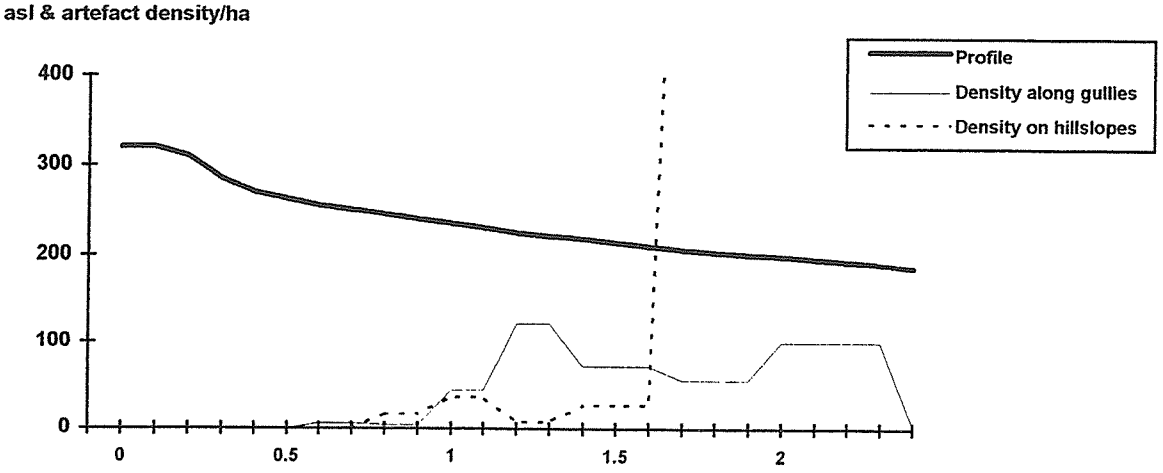
Artefact density was highest within the lower parts of the catchment, and declined with increasing elevation (Table 19, Figure 9). There was sufficient exposure along gullies above 240m asl and on hillslopes and ridges above 260m asl to be confident of this pattern. Of particular note was a marked increase in artefact density on hillslopes at 200-210m asl. This was due to the occurrence of two knapping locations at A33 and A34 on a long low spur north-east of gully AA.

Table 19: Finds and exposures in catchment A and confluence AB

Height asl	Gully			Hillslopes & ridges		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
180-190m	0.90	5	6/ha			
190-200m	0.14	14	100/ha			
200-210m	0.16	9	56/ha	0.08	80	1,000/ha
210-220m	0.25	18	72/ha	0.11	3	27/ha
220-230m	0.32	39	122/ha	0.12	1	8/ha
230-240m	0.43	19	44/ha	0.11	4	36/ha
240-250m	0.78	3	4/ha	0.06	1	17/ha
250-260m	0.72	4	6/ha	0.08		0/ha
260-270m	0.33		0/ha	0.45		0/ha
270-280m				0.75		0/ha
280-290m						
290-300m						
300-310m						
310-320m						
Total	**4.03**	**111**	**28/ha**	**1.76**	**89**	**50/ha**

Most of the artefacts were found along gully AA and on the low spur to the north-east; all these finds occurred below 235m asl. Other hillslopes and two gullies within catchment A revealed sparse finds in largely disturbed contexts.

Figure 9: Artefact density in catchment A



11.3 GULLY AA

Archaeologically, gully AA stands out as one of the more interesting in the lease, despite adjacent extensive land disturbance. A complex of find locations (8 were recorded) occur over a distance of 600m. Artefacts were generally not numerous (58 were recorded) but they appear to have resulted from focussed activities. A pebble tool was found at location A3 together with 4 pieces of orange-red indurated mudstone which appeared to have come from a single flaking event. Location A4 was a focussed site, with 25 recorded artefacts, including a number of pieces with well worked and retouched edges, and an axe. Basalt pieces were also found on locations A7 and A8.

The banks of the gully were eroded and artefacts were associated with a thin (<10cm) remnant A unit soil. Some large trees remained. It appears that a fairly narrow band of remnant deposit occurs immediately adjacent to the gully; the tight clustering of recorded artefacts on A3, A4 and A7 (separated by exposures without finds) suggests some localised integrity. Artefacts on A8 occurred as a more extensive scatter, but also appeared to be eroding from a remnant A unit soil. Other find locations were more disturbed. A1 and A2 were exposed on an excavated drain and dam wall and may well have come from a single "site". A5 was found adjacent to a second dam; the surrounding area had been heavily disturbed.

Beyond the present lease area (within the Bengalla lease to the south) the entire length of gully AA was not previously surveyed, but an interesting site complex (Bengalla site B35)

with a hammerstone, pebble tool, and knapping events, was found near its confluence with the main creek flowing through that lease (Rich 1993:156-160).

11.4 ARTEFACT ASSEMBLAGE

The majority of artefacts were of silcrete followed by indurated mudstone (Table 20), in keeping with the overall trend of raw material useage for the lease. Silcrete pieces were predominant over silcrete flakes, with the opposite the case for indurated mudstone; trends also in keeping with the overall debitage breakage pattern for the lease. Coarser-grained materials - igneous and quartzite - were relatively infrequent, but all artefact types were represented by these materials.

Possible backed blade technology was identified only at locations A33 and A34 on the spur. These knapping events were, respectively, of silcrete and indurated mudstone. They had been affected by ploughing and subsequently by grading and use of the track on which they were found. The artefacts from A33 in particular were much broken.

Much of the assemblage from this part of the study area appears to have resulted from the production of stone pieces useable as tools, and tool maintenance. Despite the presence of flaking debris from the two (probable) backed blade knapping events, macroscopically identifiable tools (pebble tools and RU pieces) made up 10% of the total assemblage - an unusually high frequency for the Hunter lowlands.

Table 20: Artefact assemblage from catchment A

Artefact types	Silcrete	Indurated mudstone	Petrified wood	Quartz	FGS	Quartzite	Igneous	Total	%
Axe							1	1	*0.6%*
Pebble tool						1	3	4	*2.2%*
RU piece	7	5					1	13	*7.3%*
Core	3	1		1		1		6	*3.4%*
Flake	41	28	1	2	2	0	5	79	*44.1%*
Piece	56	16	0	3	0	0	1	76	*42.5%*
Total	**107**	**50**	**1**	**6**	**2**	**2**	**11**	**179**	
%	*59.8%*	*27.9%*	*0.6%*	*3.4%*	*1.1%*	*1.1%*	*6.1%*		*100%*

11.5 DEVELOPMENT IMPACT & RECOMMENDATIONS

The proposed development as currently designed will affect locations A1-A9, A11-A19 (infrastructure development), and depending on the locations of drainage or other works, locations A20-A34 may also be affected.

The following recommendations are made:

1. The locations of A20 - A34 and their landscape setting should be avoided if possible,
2. If reported artefact locations cannot be avoided then consent to destroy must be obtained from the National Parks and Wildlife Service. Given the sparse nature of the finds, and the extent of past land disturbance it is considered that consent to destroy most artefacts should not require further archaeological work, except for
   i. Gully AA, being locations A1-A4 and the area between these, and locations A7-A8 and the area between these, which should be archaeologically salvaged. Such work may include mapping, surface collection and subsurface investigation - test excavation and/or mechanical stripping to identify/define concentrations, and/or controlled hand excavation. Of the complex of finds along gully AA, site A4 is the most significant and would warrant controlled field recovery.
   ii. The igneous RU flake from site A11 and the pebble tools from locations A12 and A22 should be collected.

12. CATCHMENT B

12.1 DESCRIPTION

This catchment drains the south side of Mt Pleasant and flows southwards, eventually flowing into the Bengalla coal lease to the south to form the main stream in that area (Rich 1993a). The northern watershed of the catchment varies from 270m asl to 365^{+}m asl on Mt Pleasant. The eastern watershed (with catchment C) is lower at c.230-260m asl. The upper slopes tend to drop steeply, and the valley profile tends to flatten out at lower altitudes (see Figure 10).

Catchment B has been largely cleared of timber, and some areas may have been ploughed (land owner pers.comm. and air photo inspection). Scattered trees (some possible regrowth) occurs across the catchment, with denser stands near the yards complex near the confluence of the main west and east branches of the stream, and along the eastern tributary in the north-east part of the catchment. This latter area may not have been ploughed.

The hillslopes were thickly grassed, and exposures in the eastern half of the catchment tended to be of limited extent, and/or had poor ground visibility (see Map 6). Overall, about 1% of the catchment and its watersheds were effectively surveyed. It is considered that exposure along gullies and around confluences in the eastern part of the catchment below c.225m asl was insufficient to be able to describe the archaeology of this area. As this area is also timbered and may not have been ploughed, and as artefacts were found on most exposures (including a petrified wood feature), it is considered that subsurface investigations are warranted if this area was to be impacted upon.

12.2 ARTEFACT DISTRIBUTION AND DENSITY

A total of 44 artefact locations were recorded within catchment B and two artefact locations were found on the watershed of catchments B and D. Most of the locations had only 1-3 artefacts, occurring on extensive exposures (see Appendix B.2 and B.13). For the most part, artefacts were very sparse. Locations with "concentrations" of artefacts were B22 at 250m asl with 8 artefacts, B32 at 205m asl with 9 artefacts, B36 at 195m asl with 8 artefacts and B29 at 220m asl with 46 artefacts (being a petrified wood feature, possibly associated with heat treatment of that material). More artefacts are likely to be present at

these locations, buried in soils adjacent to the exposures. More detailed descriptions of these locations are included in Appendix C.

Overall, artefact density was notably higher along gullies than on hillslopes and ridges (Table 21, Figure 10). An exception was an increase in artefact density on hillslopes at elevations of 250-260m asl; however, this is due to the identification of only two locations with artefacts (B27 and B28) in the north-east part of the study area and a generalisation of increased artefact density on higher hillslopes should be regarded with caution. No artefacts were found in the higher steeper part of the catchment above 280m asl, despite there being sufficient exposure. The marked increase in artefact density along gullies at 220-230m asl is due to the identification of a petrified wood concentration at site B29.

Figure 10: Artefact density in catchment B and AB confluence

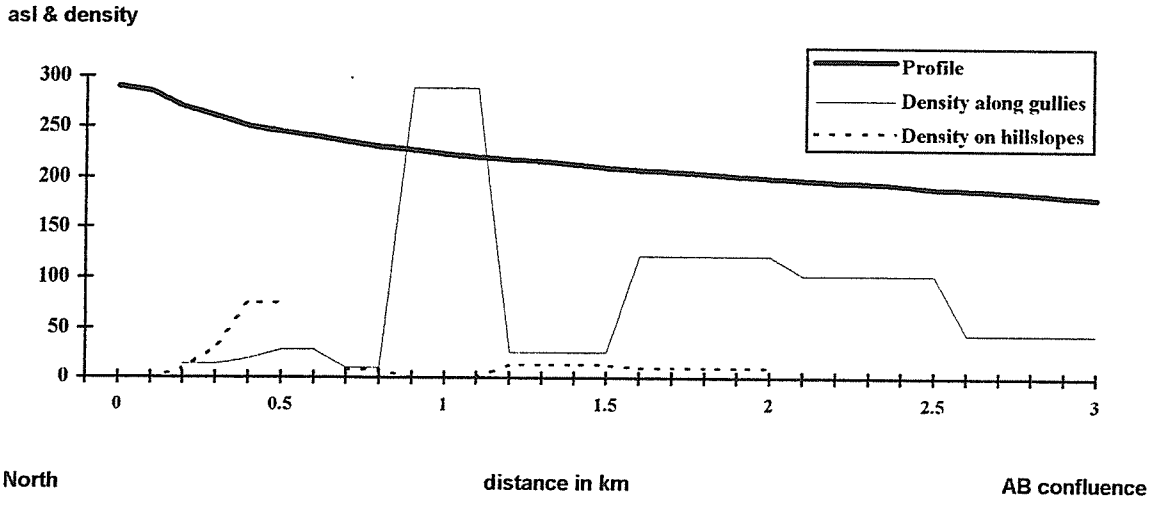


Table 21: Distribution of finds and exposures in catchment B & AB confluence

Height ASL	Gully			Hillslopes & ridges		
	Extent in ha	No of finds	Density /ha	Extent in ha	No of finds	Density/ha
180-190m	0.09	4	44/ha	0.00		
190-200m	0.31	32	103/ha	0.01		
200-210m	0.09	11	122/ha	0.21	2	10/ha
210-220m	0.23	6	26/ha	0.16	2	13/ha
220-230m	0.18	52	289/ha	0.21		0/ha
230-240m	0.30	3	10/ha	0.26	2	8/ha
240-250m	0.39	11	28/ha	0.00		
250-260m	0.75	14	19/ha	0.04	3	75/ha
260-270m	0.37	5	14/ha	0.10	3	30/ha
270-280m	0.07	1	14/ha	0.13	1	8/ha
280-290m	0.03			0.18		0/ha
290-300m				0.23		0/ha
300-310m						
310-320m				0.03		
Total	**2.81**	**139**	**50/ha**	**1.56**	**13**	

12.3 ARTEFACT ASSEMBLAGE

Silcrete was the predominant raw material, followed by indurated mudstone. Petrified wood, quartz and chalcedony were also represented. The igneous/big tool assemblage was quite rare (only c.3% of artefacts compared to c.12% in catchment A). RU pieces were only of indurated mudstone (Table 22). Silcrete flakes were predominant over other pieces of the same material; contrary to the overall trend for the lease.

Only 1 backed piece was recorded; a Bondi point from site AB3 (ie. within the AB confluence). This one artefact represents c.0.7% of the artefact assemblage; lower than the 1.3% recorded for the lease overall. Site B29 had 2 elongate flakes, one with a focal platform and blade ridges on the dorsal surface, and another flake had a faceted platform and blade scars on the dorsal surface; suggesting an additional element of Bondaian technology.

Table 22: Artefact assemblages from Catchment B and Confluence AB

Artefact types	Silcrete	IM	Petrified wood	Quartz	Other FGS	Igneous & Qzite	Total
Pebble tool						1	1
RU piece		4		1			5
Backed piece	1						1
Core	10	5		2		2	19
Flake	35	16	4	1	1	1	58
Piece	19	6	36	4			65
Not recorded	2	1					3
Total	**67**	**32**	**40**	**8**	**1**	**4**	**152**

Site B29 included (what appears to have been) a petrified wood heat treatment and knapping feature. Petrified wood pieces, including heat shatters and "pot-lid" shatters, were eroding from a cluster 40x40cm in diameter. Additional petrified wood pieces and flakes were scattered within 1m of the feature. In all 36 petrified wood artefacts were recorded, most being <3cm long. Eight silcrete and 2 indurated mudstone artefacts were also found. Ground exposure at this site was limited, and the site is likely to be more extensive. The presence of this feature, apparently unique for this raw material, highlights the potential sensitivity of the adjacent wooded area of catchment B.

12.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

The proposed development as currently designed will affect parts of this catchment: the south-west emplacement would affect the upper reaches of the western part of the

catchment, a haul road would be constructed across the centre of the catchment, the Warkworth South open cut pit is located on the western flank of the catchment, and other drainage works and/or settling ponds may be constructed in the area. Artefact locations AB1-AB2, B1-B2, B6-B22, and B33-B36 and the southern end of the area of PAD (potential archaeological deposit) across the confluence of the creek and eastern tributary would be affected. Locations B3-B5, B23-B32, B37-B44 and AB3-8 may be affected, depending on the final design of works.

The following recommendations are made:

1. The locations of B3-B5, B23-B32, B37-B44 and AB3-8 should be avoided if possible. If it is not possible to avoid all these locations and their landscape setting then priority should be given to avoiding impact on B23-B32 and the wooded area within the central area of the catchment (Maps 7 and 9) as this would avoid a suite of known artefact locations within a continuous landscape setting, as well as avoiding a sample of artefacts which are probably present, buried in soils and not yet exposed (area of PAD).
2. If reported artefact locations cannot be avoided then consent to destroy must be obtained from the National Parks and Wildlife Service. Given the sparse nature of the finds, and the extent of past land disturbance it is considered that consent to destroy most finds should not require further archaeological work, except for
   i. Finds B29-B35 and the associated area of woodland PAD (potential archaeological deposit) should be subject to exploratory subsurface investigation (test pitting and/or mechanical scrapes/trenching) to determine the extent/nature of previous ground disturbance, elucidate geomorphological processes, and to identify artefact concentrations suitable for salvage. A range of artefact concentrations should be recovered if present, not just backed blade knapping events.
   ii. Excavation at AB3, being the only reported location with a backed blade in this catchment, should be carried out. Such excavation may be of only limited extent.
   iii. The pebble tool from B41 should be collected.

13.0 CATCHMENT C

13.1 DESCRIPTION

This catchment drains in a south-easterly direction towards the Hunter River. The catchment is about 3km long, from watershed to Hunter flats, and covers about 300 ha. In the north-west part of the catchment elevations reach 270m asl, and drop to 145m asl on the Hunter flat (see Figure 11). The upper reaches of the catchment are typically steep and gullies have eroded out; one to a depth of c.3-4m.

Most of catchment C had been ploughed. Residential development on 2-3ha blocks has developed along Roxburgh Road in the south-east margin of the study area. Only the north-west part of the catchment, possibly a block of land in the south of the catchment, a narrow band along the main drainage, and a narrow strip along a tributary gully may not have been ploughed (see Map 7).

An area of about 50ha, consisting of hillslopes and bluffs in the north-east part of the catchment, were not available for survey (see Map 4).

13.2 ARTEFACT DISTRIBUTION AND DENSITY

All the finds within the eastern part of the catchment (C27-C33) were found in disturbed contexts (eg. ploughed paddocks, contour drains).

Locations C1-C5 and C26 along the main drainage line in the mid-reaches of the catchment occurred in less disturbed contexts; artefacts appeared to be *in situ* at the two silcrete knapping events of C1 and C5. Only 3 artefacts were found between the two knapping events (a distance of c.400m with good exposures). The surface evidence suggests that the two knapping events were isolated phenomenon. The possibility that other cultural features might be present across the valley floor but not exposed was considered but is unlikely given the absence of mappable alluvium here.

The gully along which C6-C11 were found generally had deflated profiles and had been trampled by stock; remnant thicker profiles occurred at C10 and C11. Finds C12-C13 on the hillslope south of the gully, and finds C14-C23 along the adjacent southern gully, appear to have been affected by ploughing and/or trampling (despite the presence of tree

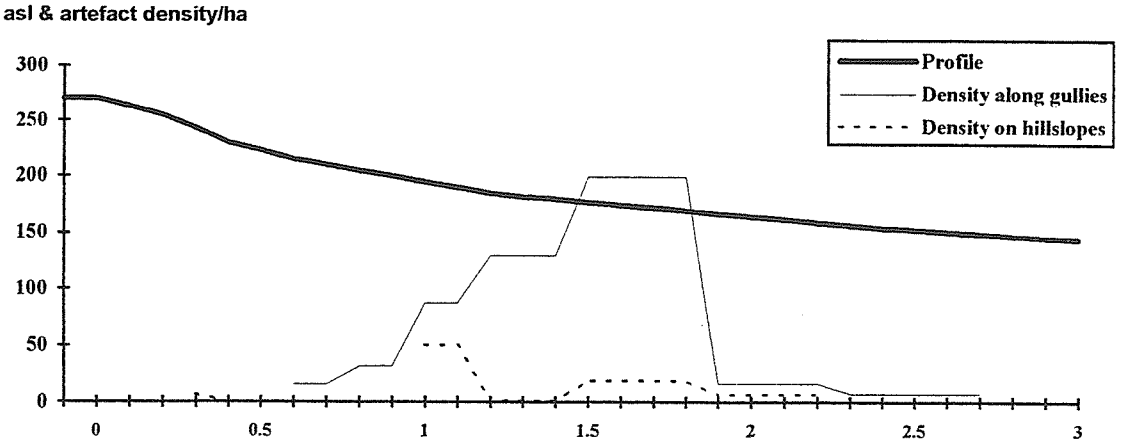
stumps in the vicinity of C20). C24 on the adjacent hillslope occurred in an area of extensive sheet erosion.

Most of the artefact locations had 5 or fewer artefacts. Larger numbers of artefacts occurred only at the two knapping events of C1 and C5, and a disturbed dispersed scatter of silcrete and indurated mudstone artefacts was found at C20. Artefact density was highest within the middle reaches of the catchment, and declined markedly with increasing elevation and with proximity to the Hunter flats (Table 23, Figure 11). Artefact density on hillslopes was generally lower than along gullies, and variable, suggesting an irregular distribution of artefacts.

Table 23: Finds and exposures in catchment C and watersheds (includes B-C and C-D watersheds)

Height asl	Gully & Gully 0.5km from Hunter flats			Hillslopes, ridges & Bluffs 0.5km		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
150-160m	0.13	1	8/ha	0.08		
160-170m	0.06	1	17/ha	0.41	3	7/ha
170-180m	0.08	16	200/ha	0.27	5	19/ha
180-190m	0.10	13	130/ha	0.78	1	1/ha
190-200m	0.32	28	88/ha	0.06	3	50/ha
200-210m	0.28	9	32/ha	0.04		
210-220m	0.31	5	16/ha	0.40	6	15/ha
220-230m				0.13		0/ha
230-240m				0.20		0/ha
240-250m				0.14	1	7/ha
250-260m				0.03		
260-270m				0.02		
Total	**1.28**	**73**	**57/ha**	**2.56**	**19**	**7/ha**

Figure 11: Artefact density in catchment C



13.3 ARTEFACT ASSEMBLAGES

Overall, silcrete was the predominant raw material, followed by indurated mudstone (Table 24). Other raw materials were also present. Cores and flakes of most of the materials were recorded, indicating that occasional knapping to produce flakes took place.

The two knapping events at C1 and C5 accounted for 23 of the silcrete artefacts. At both locations silcrete pieces were predominant over silcrete flakes, in contrast to other locations where in all, silcrete flakes were predominant over silcrete pieces. At both C1 and C5 broken pieces of elongate flakes were recorded; as were whole elongate flakes at C5. The predominance of pieces over flakes at these two knapping events is likely to be a function of the breakage of elongate and other thin flakes during knapping.

Table 24: Artefact assemblage from Catchment C

Artefact types	Silcrete		IM	Quartz	Porcellanite	Igneous	Total
	C1,C5	Others					
RU piece		2	1				3
Core		1	1	1		1	4
Flake	5	13	17	1	1	4	41
Piece	14	10	12	3			39
Not recorded	4	1					5
Total	**23**	**27**	**31**	**5**	**1**	**5**	**92**

In comparison with the knapping events at C1 and C5, the artefact assemblage at site C20 showed little evidence for backed blade production; at C20 the assemblage consisted predominantly of flakes longer than wide in shape.

13.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

The proposed development would destroy all recorded finds in catchment C. Given the generally sparse nature of the finds, and the extent of past land disturbance it is considered that most of catchment C does not warrant further archaeological work. The exceptions are:

1. Locations C1 and C5. Both knapping features should be recovered.
2. To complement that work, finds C6-C11 which appear to have resulted from casual resource use should be mapped and collected.

14.0 CATCHMENT D

14.1 DESCRIPTION

This catchment drained in an east-south-easterly direction towards the Hunter River. The catchment was about 3km long, from the western watershed to the Hunter flats, and covered about 200 ha. In the north-west, elevations reached 270m asl, and dropped to c.150m asl on the Hunter flat (see Figure 12). The upper reaches of the catchment were typically steep and gullies had eroded out; one to a depth of >4m.

Most of catchment D had probably been ploughed; the possible exception being the wooded western upper slopes (see Map 7). An area of c.85ha, consisting of hillslopes, bluffs and a c.600m section of the main drainage line in the south-east part of the catchment, was not available for survey (see Map 4) but appeared much disturbed.

14.2 ARTEFACT DISTRIBUTION AND DENSITY

All finds within the eastern part of the catchment (D10-D24) were found in disturbed contexts (ploughed paddocks, contour drains and recently deposited alluvium), as was D6 in the upper catchment. No features such as knapping events were identified.

Artefact density was low within catchment D, being mostly <4 artefacts/1,000m^2 of exposure. There was a slight tendency for an increase in artefact density towards the central part of the catchment (Table 25, Figure 12). Finds were also very sparse in the less disturbed upper part of the catchment (above c.210m asl), and this area is likely to have always had low artefact density.

14.3 ARTEFACT ASSEMBLAGE

A range of raw materials were recorded, with silcrete being predominant (Table 26). There was little evidence for backed blade production, with only one elongate flake reported. Silcrete flakes were predominant over other pieces of silcrete, indicating that flakes may not have been commonly broken during knapping.

Table 25: Finds and exposures in catchment D & watersheds (includes B-D, C-D & D-E watersheds)

Height asl	Gully & Gully 0.5km from Hunter flats			Hillslopes, ridges & Bluffs 0.5km		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
160-170m	0.40	12	30/ha	0.21	1	5/ha
170-180m	0.34	9	27/ha	0.20	3	15/ha
180-190m	0.24	17	71/ha	0.27		0/ha
190-200m	0.18	3	17/ha	0.64	1	2/ha
200-210m	0.13	4	31/ha	0.39	3	8/ha
210-220m	0.09	1	11/ha	0.17		0/ha
220-230m	0.10	2	20/ha	0.08		
230-240m	0.04			0.06		
240-250m	0.02			0.05	1	20/ha
250-260m	0.01			0.03		
260-270m	0			0.12	3	25/ha
Total	**1.55**	**48**	**31/ha**	**2.22**	**12**	**5/ha**

Figure 12: Artefact density in catchment D

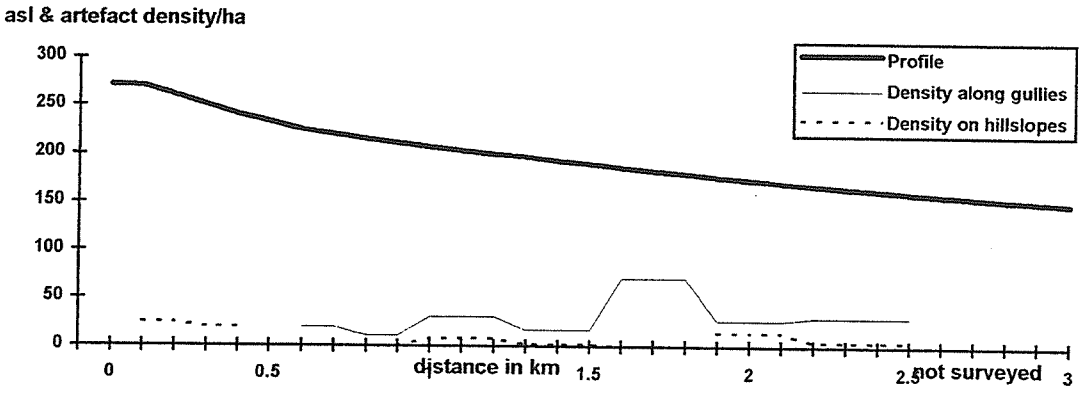


Table 26: Artefact assemblage from Catchment D

Artefact types	Silcrete	IM	Quartz	Other FGS	Igneous	Total
Axe					1	1
RU piece	4	2				6
Core	1	2	1		2	6
Flake	15	3		1	2	21
Piece	12	4	4	2	2	24
Not recorded		1			1	2
Total	**32**	**12**	**5**	**3**	**8**	**60**

14.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

The proposed development would destroy all recorded finds within catchment D. Given the very sparse distribution of finds and the extent of past land disturbance, catchment D does not warrant further archaeological work except:

1. Find D1, being one of only three stone axes found in the lease, should be collected.

15.0 CATCHMENT E

15.1 DESCRIPTION

This catchment drained in an easterly direction towards the Hunter River. The catchment was nearly 4km long and covered about 470 hectares. In the west, elevations reached c.300m asl and dropped to 150m on the Hunter flats (see Figure 13). The upper reaches of the catchment were typically steep, with some deep erosion along the mid-reaches.

Much of catchment E had probably been ploughed, but an area in the middle-upper reaches of the catchment supported a regenerating woodland. This area appears to have been less intensively disturbed, at least in recent times.

15.2 ARTEFACT DISTRIBUTION AND DENSITY

All but one of the recorded artefact locations had 10 artefacts or fewer, and the majority had only one find. However, a number of the artefact locations were likely to be more extensive and contain more artefacts than indicated by surface recording; including sites E2, E4 and E6-13 within the woodland area. A discontinuous scatter of artefacts, in disturbed contexts, also appeared to extend across hillslopes low down in the catchment.

Location E4, relatively high in the catchment at 220m asl, had the largest recorded assemblage within the catchment, and items included debitage <1cm in size, cores, a flake with retouch and/or usewear, and two igneous pebble tools. Knapping of silcrete, indurated mudstone and igneous materials appear to have been carried out, along with other activities. Location E12 had a petrified wood knapping event.

Sites and finds within the eastern half of the catchment (E18-E39) appeared to have been disturbed and/or dispersed by previous land use. Notable in this regard was E22 at which a cream-coloured indurated mudstone (possibly porcellanite) knapping event appeared to have been dispersed over a distance of at least 10m. Other notable finds in this part of the catchment included an edge-ground pebble axe at E33. Other flakes with retouched/used edges were also found.

On the whole, artefact density within the lower part of the catchment was similar on both hillslopes and along gullies (Table 27, Figure 13). This confirmed impressions, formed during the field work, of a preference for site locations on lower footslopes above the main

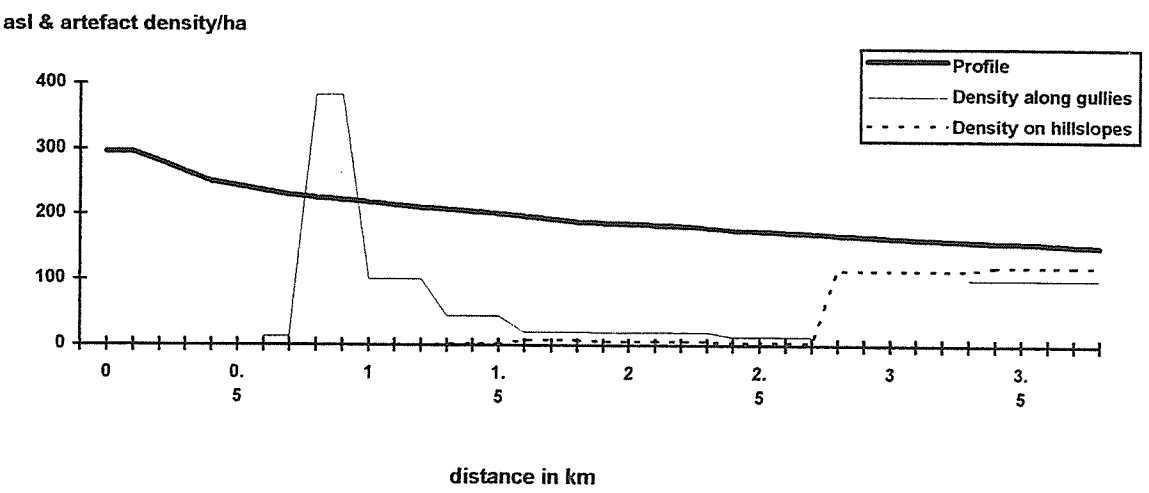
drainage line near its confluence with the Hunter flats. This area may have been a focal area for occupation; but sites were in poor physical condition.

Above 170m asl artefact density declined markedly, until c.210-230m when there was a sharp increase in artefact density along the main drainage line. This latter increase in density coincided with the recording of artefacts at sites E2 and E4, on the western margin of the woodland area.

Table 27: Finds and exposures in catchment E (includes B-E, D-E, E-F & E-H watersheds)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
150-160m	0.12	12	100/ha	0.05	6	120/ha
160-170m	0.10			0.14	16	114/ha
170-180m	0.08	1	13/ha	0.25	1	4/ha
180-190m	0.26	5	19/ha	0.67	4	6/ha
190-200m	0.80	17	21/ha	0.77	6	8/ha
200-210m	0.31	14	45/ha	0.52	1	2/ha
210-220m	0.05	5	100/ha	0.28		0/ha
220-230m	0.12	46	383/ha	0.25		0/ha
230-240m	0.56	7	13/ha	0.13		0/ha
240-250m	0.02			0.07		
250-260m						
260-270						
270-280m				0.06		
Total	**2.42**	**107**	**50/ha**	**3.19**	**34**	**11/ha**

Figure 13: Artefact density in catchment E



15.3 ARTEFACT ASSEMBLAGES

A range of raw materials were recorded, of which silcrete was predominant (Table 28). An axe and 2 pebble tools were recorded, and RU pieces were equally of silcrete, indurated

mudstone and igneous materials. Silcrete pieces were predominant over silcrete flakes, while indurated mudstone flakes were predominant over indurated mudstone pieces; in keeping with the overall pattern within the lease. Apart from the petrified wood knapping event there was little evidence of backed blade production (elongate flakes were rare in the recorded assemblages - c.4%).

The upper-mid-reaches of catchment E appeared to be sufficiently undisturbed and with potential to be able to provide good numbers of artefacts for comparison with knapping events found along lower drainage lines.

Table 28: Artefact assemblage from catchment E

Artefact types	Silcrete	IM	Quartz	Other FGS	Igneous	Total
Axe					1	1
Pebble tool					2	2
RU piece	3	4			3	10
Core	10	4	2	2	7	25
Flake	19	26	2	2	5	54
Piece	28	12	1	5		46
Not recorded	3					3
Total	**63**	**46**	**5**	**9**	**18**	**141**

15.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

The proposed development would destroy all finds recorded within catchment E, with the possible exception of E32 and E33. Given the extent of past land disturbance most of this catchment does not warrant further archaeological work, except for the woodland western reaches of the catchment. Although this part of the catchment appears to have been cleared of its original timber, and there is evidence of former erosion, surface indications suggest that relatively intact deposit has survived. Notably, this appears to be the most intact part of the four eastern-draining catchments within the study area.

It is recommended that:

1. Consent to destroy finds within catchment E should be issued subject to archaeological salvage, being:
   i. Archaeological investigations at locations E2-E12 generally including surface collection, geomorphological investigations, exploratory excavation, and salvage excavation as appropriate.
   ii. The axe at E33 should be collected, if likely to be affected by works.

16.0 CATCHMENT F

16.1 DESCRIPTION

This is one of the smaller catchments in the study area, being only c.2km long and covering c.160 hectares. It drains in an east-south-easterly direction towards the Hunter River. The maximum elevation on the western watershed is only 230m asl, and it drops to c.155m asl on the Hunter flats (see Figure 14). The mouth of catchment F is only some 200m or so from the present channel of the Hunter River. Gravels occur on the northern ridge top, but do not contain much in the way of artefact-quality raw materials.

Catchment F had been heavily disturbed by previous land use. The entire catchment had probably been ploughed; with the possible exception of very narrow strips along the bank of the main drainage line at locations F6-F8 and F14. An area of about 6ha on a hillslope and ridge in the north-east part of the catchment was not available for survey. Air photos show that this area has been cultivated.

16.2 ARTEFACT DISTRIBUTION AND DENSITY

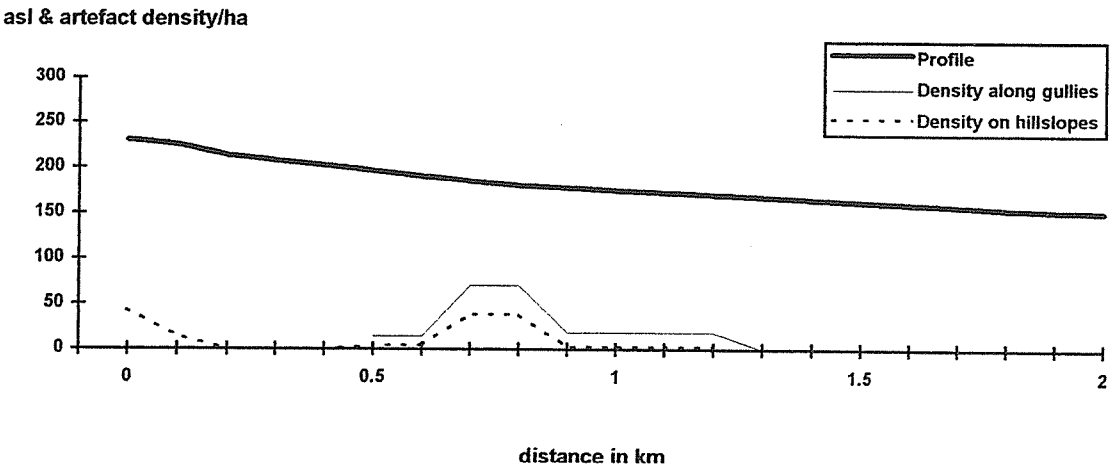
Thirteen of the seventeen recorded artefact locations had only 1 find each, and all but one location had fewer than five artefacts. A complex of finds (F6-F14) occurred along the upper-middle reaches of the main drainage line, possibly eroding from a remnant band of unploughed soils flanking the sides of the gully. However, artefacts had been dispersed by erosion and trampling. The most substantial site was F8 at which 8 artefacts were recorded, including indurated mudstone and silcrete cores. A flaked igneous pebble tool was found at F14.

Table 29: Finds and exposures in catchment F (includes E-F & F-H watersheds)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
160-170m	0.11		0/ha			
170-180m	0.21	4	19/ha	0.37	1	3/ha
180-190m	0.20	14	70/ha	0.08	3	38/ha
190-200m	0.43	6	14/ha	0.56	2	4/ha
200-210m				0.08		
210-220m				0.13		
220-230m				0.13	2	15/ha
230-240m				0.07	3	43/ha
Total	**0.95**	**24**	**25/ha**	**3.19**	**11**	**11/ha**

Artefact density within catchment F was low; a somewhat unexpected result given the proximity of the Hunter River. This may be a direct function of the paucity of exposure on hillslopes/ footslopes below c.170m asl. The spur between the two arms of catchment F, which slopes towards the Hunter River may have been quite a good camping spot, but at the time of the survey no ground exposures were found here. This location is likely to have artefacts present. However, as this area has been cultivated it is considered that archaeological investigation is not warranted.

Figure 14: Artefact density in catchment F



16.3 ARTEFACT ASSEMBLAGES

Silcrete was the predominant raw material, making up more than half the artefacts (Table 30). A range of artefact types were recorded, but no evidence of backed blade production was noted.

Table 30: Artefact assemblage from catchment F

Artefact types	Silcrete	IM	Igneous/Qzite	Total
Pebble tool			1	1
RU piece		1		1
Core	1	2		3
Flake	9	2	3	14
Piece	10	4	2	16
Total	**20**	**9**	**6**	**35**

16.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

All finds except F1-F3 would be destroyed. However, it is considered that catchment F is too disturbed to warrant further archaeological work; except that the pebble tool at F14 should be collected.

17.0 CATCHMENT G

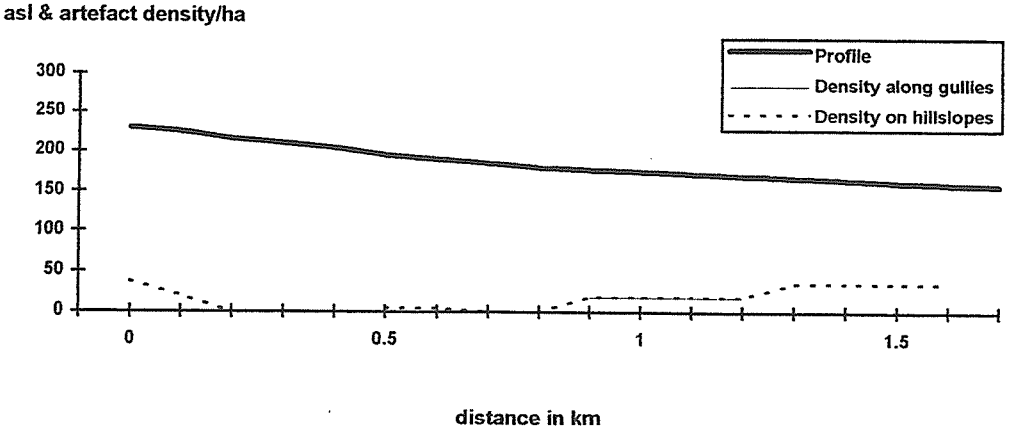
This was the smallest catchment in the study area, being only c.2km long and covering only c.150ha. It drained in a north-easterly direction towards the Hunter River. The maximum elevation on the western watershed was only 230m asl, and it dropped to <160m asl on the Hunter flats (see Figure 15). Catchment G has been heavily disturbed by previous land use; the entire catchment has probably been ploughed. No intact artefact-bearing soil profiles were recorded. An area of about 11ha on a hillslope in the north-east part of the catchment was not available for survey. Air photos show that this area had been ploughed.

Artefact density within catchment G was relatively low; and similar to catchment F. Most of the artefacts were found on hillslopes; hardly surprising as most of the exposure occurred on hillslopes (Table 31). Artefact density tended to be higher on lower hillslopes than higher hillslopes, with 4 artefacts on the F-G watershed.

Table 31: Finds and exposures in catchment G (includes F-G & G-H watersheds)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
160-170m				0.14	5	36/ha
170-180m	0.11	2	18/ha	0.26	5	19/ha
180-190m	0.01			0.13		0/ha
190-200m				0.39	2	5/ha
200-210m				0.07		
210-220m				0.67		0/ha
220-230m				0.05	1	20/ha
> 230m				0.08	3	38/ha
Total	**0.12**	**2**	**25/ha**	**1.79**	**16**	**9/ha**

Figure 15: Profile through catchment G, and artefact density



All finds occurred in disturbed contexts (see Appendix B8), and most consisted of pieces of debitage (as opposed to cores or tools) (Table 32).

Table 32: Artefact assemblage from catchment G

Artefact types	Silcrete	IM	Quartz	Total
Flake	4			4
Piece	8	4	2	14
Total	**12**	**4**	**2**	**18**

DEVELOPMENT IMPACT & RECOMMENDATIONS

All finds within catchment G (ie. G1-G8) would not be affected by current development design. FG1-FG3 on the catchment watershed may be affected. Given the extent of past disturbance it is considered that consent to destroy FG1-3 should be issued without further archaeological work, if they are to be affected by works.

18.0 CATCHMENT H

18.1 DESCRIPTION

This catchment drained in a north-north-easterly direction towards the Hunter flats. The catchment had two drainage lines, one longer than the other, which joined on the northern border of the study area. The catchment was c.3km long and covered under 300 hectares. The maximum elevation on the western watershed was 250m asl, and the lowest elevation was 165m just beyond the confluence of the two drainage lines (Figure 16).

Most of catchment H appeared to have been ploughed, with the possible exception of a lightly timbered area near the confluence of the two arms of the catchment. Scattered trees higher up the catchment appeared to have regenerated since previous clearing.

18.2 ARTEFACT DISTRIBUTION AND DENSITY

There was relatively little ground exposure within catchment H; just 0.4ha total. With ground exposure recorded on the catchment watersheds included, only 0.7% of the catchment was effectively surveyed. The paucity of finds recorded from this catchment (only 30 from 14 locations) was likely to be due more to the near-absence of ground exposure along gullies than indicating a "real" paucity of finds.

Virtually nothing is known of artefact distribution along the drainage lines higher in the catchment. Site and exposure data suggest that artefact densities within the lower parts of catchment H, both along the drainage lines and on lower hillslopes, may have been quite high (Table 33, Figure 16). Site H6, at which 9 artefacts in a 3x3m area were found at an ants nest, is located within the catchment of the two drainage lines and within the (possibly) less disturbed area. During the survey an area surrounding and including H6 was identified as a PAD (potential archaeological deposit). Given the landscape attributes of the area (north-east aspect, gully confluence) it is considered that subsurface investigation should be carried out to assess the archaeological nature of the area and the likely impact of past land use.

18.3 ARTEFACT ASSEMBLAGE

As elsewhere, silcrete was the predominant raw material. However, little can be said of the artefact assemblage due to the small number of recorded items (Table 34).

Table 33: Finds and exposures in catchment H (includes E-H, F-H, G-H & H-I watersheds)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
170-180m	0.02	9	450/ha	0.01	4	400/ha
180-190m	0.11	12	109/ha	0.14	1	7/ha
190-200m				0.13	2	15/ha
200-210m				0.18	1	6/ha
210-220m	0.05			0.98		0/ha
220-230m	0.02			0.05		
230-240m	0.002	1	±100/ha	0.05		
240-250m				0.07		
Total	**0.20**	**22**	**110/ha**	**1.61**	**8**	**5/ha**

Figure 16: Artefact density in catchment H

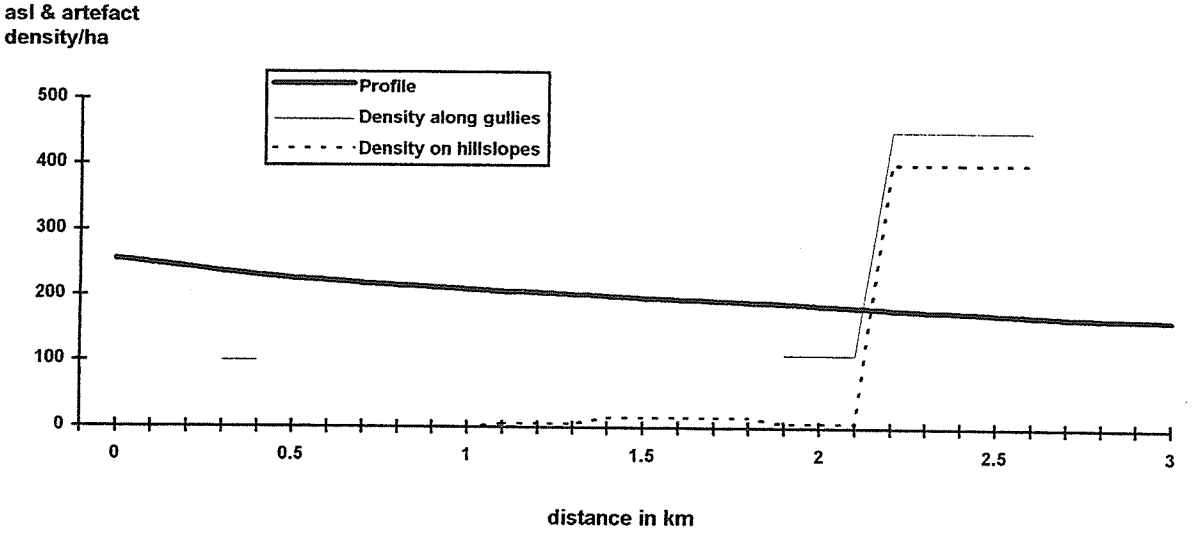


Table 34: Artefact assemblage from catchment H

Artefact types	Silcrete	IM	Igneous	Total
RU piece	2	1		3
Core	1			1
Flake	6	5	1	12
Piece	8	6		14
Total	**17**	**12**	**1**	**30**

18.4 DEVELOPMENT IMPACT & RECOMMENDATIONS

Most of catchment H would be destroyed by the proposed development. There is no reason to think that archaeological material does not occur, with varying densities, across the entire catchment. While little is known of the distribution or nature of sites within this

area it is considered that most of the catchment is too disturbed to warrant further investigation.

The following recommendations are made:

1. Consent to destroy artefacts within catchment H should be issued subject to archaeological investigations at H6 and its vicinity. These investigations should include exploratory subsurface investigations (e.g. test pitting, mechanical excavation/scrape) with more controlled excavation as appropriate.

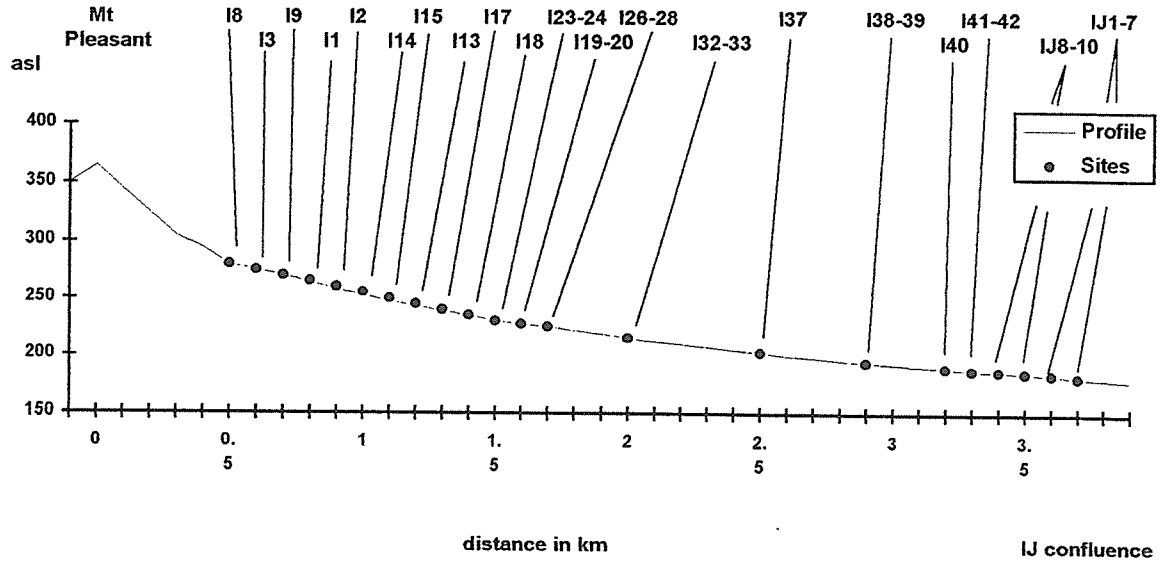
19.0 CATCHMENT I

19.1 DESCRIPTION

This is one of the larger catchments within the study area; covering c.400ha. Catchment I drained in a north-north-easterly direction, and the confluence of catchments I and J (J being to the immediate west) is just within the northern boundary of the study area. Catchment I varied considerably in elevation, from c.365m at Mt Pleasant, to <180m on the northern boundary of the confluence (see Figure 17). The upper reaches of the catchment were typically steep.

Much of catchment I had probably been ploughed, and it appears that a woodland vegetation was allowed to regenerate in various places. Some parts of the catchment were recently cultivated. Unploughed locations appeared to include location I41 low down in the catchment, possibly I37, I19 and adjacent confluence and flanking banks upstream to location I4, possibly the hillslope south of site I5, and possibly location I1.

Figure 17: Profile through catchment I



19.2 ARTEFACT DISTRIBUTION AND DENSITY

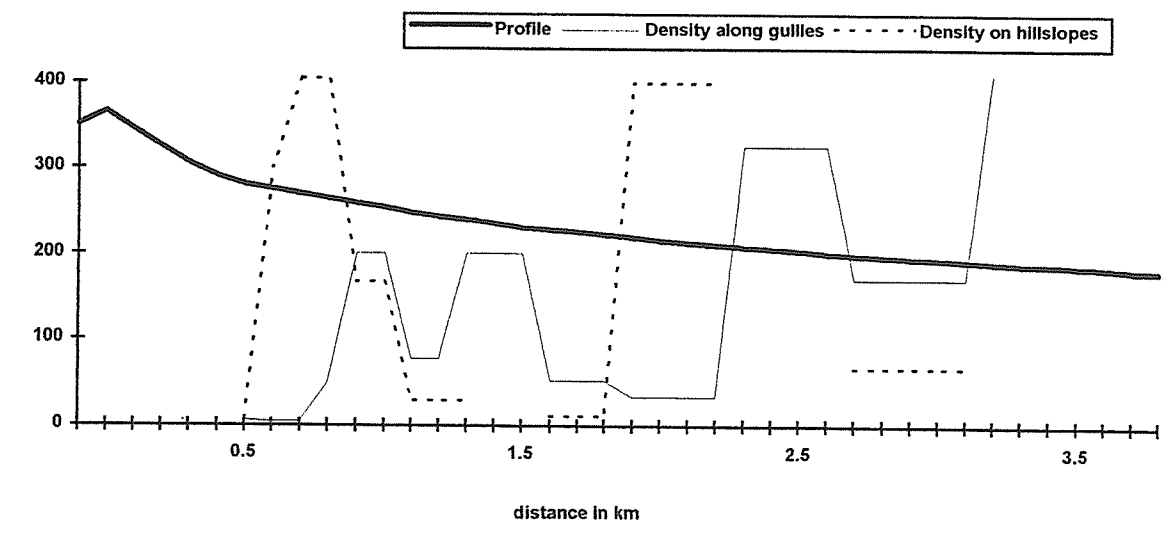
Artefacts were recorded along most of the catchment; the paucity of artefact locations near I37 probably being due to a paucity of ground exposure in that part of the catchment.

Artefact density varied considerably along the catchment, with an overall decline in artefact density along gullies with increasing elevation (Table 35, Figure 18). Artefact density varied considerably on hillslopes, with highest densities occurring c.210-220m asl and c.250-280m asl. Very high elevations in the catchment (above c.320m asl) on the slopes of Mt Pleasant had no finds. A picture of the distribution of finds on hillslopes at lower elevations (below 220m asl) may be obscured by scant ground exposure.

Table 35: Finds and exposures in catchment I (includes B-I, H-I & I-J watersheds & I-J confluence)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
180-190m	0.15	170	1,133/ha			
190-200m	0.10	17	170/ha	0.03	2	67/ha
200-210m	0.08	26	325/ha	0.01		
210-220m	0.64	21	33/ha	0.01	4	400/ha
220-230m	0.23	12	52/ha	0.27	3	11/ha
230-240m	0.31	62	200/ha	0.07		
240-250m	0.13	10	77/ha	0.14	4	29/ha
250-260m	0.08	16	200/ha	0.12	20	167/ha
260-270m	0.10	5	50/ha	0.01	6	>400/ha
270-280m	0.24	1	4/ha	0.01	3	300/ha
280-290m	0.16	1	6/ha	0.18	1	6/ha
290-300m	0.02			0.24		0/ha
300-310m	0.02			0.01		
310-320m				0.04		
320-330m				0.36		0/ha
330-340m				0.24		0/ha
340-350m				0.03		
350-360m				0.01		
Total	**2.26**	**341**	**151/ha**	**1.78**	**43**	**24/ha**

Figure 18: Artefact density in catchment I & IJ confluence



19.3 RECORDED ARTEFACT LOCATIONS

Forty-three artefact locations were recorded within catchment I, one was recorded on the watershed between catchments H and I, and 10 were recorded within the I-J confluence. Most of the artefact locations are likely to have more artefacts and be more extensive than indicated by the surface recordings.

Locations I1-I3 in the upper catchment may be a single complex of finds amongst a regenerating woodland, with signs of some ground disturbance.

Locations I4 and I17-I27 are probably part of a single complex of finds, possibly not ploughed, extending along the banks of the main drainage line, a tributary gully and around the confluence of those two streams. This area has been cleared in the past, but occasional large trees and some tree stumps indicate limited ploughing (if at all). Beyond this complex of finds, the gully banks and flanking hillslopes have been ploughed.

Locations I38-I42 are likely to form another complex of finds, and may be more-or-less continuous with IJ1-IJ9 around the confluence to the immediate north. Locations I38-I42 have an adjacent vegetated area of PAD. The I-J confluence appears to have a single discontinuous scatter of artefacts over a distance of at least 800m with some recognisable knapping events. However, much of the confluence may have been ploughed.

19.4 ARTEFACT ASSEMBLAGES

The artefact assemblages from catchment I and the IJ confluence encompass almost the full range of variability in the lease, both in the range of raw materials and in the range of artefact types. The only items not recorded were axes (Table 33).

Table 36: Artefact assemblages from catchment I and IJ confluence

Artefact types	Silcrete	IM	Quartz	Other FGS	Igneous/ Qzite	Total	%
Pebble tool					2	**2**	*0.5%*
RU piece	9	11	1	1	2	**24**	*6.3%*
Backed piece	5	5				**10**	*2.6%*
Core	12	6		1	1	**20**	*5.2%*
Bipolar	1	2	2			**5**	*1.3%*
Flake	68	52	2		7	**129**	*33.6%*
Piece	119	52	10	4	1	**186**	*48.4%*
Not recorded	6	1	1			**8**	*2.1%*
Total	**220**	**129**	**16**	**6**	**13**	**384**	
%	***57.3%***	***33.6%***	***4.2%***	***1.6%***	***3.4%***		***100%***

The artefact assemblages showed some variation at different levels of the catchment (Table 37). The frequency of backed pieces was higher in the IJ confluence than overall (4.3% compared to 2.6% and 1.2% for the lease as a whole), and occurred irregularly higher upstream. The frequency of RU pieces increased consistently with increasing height in the catchment. Pieces were strongly predominant over flakes within the lower part of the catchment, and flakes were almost equal to or predominant over pieces in the upper part of the catchment. In the middle-upper part of the catchment indurated mudstone was predominant over silcrete, and the highest frequencies of igneous/quartzite materials were also recorded there.

Table 37: Artefact assemblages along catchment I & IJ confluence (gullies only)

asl	Locations	Artefact types	Silc.	IM	Quartz	Other FGS	Ign/ Qzite	Total	*% each section*
180-190m	I-J confluence IJ1-IJ10	Pebble tool							*0%*
		RU piece	1			1		**2**	*1.2%*
		Backed piece	4	3				**7**	*4.3%*
		Core	3	3				**6**	*3.7%*
		Bipolar	1	1				**2**	*1.2%*
		Flake	38	18	1			**57**	*35.2%*
		Piece	59	23	3	3		**88**	*54.3%*
		Not recorded	6	1	1			**8**	
		Total *% section*	**112** *65.9%*	**49** *28.8%*	**5** *2.9%*	**4** *2.4%*	**0**	**170**	*100%*
190-220m	I32-I35 I37-I42	Pebble tool					1	**1**	*1.6%*
		RU piece	2					**2**	*3.1%*
		Backed piece							
		Core	2	2		1		**5**	*9.4%*
		Bipolar							
		Flake	8	8				**16**	*25.0%*
		Piece	22	14	3		1	**40**	*62.5%*
		Total *% section*	**34** *53.1%*	**24** *37.5%*	**3** *4.7%*	**1** *1.6%*	**2** *3.1%*	**64**	*100%*
230-240m	I4, I7 I18-I28	Pebble tool					1	**1**	*1.4%*
		RU piece	3	6	1		1	**11**	*14.9%*
		Backed piece		2				**2**	*2.7%*
		Core	3					**3**	*4.1%*
		Bipolar		1	2			**3**	*4.1%*
		Flake	12	21	1		4	**38**	*51.4%*
		Piece	6	9	1			**16**	*21.6%*
		Total *% section*	**24** *32.4%*	**39** *52.7%*	**5** *6.8%*	**0**	**6** *8.1%*	**74**	*100%*
240-290m	I1, I6 I8-I9 I13-I15 I17	Pebble tool							
		RU piece	2	4			1	**7**	*21.2%*
		Backed piece	1					**1**	*3.0%*
		Core	2	1				**3**	*9.1%*
		Bipolar							
		Flake	6	4				**10**	*30.3%*
		Piece	6	4	1	1		**12**	*36.4%*
		Total *% section*	**17** *51.5%*	**13** *39.4%*	**1** *3.0%*	**1** *3.0%*	**1** *3.0%*	**33**	*100%*

The variations in artefact assemblages along the catchment suggest there was variation in activities along the drainage line. Backed pieces were discarded with irregular frequency along most sections of the catchment, but backed blade production was probably concentrated within the lower parts of the catchment. Activities involving discard of artefacts with retouched and/or used edges occurred with increasing frequency higher in the catchment.

19.5 CONCLUSIONS

Catchment I (and catchment J see below) had the highest artefact density within the study area. Artefacts were found at all elevations (subject to the presence of suitable ground exposure) below c.285m asl. Generally, artefact density declined along gullies with increasing elevation, but relatively high surface densities (>100/ha) were found to c.260m asl on hillslopes. Artefact assemblages indicate some variation in activities along the drainage line; with backed blade production occurring lower down the catchment, and other tools being discarded more frequently higher in the catchment.

While much of the catchment has been ploughed some areas appear to have survived without such disturbance. Three areas in particular have good archaeological potential. These are the complex of finds I4 and I17-I27 along the main drainage line and an associated tributary gully, and sites I37-I39 and I40-I42 low down in the catchment. The potential of sites I1-I3 will be affected by the extent of past land disturbance.

19.6 DEVELOPMENT IMPACT & RECOMMENDATIONS

All recorded finds in catchment I would be affected by the proposed development. It is recommended that:

1. Archaeological investigations should be carried out at locations I4 and I17-27, and lower down the catchment at locations I38-I42 and in the associated vegetated PAD. These investigations should include surface collection, geomorphological investigations, exploratory excavation, and salvage excavation as appropriate.
2. Surface collection and exploratory investigation (eg. mechanical stripping) should be carried out across the I-J confluence, and between locations I1-I3, to determine the

extent of past land disturbance. Appropriate salvage (including a no-salvage option) should be carried out, based on the results of those explorations.

3. Artefacts at I14, including a backed piece, should be collected as reference material, given its relatively high location.
4. The pebble tool at I33 should be collected.
5. No further archaeological work should be required within the remainder of the catchment.

20.0 CATCHMENT J

20.1 DESCRIPTION

Only part of this catchment fell within the study area (c.250 ha). It drained in a north-north-easterly direction to join with catchment I just within the northern boundary of the study area. Catchment J varied in elevation from c.335m asl to <180m at the confluence with stream I. A shorter, but substantial tributary, joined the main drainage line within the study area; the confluence between the two includes a gentle footslope with archaeological potential.

Much of catchment J had been ploughed. One relatively large area which appeared to have not been ploughed extended along the main drainage line from about location J19 northwards to J25, and northwards across the confluence of the two arms of the catchment to location J35.

20.2 ARTEFACT DISTRIBUTION AND DENSITY

Artefact density showed an overall decline along gullies with increasing elevation (Table 38, Figure 19). Artefact density varied on hillslopes, but density on hillslopes high in the catchment (250-260m asl) exceeded artefact density along gullies at the same elevation.

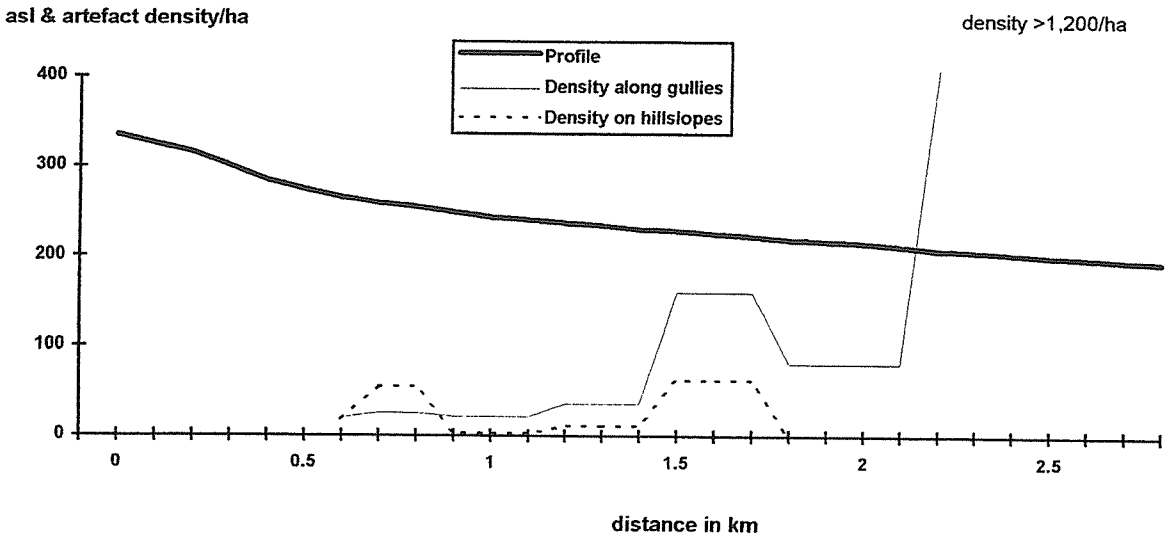
Table 38: Finds and exposures in catchment J (includes I-J watershed)

Height asl	Gullies & gullies 0.5km			Hillslopes, ridges & bluffs		
	Extent in ha	No of finds	Density/ha	Extent in ha	No of finds	Density/ha
200-210m	0.06	74	1233/ha			
210-220m	1.67	139	83/ha	0.31		0/ha
220-230m	0.10	16	160/ha	0.75	47	63/ha
230-240m	0.11	4	36/ha	0.72	8	11/ha
240-250m	0.19	4	21/ha	0.67	2	3/ha
250-260m	0.08	2	25/ha	0.47	26	55/ha
260-270m	0.05	1	20/ha	0.23	4	17/ha
270-280m	0					
280-290m	0.13		0/ha			
290-300m				0.01		
Total	**2.39**	**240**	**100/ha**	**3.16**	**87**	**28/ha**

Some 44 artefact locations were recorded within catchment J (excluding the I-J confluence). The complex of finds occurring across the confluence of the two arms of catchment J were recorded as separate locations (J29-J35) but these are likely to be part of a single (? discontinuous) scatter of artefacts across the confluence. Locations J41-

J44 along the north side of the northern tributary are also likely to have once been a complex of finds (now separated by ploughed paddocks and farm buildings).

Figure 19: Artefact density in catchment J



Most of the artefact locations had only one recorded artefact. The more substantial sites included J4, J26, J33, J35, J36, J42 and J43.

J4 was a fairly sparse site on a hillslope (c.250m asl) above the main drainage line. Eighteen artefacts were recorded, mostly silcrete, and included cores, an RU piece and debitage.

J26, J33, J35 and J36 are part of the complex of finds occurring around the confluence of the two drainage lines. At J26 an RU flake, a pebble tool and debitage was recorded. At J33, 44 artefacts were recorded in an area of 50x50m about 100m from the northern tributary. J35 was recorded along a track between J33 and the tributary. J36 was recorded from around farm buildings east of J35. A substantial number of cores, including blade cores, were recorded at J35; the other two locations also had cores. Other finds included a backed blade, RU flakes and debitage.

J41-J44 appeared to include remnants of knapping floors, geometric and other backed blades, and a pebble tool.

20.3 ARTEFACT ASSEMBLAGE

As with catchment I catchment J had almost the full range of assemblage components occurring within the Mt Pleasant lease (Table 39); except that no axes were recorded. Catchment J had a higher frequency of silcrete artefacts than catchment I - 73% and 57% respectively.

Within catchment J there was some variation between assemblages occurring around the main confluence area and assemblages reported from hillslopes (Table 39). The hillslope assemblage had a lower frequency of silcrete, and higher frequencies of indurated mudstone and quartz. With regard to artefact types the hillslope assemblage had a higher frequency of pebble tools and other RU pieces. On hillslopes flakes outnumbered other pieces, but along gullies around the main confluence area other pieces outnumbered flakes. No backed pieces were recorded from hillslopes, but along gullies around the main confluence area they made up nearly 3% of the assemblage.

Table 39: Artefact assemblages from catchment J

Locations	Artefact types	Silc.	IM	Quartz	Other FGS	Ign/ Qzite	Total	*% each section*
Total assemblage	Pebble tool					4	**4**	*1.2%*
	RU piece	7	7		1	3	**18**	*5.6%*
	Backed piece	3	3				**6**	*1.9%*
	Core	17	6	1			**24**	*7.4%*
	Bipolar	0	0	1			**1**	*0.3%*
	Flake	96	28		2	3	**129**	*39.9%*
	Piece	112	24	1	3	1	**141**	*43.7%*
	Not recorded	1					**1**	
	Total *% total*	**236** *72.8%*	**68** *21.0%*	**3** *0.9%*	**6** *1.9%*	**11** *3.4%*	**324**	*100%*
200-225m asl along gullies	Pebble tool					2	**2**	*0.9%*
	RU piece	4	2			2	**8**	*3.5%*
	Backed piece	3	3				**6**	*2.7%*
	Core	13	5				**18**	*8.0%*
	Bipolar			1			**1**	*0.4%*
	Flake	65	12		1	2	**80**	*35.6%*
	Piece	89	18	1	2		**110**	*48.7%*
	Not recorded	1					**1**	
	Total *% section*	**175** *77.4%*	**40** *17.7%*	**2** *0.9%*	**3** *1.3%*	**6** *2.7%*	**226**	*100%*
on hillslopes only	Pebble tool					2	**2**	*2.3%*
	RU piece	3	5			1	**9**	*10.3%*
	Backed piece							
	Core	4	1	1			**6**	*6.9%*
	Bipolar							
	Flake	27	12		1	1	**41**	*47.1%*
	Piece	21	6		1	1	**29**	*33.3%*
	Total *% section*	**55** *53.1%*	**24** *37.5%*	**1** *4.7%*	**2** *1.6%*	**5** *3.1%*	**87**	*100%*

20.4 CONCLUSIONS

The area of, and surrounding, the confluence of the two arms of catchment J appears to be rich in finds, and may not have been ploughed; although soils are thin and the area has clearly not survived in pristine condition. The area has a relatively high artefact density, and includes a variety of stone artefact assemblages.

The artefact assemblages suggest that a wide range of activities occurred along gullies within the main confluence area, including backed blade production. Artefacts recorded from hillslopes appear to represent a similar range of activities, but without backed blade production.

The vegetated area across the two arms of catchment J appears to have considerable potential for investigating issues in relation to the nature of artefact assemblages along streams vs hillslopes. It would be possible to investigate the immediate stream banks around the confluence, as well as systematically investigate the distribution and nature of archaeological material on the spur within the confluence.

20.5 DEVELOPMENT IMPACT & RECOMMENDATIONS

All of catchment J within the lease would be affected by the proposed development, including the area within the confluence of the two arms of catchment J, considered to have some archaeological potential (see Maps 7 and 9).

It is recommended that:

1. Consent to destroy finds occurring within the effected area should be issued subject to archaeological salvage at locations J22-J35. Archaeological investigations should be carried out along both banks of the southern arm, and across the confluence area towards the northern arm. These investigations should include surface collection, geomorphological investigations, exploratory excavation, and salvage excavation as appropriate.

PART 3: APPENDICES

APPENDIX A:

PLATES

Plate 1: 1995 air photo

Plate 2: Locations A1 and A2, camera facing south. A1 is marked by the black bag (right mid-ground) and artefacts at A2 were found on the dam bank (left mid-ground). Film B frames 1-3.

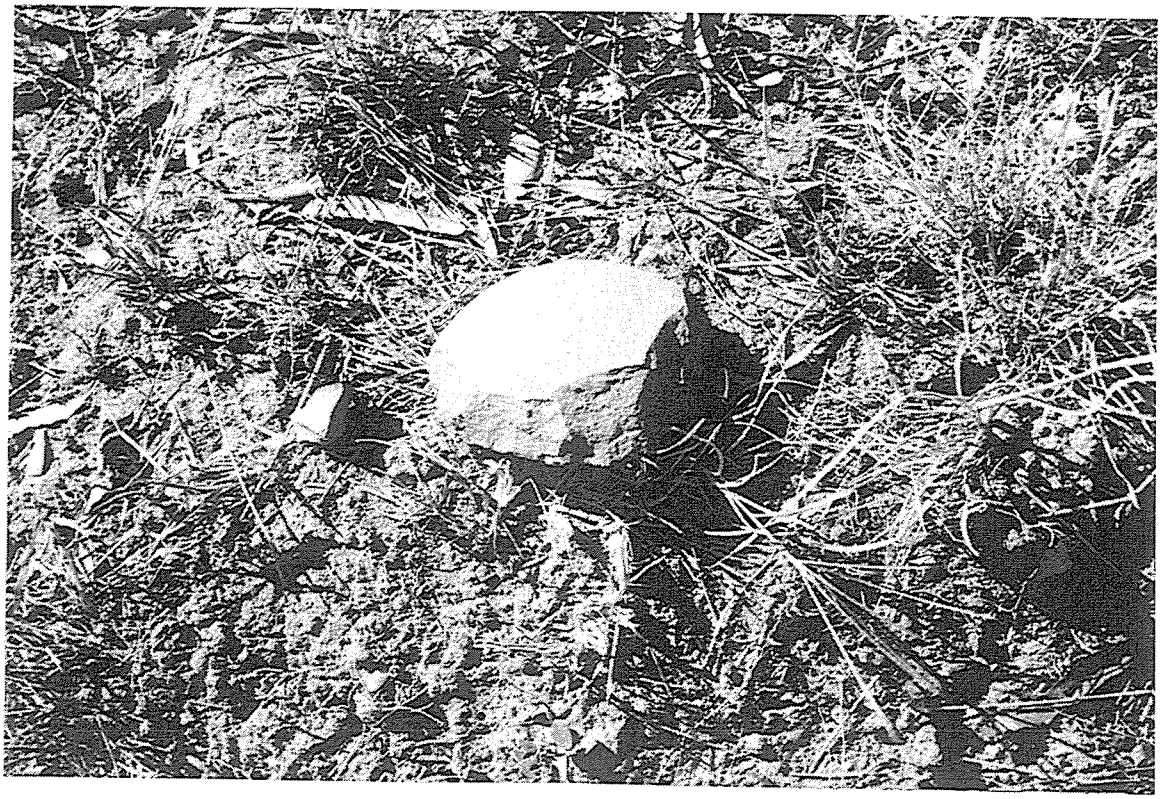


Plate 3: Location A3. Detail of pebble tool. Film B frames 4-6.

Plate 4: Locations A3 and A4. A3 is located on the creek bank in the foreground right side of the photo, and A4 is located in the mid-ground left side of the photo. Camera facing east. Film B frames 7-9.

Plate 5: Location A22. Camera facing south-east. Film I, frames 34-36.

Plate 6: Detail of hammerstone/anvil at A22. Film I, frames 31-33.

Plate 7: Location A33. Camera facing north-east. Film I, frames 28-30.

Plate 8: Location A34. Camera facing south-west, with Bengalla lease in background.
Film I, frames 25-27.

Plate 9: General view over watershed of catchments B and I. Camera facing south-east.
Film A, frames 1A-3A.

Plate 10: Location B21. Camera facing south. Film A, frame 0A.

Plate 11: Location B23. Camera facing west. Film A, frames 4A-6A.

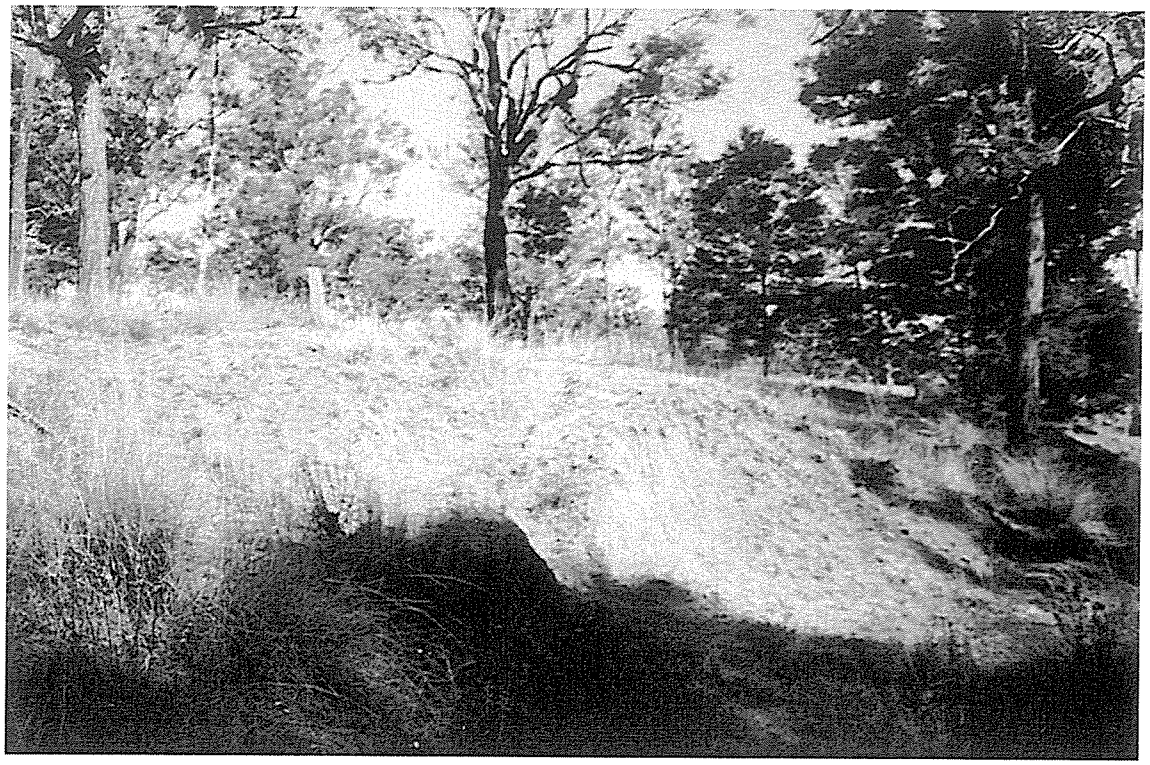


Plate 12: Location B29, camera facing south-east. Film A, frames 7A-9A.

Plate 13: Petrified wood pieces at Location B29. Film A, frames 10A-12A.

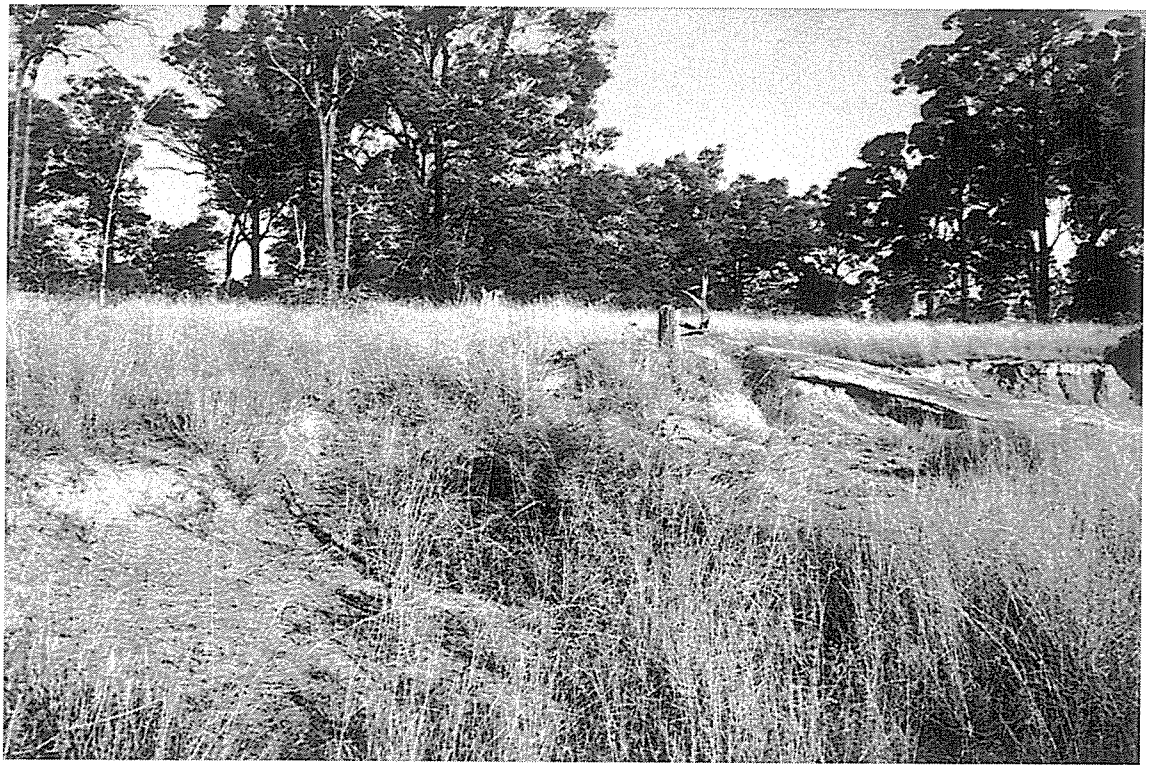


Plate 14: Location B32, camera facing south. Film A, frames 13A-15A.

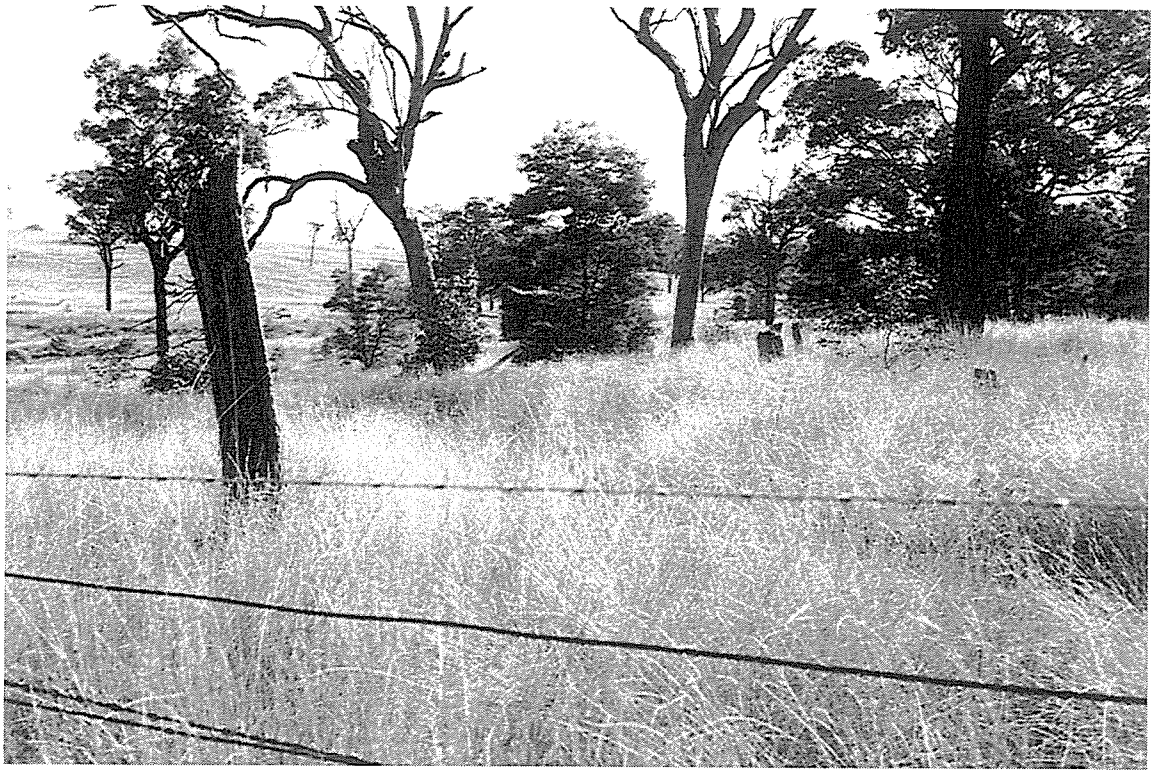


Plate 15: Area of Potential Archaeological Deposit (PAD) north of location B36. Camera facing north. Film H, frames 2-5.