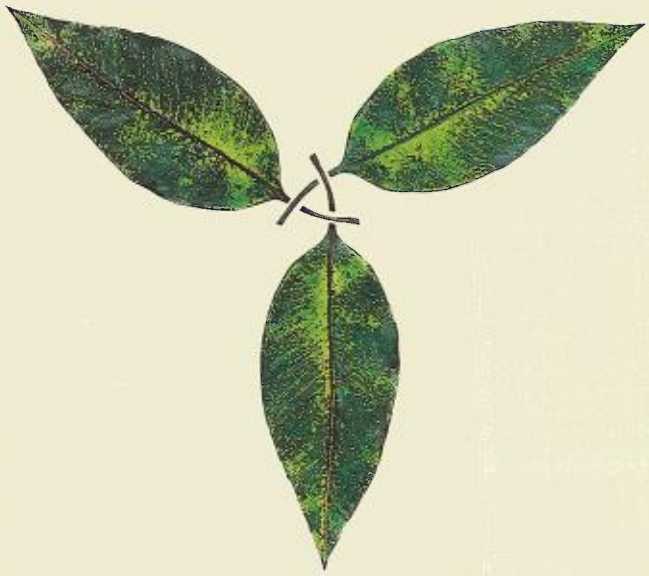
EIS 958

AB019642

Proposed rock crusher and screening plant allied to increased extraction capacity at approved sand and gravel operation : portion 22, Parish of Gungoandra, County Beresford, Shire of Cooma-Monaro : environmental impact statement



MARGULES
GROOME
PÖYRY
PTY LTD

PROPOSED ROCK CRUSHER AND SCREENING PLANT ALLIED TO INCREASED EXTRACTION CAPACITY AT APPROVED SAND AND GRAVEL OPERATION

PORTION 22 PARISH OF GUNGOANDRA COUNTY BERESFORD, SHIRE OF COOMA-MONARO

ENVIRONMENTAL IMPACT STATEMENT

JULY 1992

Prepared by

MARGULES GROOME PÖYRY PTY LTD

in association with

- Willing and Partners Pty Ltd
- Maxine Davis - Will Osbourne
- Navin Officer Archaeological Resource Management
- Mark Eisner and Associates Pty Ltd

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ENVIRONMENTAL IMPACT STATEMENT

July 1992

Prepared on behalf of
AMEY BROS PTY LTD

by

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422034037

Form 4

Environmental Planning and Assessment Act, 1979 (Section 77(3)(d))

ENVIRONMENTAL IMPACT STATEMENT

This Statement has been prepared by or on behalf of Amey Bros Pty Ltd of 19 Carwoola Place, Queanbeyan, being the applicant making the development application referred to below.

This Statement accompanies the development application made in respect of the development described as follows:

Proposed rock crusher and screening plant allied to increased extraction capacity at approved sand and gravel operation

The development application relates to the land described as follows:

Real property description:	**Portion 22** **Parish of Gungoandra County Beresford** **Shire of Cooma-Monaro**

The contents of this Statement, as required by Clause 34 of the Environmental planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

Name, Qualifications and Address of person who prepared Environmental Impact Statement	Jamie Rowland Dawson BLA AAILA 45 Jardine Street KINGSTON ACT 2604

Certificate

I, Jamie Rowland Dawson of 45 Jardine Street, Kingston ACT, hereby certify that I have prepared the contents of this Statement in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

J R Dawson

.....

Signature

31 July 1992

TABLE OF CONTENTS

APPENDICES

TABLES

Following Page

PLATES

FIGURES

SECTION 1 INTRODUCTION

This Environmental Impact Statement (EIS) describes and assesses a proposal by Amey Bros. in association with the landholder C V Povey to:

- continue an approved sand and gravel extraction operation; and
- to operate a rock crusher and screening plant to process a proportion of the materials extracted.

The site is 10 kilometres north of Bredbo and 65 kilometres south of the Canberra GPO (refer Figure 1: Location Plan) and is located on Portion 22 Parish of Gungoandra, County Beresford. The site of both the extraction and processing operations is 1.3 to 2.5 kilometres west of the Monaro Highway (State Highway 19) and adjoins the eastern bank of the Murrumbidgee River.

The proposal is a Designated Development under EPA Regulation - Schedule 3 Items (k) and (n). Therefore, an EIS is required to be prepared and placed on public exhibition prior to submission of the development application to the Cooma-Monaro Shire Council.

Relelvant NSW State Government and Local Government authorities were consulted as part of the EIS process. Those contacted are listed in Appendix A. The EIS addresses specific issues raised during these consultations and incorporates suggested ameliorative measures.

Visitors Information Centre
Caravan Parks
Camping Sites
Youth Hostels
Barbecue Picnic Sites and Toilets
Barbecue Picnic Sites
Toilets T

Fishing Spots
Golf Courses
Swimming Spots
Tracking Stations
Features of Interest
Petrol Sales
Airport

Lookouts
Main Highway, National Route Marker 25
Tourist Roads
Other Roads
Railway
Forest and Scrub
Pine Plantation

FIGURE 1
LOCATION PLAN

MILES 5 0 5 MILES 10
KILOMETRES 5 0 5 10 15 KILOMETRES

Produced by the Division of National Mapping, Department of National Development for the Australian Capital Territory Tourist Bureau, Department of the Interior. 1972.

NMP 70/218

Printed by the Commonwealth Government Printer, Canberra, 1972.

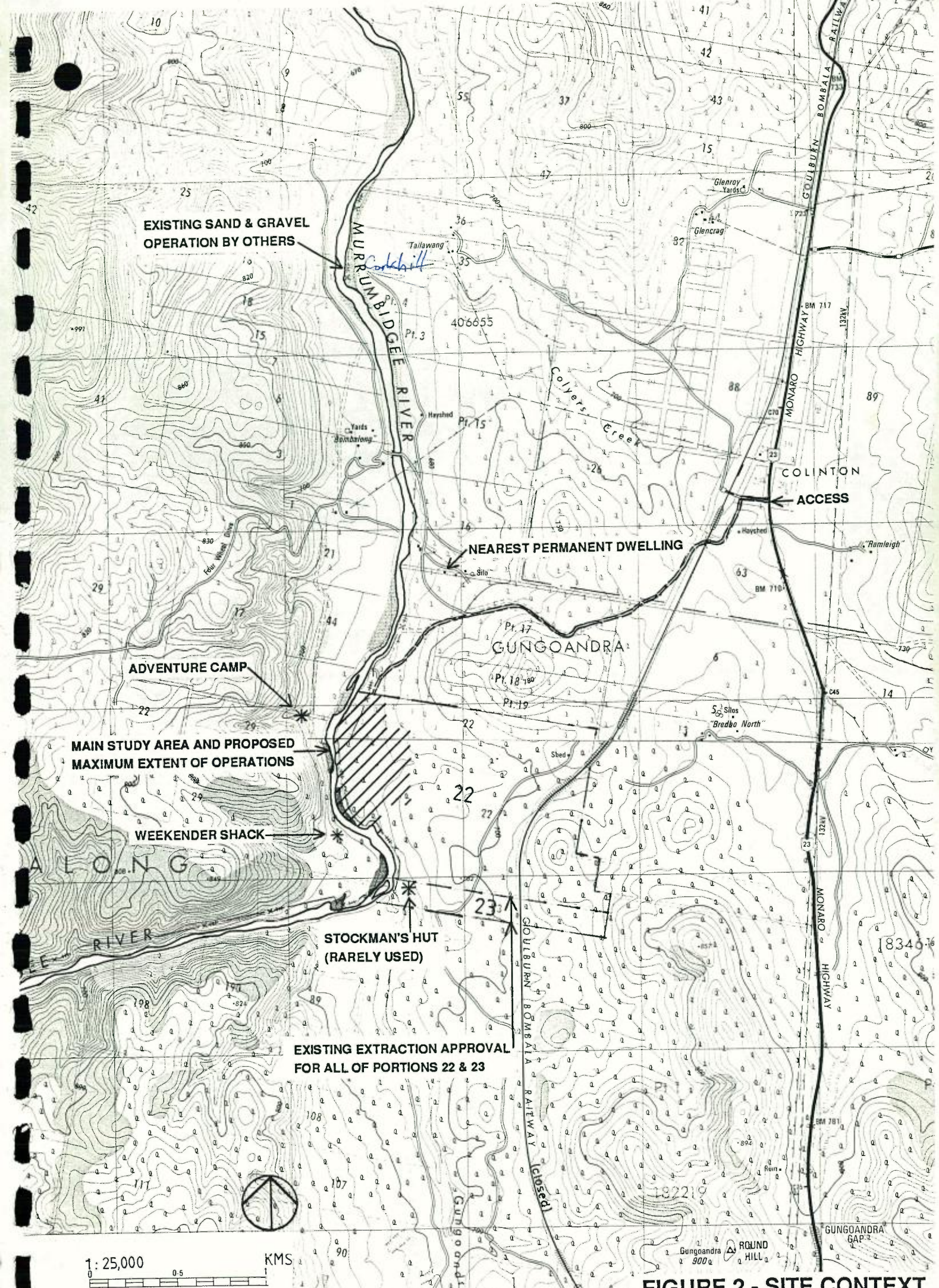
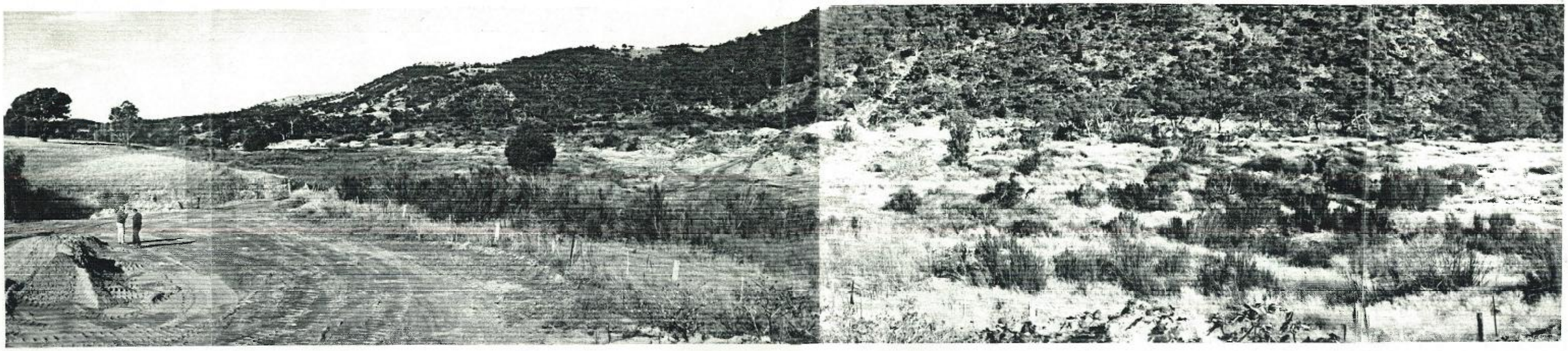


FIGURE 2 - SITE CONTEXT

PLATE 1: The access road immediately north of the site. The gateway (middleground low point) is the northern boundary of the site. The main extraction area can be viewed centre left and the vegetation buffer (woodland) to remain is centre right.

PLATE 2: The current main extraction area with the access road left and in the background the wooded eastern hill to remain. The steep slopes will be undisturbed. The main water quality control pond to be formed in the centre low point.

PLATE 1 & 2 Views of the northern entry and main extraction area



JOINS BELOW LEFT

PLATE 3: View to the south (left) across the previous extraction area to the stockpile area (centre). The Murrumbidgee River is beneath the steep wooded hill in the background.

PLATE 4: View to the north west (middleground left) of the wooded riparian buffer zone to remain. The current main extraction area (centre left background) and main expansion area (centre middleground). The wooded hill to remain is right background. The pasture paddock (right foreground) is the proposed dark sand extraction area. Current stripped area and stockpiles in the foreground.

PLATE 3 & 4 Views (200°) from the dark sand extraction area across the alluvial flats

SECTION 2 BACKGROUND

2.1 Sand and Gravel Extraction in the Region

Demand for sand and gravel associated with urban development in Canberra and Queanbeyan has provided the main impetus for extractive industries in the ACT Sub-region. Materials extracted include sand, natural gravel and crushed rock. In addition, brickmaking clay and shale are also quarried; and topsoil is stripped from a number of sites. In 1990, the estimated annual ACT usage of sand was 640,000 tonnes; and gravel and crushed rock was 910,000 tonnes. (ACT Department of Environment, Land and Planning and NSW Department of Planning Report to NSW-ACT Consultative Forum, October 1990.)

Most sand is used to produce concrete and is obtained from the Lake George area. The coarser river sand (such as from the Colinton pit) is used as bedding sand and as a drainage medium for ovals and playgrounds. Screened river gravel is used in exposed aggregate concreting and for other landscaping purposes. Fine aggregate produced by crushing river gravel and stone is principally used as road base course or for production of concrete.

Sand and gravel have low values per unit weight. Therefore, transport costs typically represent a significant proportion of total delivered costs. This means that the economic viability of a sand and gravel operation is sensitive to transport distance. Within the region, these resources are typically found adjacent to the main rivers and their tributaries. The distance and locational factors combined meant that early operations in the region were conducted within the ACT in close proximity to Canberra, principally along the Murrumbidgee River. However, since 1986/87 all commercially oriented river based extractive operations have been phased out within the ACT. This reflects ACT Government policies precluding such developments within the Murrumbidgee River corridor. Similar controls have since been imposed by the Yarrowlumla Shire Council north of the ACT. This means that the remaining opportunities to develop extractive industries within the region are largely confined to the Murrumbidgee and its tributaries within Cooma-Monaro Shire; and deposits near Lake George at Bungendore. There is also some potential to develop more remote sites along the Shoalhaven to the east of the region. However, the major Hume Highway upgrading between Yass and Goulburn will place considerable demands on pits in this area and also those located further north.

One likely result of these development controls on extractive industries is that haulage distances from pits to service Canberra-Queanbeyan are likely to increase. Therefore, the price of these materials in the Canberra market is likely to increase. This will also affect the cost and availability of these materials in the surrounding towns of Cooma, Goulburn and Yass.

The ACT and Sub-region Planning Committee is currently investigating a more co-ordinated approach to the development and management of extractive industries on a regional basis. These discussions involving the ACT Government and the local Councils are ongoing and there is no fixed timetable for an agreement to be reached.

2.2 Past Land Uses of the Site

Portion 22 has been grazed since the mid 19th century. Sand and gravel extraction commenced in 1974 following the granting of formal Council approval for an extractive operation to remove sand and gravel from Portion 22 and 23 using a front end loader and trucks. This approval remains current (Appendix B). Extraction through the 70's and 80's, principally involved the use of truck and front end loader equipment. The site was originally operated by the Lazarno Bros. with the current operators taking over the site in 1991.

The operation was expanded in January 1992 to include a crusher for processing gravel into course and fine aggregate and a screening plant (10/14/20mm gradings). This was operated without approval for three months. The crushing operation has been stopped and the plant removed pending Council approval of the development application. The need to obtain formal approval to expand the operation has prompted the preparation of this EIS.

2.3 Justification for the Proposal

As discussed in Section 2.1, there is strong demand for these materials in the Sub-region. In addition, the possible alternative sources of supply within an economic haulage distance of this market are becoming limited due to the planning constraints.

These materials are essential materials for use in the building industry and supplies will have to be obtained from sources somewhere within an economic haulage distance of the market. Hence, if one accepts that these materials will be supplied from some location within the Sub-region then it becomes an issue of whether a proposed site can be operated economically and within acceptable levels of environmental impacts. The characteristics of the proposed operation that could be used to test whether it meets these objectives are described below:

- **Transport distance**
  The site is relatively close to the major markets, particularly developments in southern Canberra and Queanbeyan. Hence, fuel consumption and transport costs are reduced.

- **Susceptibility to flooding**
  The extractive area is mainly located above the higher frequency event Murrumbidgee River flood channel.

- **Access**
  There is an existing access road.

- **Rehabilitation**
  The site has good potential for satisfactory rehabilitation.

- **Resource quality**
  The sand deposits contain a small fraction of "fines" or clay and other sediments. This reduces the likelihood that sediments will be discharged from the site in quantities likely to cause water discolouration (Peter Fogarty, Department of Conservation and Land Management pers. comm). The extracted materials are of marketable quality and in demand.

- **Environmental management**
  Finally, whilst upgrading the development increases the need for a sound environmental management and restoration works program; it also provides the financial means to implement such a program.

Therefore, this project to supply essential products can be justified as an appropriate activity for the site if it can be demonstrated that this can be done in an environmentally and socially acceptable manner, and that it is economically viable.

2.4 Consequences of Not Approving the Proposal

The operators have indicated that if approval is not granted, they would scale back the operation to a level that is in compliance with the current approval. Thus, extractive activities (albeit at a reduced level) would continue at this site; and additional supplies would also be required from other riverine or old riverine deposits in the Sub-region. This would almost inevitably lead to an increase in haulage distance.

2.5 Assessment of Existing Operation

The fact that the proposed operations were conducted for a limited period without approval allows an assessment of the consequences arising from a decision to formally approve these operations. The following summarises the relevant aspects of the environmental assessment which is presented in more detail in Section 5.

Erosion: The site is predominantly flat and shows little evidence of active erosion associated with the existing extraction areas. The site is located above normal river levels but would be innundated during high flow events. Whilst not a serious problem at the current extent of operations, erosion of unconsolidated areas could occur during floods. Therefore, progressive rehabilitation of the site is proposed to minimise the extent exposed at any given time.

Runoff: The site is drained via the northern or downstream end. Under the proposal, the existing drainage pattern will be modified to include a sedimentation pond to slow water leaving the site allowing sediment to settle prior to discharge into the river channel. Catchdrains are required above the dark sand extraction operation in the pasture paddock to redirect runoff away from disturbed areas.

River flows/stream bed morphology: Extraction of materials from the site has not adversely affected river flows and has not affected stream morphology except during floods. The Department of Water Resources favours removal of sand beds on the eastern edge of the river to increase flow capacity of the river so as to lessen current undercutting of the western outer bank. (Barry Starr pers. comm)

Water quality: As discussed previously, the low fines fraction in the sand means that there are no adverse impacts on water quality. This also means that there are no cumulative impacts on water quality. The stockpile of crushed material could adversely affect water quality if floodwaters were to extend to that level. Storage of fuel in areas potentially affected by floods constitutes a serious risk to water quality if a spill should occur. Bunding to afford protection from high water levels is an important part of the proposed environmental protection measures.

Terrestrial ecology: There are no fauna species on the NPWS Schedule 12 that are present or are likely to be affected by the proposal. There are no plant species of any significance that are known to exist on the site. Past disturbance has reduced the conservation status of the site.

Noise: The site is remote (> 900 metres) from permanent habitation. Shacks across the stream are occasionally occupied on weekends and during holidays. Because the crusher will not be operated during these periods, the occupants are not affected by additional operational noises from the site.

Recreation and visual impacts: The site is largely screened from the river by remnant vegetation. Parts of the existing and proposed extraction area are visible from the river. However, these features would remain visible because extractive operations would continue irrespective of whether the proposal is approved or not. There is little recreational use along this part of the river.

Access and transport: The site is serviced by an unsealed road used by two other local residents, two 'weekenders' and another sand and gravel pit operator. Cumulative impacts in the form of an increased volume of heavy traffic on the Monaro Highway can be attributed to the current operations of these sites as well as to operations occurring on other sites to the south of Bredbo.

Land use: The rural land uses in the surrounding area are unaffected by the project.

In conclusion, there are some elements of the proposed operation that will be changed to bring it up to an acceptable standard. However, there are no apparent adverse impacts that cannot be addressed by these improvements.

SECTION 3 THE EXISTING ENVIRONMENT

3.1 Location

The site is located on the 'Glenroy' property in Portion 22 Parish of Gungoandra County Beresford. This is 10 kilometres north of Bredbo, and is west of the Monaro Highway adjacent to the Murrumbidgee River. Portion 22 has an area of 130 hectares. The site is shown in Figure 2 - Site Context Plan. The extractive operation is based on deposits of sand, gravel and pebbles within a 17 hectare alluvial flat adjacent to the river. An improved pasture paddock adjacent to the alluvial deposits is being excavated for dark sand with a potentially suitable area of up to 5 hectares.

3.2 Landuse and Zoning

The land is owned by Mr C V Povey. The alluvial flat or floodplain is not grazed due to a lack of palatable grasscover. The remainder of Portion 22 is utilised for grazing.

Adjoining landuses include grazing on the eastern side of the river and on the floodplain to the west. Woodlands on the steeper elevations have little economic value. An adventure group camp and weekender nearby would use this woodland for bushwalking.

The relevant environmental planning instrument is the Cooma-Monaro Local Environmental Plan No. 1. The area is zoned 1(a) Rural "A" zone. Extractive industry is an approved activity in the zone subject to Council consent.

3.3 Climate

The nearest climatic collection data comes from Canberra. Annual rainfall at Canberra is 630mm, with 1713mm annual evaporation.

Wind direction at Michelago is predominantly southerlies in winter and northerlies in spring-summer-autumn. Some northerlies also occur in winter. Winds from the east are very rare. The windiest months are August to October. (Ron Tito pers. comm).

3.4 Topography, Geology and Soils

Topography

The alluvial floodplain has a 6 metre range in elevation, with the higher points being above all but the highest floods (> 1 in 20 year interval). The floodplain typically has less than 1 in 20 gradient. Steeper grades, between 1 in 2 and 1 in 4, are found on the river bank and on the old bank which is located between the floodplain and upslope areas. The dark sand extraction operation is located above this clearly defined topographical feature. Slopes in the area nominated for extraction are approximately 1 in 25.

At its northern end, the site is dominated by a wooded hillock that rises 60 metres above the main extraction area and extends into a major hill to the east.

Geology

The geology of the study area is shown by Figure 3. Much of the study area is underlain by volcanic rocks of Silurian age, particularly rhyolitic lithic crystal tuff which occurs on both sides of the river sediments in this area (Geological Survey of NSW 1977). The Murrumbidgee Fault line lies just to the west of the Murrumbidgee River and separates the

steep mountainous terrain to the west from river flats and gently sloping hill country to the east of the river.

The river flats and adjacent terraces contain variable depths of Quaternary gravel, sand and silt. Finer sediments comprising deep silty deposits have been exposed on the eastern edge of the study area where dark sand is being excavated. This finer sediment contains some clay particles and has probably been deposited during high floods at a time when the river occupied the eastern river channel.

There are no large rock outcroppings in the study area, and there is only one minor development of river shoals at the southern end of the study area.

Soils

There is little development of soil on the alluvial deposits adjacent to the Murrumbidgee River. They show little or no profile development and are very sandy or gravelly. The deep sand banks associated with the old river channel contain large amounts of stone cobble. In contrast, many of the sand banks deposited along the edges of the present river appear to consist mainly of well-washed sand. Both the deeper gravels and the river edge sand deposits are mined as part of the current sand extraction operation.

In the south-east section of the study area deep silty sediments have been exposed by recent soil excavation. Examination of the exposed profiles indicates that this material is also alluvium from the river, probably deposited during floods. The occurrence of this silty alluvium corresponds approximately with the lower slopes of a cultivated paddock presently being used for sheep grazing. The soils in this area have a higher clay content, and because of their smaller particle size are more likely to erode if exposed and subjected to heavy rainfall.

On the hillslopes east of the existing quarry, shallow, well-drained, brown sandy clay loam soils extend upslope from the edge of the alluvial sediments and former river bank. These soils are derived from decomposition of the acidic Silurian volcanic rocks in this area. There is a moderate amount of organic matter in the soil surface horizon. This includes decomposing leaf litter and grass stems. The soils grade gradually to a considerable depth where, at least in some areas, there appeared to be an abrupt change to yellow clay.

3.5 Vegetation

Five main vegetation zones occur within the study area. These are briefly described below and a list of plant species recorded is given in Appendix C: Table C.1. Species names used are those given in Jacobs and Pickard (1981) and Jacobs and Lapinpuro (1986).

River-edge (Riparian) Vegetation

Much of the length of the river in the study area is well vegetated, although in some places the edge has been smothered by sand or disturbed by machinery. Clumps of Willows (*Salix* spp.) have established along the river banks and now help to stabilise these areas. Dense cover is provided by thickets of burgan (*Kunzea ericoides*), wattles (*Acacia rubida, A. dealbata*), river bottlebrush (*Callistemon sieberi*), and river tea-tree (*Leptospermum obovatum*).

Reeds, sedges, grasses and herbs are abundant along the river edge and form a distinct zone of water-edge plants. Common species include the reed (*Phragmites australis*), common rush (*Juncus usitatus*), river club rush (*Schoenoplectus validus*), umbrella sedge (*Cyperus eragrostis*), water couch (*Paspalum distichum*) and blown grass (*Agrostis avenacea*). Herbs are also abundant in this area.

Alluvial Flats

The vegetation established on deep alluvial river gravels and sands is similar enough throughout to be treated as one vegetation type. This area includes applebox woodland (*Eucalyptus bridgesiana*), thickets of burgan scrub (*Kunzea ericoides*), and extensive areas of exotic tussock grassland mainly African lovegrass (*Eragrostis curvula*).

Small groups of trees, particularly applebox (*E. bridgesiana*) and occasional snow gums (*E. pauciflora*) and manna gums (*E. viminalis*) occur on the higher gravel terraces. These trees have been individually mapped (Figure 4) and provide a focal point for determining areas that will be retained to protect the visual character of the edge of the river. The trees also provide important wildlife habitat (see Section 3.6).

The dominant ground cover throughout this area consists of African lovegrass (*Eragrostis curvula*). In places burgan also forms dense shrub thickets. Occasional tussocks of the native tussock grass (*Poa labillardieri*) indicates that this species may once have been more abundant. Many of the plants established on the river gravels are exotic and highly invasive of disturbed sites. The most abundant species were African lovegrass, serrated tussuck (*Nassella trichotoma*), common thorn apple (*Datura stramonium*), purpletop (*Verbena bonariensis*), and three-flowered nightshade (*Solanum triflorum*). A full species list is given in Appendix C: Table C.1.

Low Escarpment Slope (former river bank)

The low escarpment running along the eastern edge of the existing gravel pit represents a former eroded river bank. It is now largely stabilised, although some deep gullies on the slope are still eroding. A few applebox trees and black cypress pines (*Callitris endlicheri*) have established on the slope. Because of the steepness of the slope this area has been less disturbed by livestock. It still supports a good cover of native shrubs including silver wattle (*Acacia dealbata*), red-stemmed wattle (*A. rubida*), cassinia (*Cassinia quinquefaria*), blackthorn (*Bursaria spinosa*), *Bertya rosmarinifolia*, guinea flower (*Hibbertia obtusifolia*), and the introduced briar rose (*Rosa rubignosa*). Grasses are also present on the slope and include particularly kangaroo grass (*Themeda australis*), African lovegrass (*Eragrostis curvula*), snow grass (*Poa sieberana*) and wallaby grass (*Danthonia caespitosa*). Other species are listed in Appendix C: Table C.1.

Regenerating woodland on higher slopes

Apple box and black cypress pine woodland occurs on the hill slope in the north east section of the study area, above the low escarpment described above. The soils in this area are not alluvial, having been derived in situ from underlying volcanic rocks. Much of the area has been cleared, but the shrub cover has grown back extensively and is now dominated by burgan thickets. Kangaroo grass and African lovegrass form a grassy understorey. The native kangaroo grass was well grazed at the time of the survey but the less palatable lovegrass appeared to be untouched. Such preferential grazing will probably lead to the loss of kangaroo grass in this area as has happened elsewhere in the district. Given the present regeneration by burgan this invasive thicket-forming native shrub will also tend to take over the hill slope, although grazing may reduce its impact. A number of woodland trees (mainly apple box and black cypress pine with a few snow gums and yellow box) are present in this area giving it an attractive appearance.

Improved pasture

The cleared paddock to the south east of the existing quarry has been previously cultivated and "improved". The paddock has been heavily grazed and is now infested with weeds. The north east corner has been invaded by burgan with an understorey dominated mainly by African lovegrass (*Eragrostis curvula*). In the majority of the paddock, the main plants that were obvious included sorrel (*Rumex acetosella*), spear thistle (*Cirsium vulgare*), saffron

thistle (*Carthamus lanatus*), scotch thistle (*Onopardum vulgare*), great mullein (*Verbascum thapsus*), viper's bugloss (*Echium vulgare*), and hoary mustard (*Hirschfeldia incana*). The richness of the weed flora in this area has probably resulted from a combination of high soil fertility (silty loam having been deposited at times of high floods), the presence of a ready source of weed colonists in the nearby river corridor, and use as a sheep camp resulting in over-grazing and high nitrification.

Rare or threatened plants

Briggs and Leigh (1985, 1988) provide information on rare or threatened plants that occur in the southern tablelands and ACT. Careful searches throughout the study area did not locate any of these species in the study area.

3.6 Terrestrial Wildlife Habitat

Criteria for assessing the conservation significance of woodland and grassland habitats in the ACT have recently been reviewed by Williams et al. (1991) and Sharp et al. (1992), and an approach for describing the quality of riverine habitats is given by the National Capital Development Commission (1981). These guidelines, combined with previous experience, provided the basis for assessing fauna habitat in the study area.

The study area contains a range of habitats suitable for vertebrate animals. However, apart from along the river, habitat structural diversity is only moderate; there are no rock outcrops, few fallen logs or hollow trees and the extensive areas where tussock grass is the main ground cover are dominated by a single exotic species, African lovegrass (*Eragrostis curvula*). Nevertheless, a number of features of the area are important. These are discussed below.

Remnant applebox (*E. bridgesiana*) woodland

The remaining groups of woodland trees in the study area provide an important habitat link in the woodland corridor along the banks of the Murrumbidgee River. Such isolated pockets of trees are particularly important for honeyeaters and other birds that migrate seasonally along the Murrumbidgee River valley (Taylor 1987). One locally uncommon honeyeater, the yellow-tufted honeyeater (*Lichenostomus melanops*) was present in low numbers in woodland patches in the study area, both near the existing gravel pit and in the woodland on the eastern hill slope. Several other honeyeaters and other birds were observed foraging in the clumps of trees (Appendix C: Table C.2). These included another locally uncommon species the brown treecreeper (*Climacteris mpicumnus*).

Because of the limited extent of tree cover, few mammals are expected to occur in the trees. Droppings of common brushtail possums (*Trichosurus vulpecula*) were collected beneath an applebox near the river bank and tree hollows in living and dead trees provide potential roosts for bats and nesting hollows for birds.

A number of species of reptiles and frogs are likely to occur in the study area (Appendix C: Table C.3) and these may at times occur in the woodland patches. Care was taken during field work to search for potential habitat of the nationally endangered pink-tailed legless lizard (*Aprasia parapulchella*) (see Osborne et al. 1991), the nationally vulnerable striped legless lizard (*Delma impar*) and the locally threatened lined earless dragon (*Tympanocryptis lineata pinguicolla*). No potential habitat for these species was found.

Apart from the locally uncommon bird species mentioned above, no rare or threatened mammals, birds, reptiles or frogs, including those species listed on the NPWS Schedule 12, are likely to occur in the study area.

Wooded Hill
(rises 60m to knoll 400m west)

Approx. Fenceline

Approx. 105 level

Improved Pasture Paddock
(Grades approx. 1 in 25 and
entire area above major 1991
flood)

Woodland

SVa

Svd

Svr

Entry
Gate

95·5

95·6

Main Pit
Operations

Qa

Dark sand operations area

Stockpile area

Operations
area

Operations
area

Ford
Crossi

flow

MURRUMBIDGEE RIVER

Svr

Murrumbidgee fault line

S-Db

LEGEND

Svr	Rhyolitic lithic crystal tuff
Qa	Quaternary gravel, sand and silt
Svd	Rhyodacitic to dacitic lithic crystal tuff
S-Db	Rhyolitic to rhyodacitic tuff
Sva	Fine - grained ash tuff

LEGEND

- Surveyed eucalypts
- Native trees
- Willows/Poplars
- Dense to medium shrub thickets
- Sparse to medium shrub cover
- Sand and pebble banks in river
- Approximate locations of vegetation cleared areas as at May 1992. Tracks as surveyed.

Note:

Survey undertaken March-April 1992. Datum 95m approximates 660m a.s.l.

COLINTON EXTRACTION OPERATION EIS

GEOLOGY

Portion 22 Parish of Gungoandra Country Beresford
Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No **3**

Wooded Hill
(rises 50m to knoll 400m west)

Approx. Fenceline

Improved Pasture Paddock
(Grades approx. 1 In 25 and entire area above major 1991 flood)

× Approx. 105 level

Woodland

Regenerating *Callitris - E. bridgesiana*. Woodland with *Kunzea* scrub and ground cover of Kangaroo grass *Themeda australis* and introduced *Eragrostis* sp.

Entry Gate

Main Pit Operations

95·5 ×

95·6 ×

Dark sand operations area

Ce

Ev

Ep

Stockpile area

Operation area

Dense Kunzea scrub.

Kunzea scrub

Ford Crossi

Operations area

flow

MURRUMBIDGEE RIVER

LEGEND

- Eucalyptus bridgesiana (Apple Box)
- Ep — Eucalyptus pauciflora (Snow Gum)
- Ev — Eucalyptus viminalis (Candlebark)
- Ce — Callitris endlicheri (Black Cypress Pine)
- Callistemon sieberi (River Bottlebrush)
- Native scrub medium to dense cover
  Sparse cover (includes kunzea, tea tree, and wattles)
- Willows
- Significant vegetation stands worthy of retention

LEGEND

- Surveyed eucalypts
- Native trees
- Willows/Poplars
- Dense to medium shrub thickets
- Sparse to medium shrub cover
- Sand and pebble banks in river
- Approximate locations of vegetation cleared areas as at May 1992. Tracks as surveyed.

Note:

Survey undertaken March-April 1992. Datum 95m approximates 660m a.s.l.

COLINTON EXTRACTION OPERATION EIS

VEGETATION

Portion 22 Parish of Gungoandra Country Beresford
Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No. **4**

Thickets of burgan and wattles

Scrub thickets occur throughout the alluvial areas and on the north-eastern hill slope. Such thickets provide cover for small birds including scrubwrens, thornbills, robins and honeyeaters. They also provide shelter for kangaroos and introduced mammals including rabbits and foxes. Although no rare or threatened species are likely to be associated with these thickets, they do provide shelter and foraging sites for birds. The thickets also have an important role in stabilising the soil and provide a seed bank for colonisation of disturbed ground.

River-edge cobble and grassy banks

The edge of the Murrumbidgee River provides important wildlife habitat (National Capital Development Commission 1981). In the study area the river bank consists mainly of sand or shingle, which in some parts is still well-vegetated. The river channel floor is variable, but appears to consist mainly of sand, with some areas of shingle at the southern end of the study area. In the middle section the bank is slightly steeper but has been stabilised by a dense cover of vegetation.

Riparian vegetation along streams is particularly important because it may stabilize the stream channel and its banks, contribute organic matter which provides a food source for detritivores living in the river, reduces the amount of sediment, nutrient and water running into the river and provides a source of logs and other debris falling into the river (Lake and Marchant 1990) (such debris provides important habitat for fish and other river wildlife).

Vertebrate wildlife associated with riparian habitats include water birds, waders, water rats (*Hydromys chrysogaster*), platypus (*Ornithorhynchus anatinus*), water dragons (*Physignathus lesueurii*), and water skinks (*Eulamprus heatwolei*). Platypus are widely distributed along the Murrumbidgee River (Greenham 1981) and, if suitable pools are available nearby, platypus may establish breeding burrows in the river bank.

3.7 Aquatic Habitats

The Murrumbidgee River provides habitat for numerous species of invertebrates and many species of vertebrate wildlife (Greenham 1981; Hogg and Norris 1988; Hogg and Wicks 1989). Invertebrates are relatively abundant in the river and along with the aquatic vegetation provide food for fish, water birds and mammals such as the platypus.

Fish likely to occur at times in the river near the study area are listed in Appendix C: Table C.3. There have been few surveys of fish in the river south of the ACT and the river is unlikely to support all species recorded near Canberra. The river provides an important corridor for fish migration during spawning periods particularly for species such as trout (Salmo ssp.) and Macquarie Perch (Macquaria australasica) which are more tolerant of cold waters (M Lintermans, ACT Parks and Conservation Service pers. comm.).

Other vertebrates that utilise the river channel and semi aquatic vegetation include platypus, eastern water rats, herons, ducks, plovers and cormorants (some of which were observed during field work for the present study, Appendix C: Table C.3), water dragons, long-necked turtles (*Chelodina longicollis*), and frogs such as Lesueur's frog (*Litoria lesueuri*), common eastern froglet (*Crinia signifera*) and the eastern banjo frog (*Lymnodynastes dumerili*).

There have been few studies of the macro-invertebrates of the Murrumbidgee River (a notable exception is the detailed study of Hogg and Norris [1988] in the ACT). Common invertebrates in the river include snails, worms, bivalves, leeches, crustaceans such as shrimps and crayfish, insect larvae including flies, dragon flies, caddis flies, mayflies and water beetles. In the ACT there is concern that the numbersof Murray Crayfish (*Euastacus*

armatus) have declined in recent years perhaps as a result of habitat destruction and over-harvesting by humans (Lintermans and Rutzou 1982). This important species may occur in the river near the study area.

3.8 Access

The access road from the extraction site to the Monaro Highway is a gravel road approximately 2.7 km long and is a gazetted public road under the control of Cooma-Monaro Shire Council. The easement is 20.115 metres width.

The road is of variable width and condition and could generally be described as being in a fair to poor state with some minor and localised problems apparent such as poor horizontal alignment (sight distance), narrow pavement width (single large vehicle) and runoff scour damage.

The proponents have expressed the opinion that the access road is suitable for its current level of usage and are not aware of any traffic problems to date. The proponents also undertake road maintenance works to ensure its continuing serviceability.

3.9 Visual Quality

The site is surrounded by undulating pasture land to the north and east with small open woodland areas. The site has low visual appeal due to the limited elevation change; generally non-descript vegetation; and evidence of past extraction works. The riparian vegetation, particularly the Apple Box woodland with its height and variation in understorey is probably the most appealing area on the floodplain.

There are few sites along the river from which it is possible to obtain views into the proposed extraction areas. The riparian vegetation and bank screens most of the site when viewed from this perspective. There are few recreational users of the Murrumbidgee River corridor in this area.

The site is visible from only one dwelling, a colourbond garage used as a weekender shack, located south west of the site (see Figure 2 - Site Context). This building is in an elevated position that looks down onto the site. The building is typically occupied only on weekends, however the proponents have not observed any usage this year.

A small shack and caravan used occasionally by a local adventure group is located 150 metres from the river to the west of the main operations area. The proponents estimate its usage as up to 15 weekends per year, plus the Christmas and Easter period. These structures are on the floodplain at a similar elevation to the extraction site. The riparian vegetation and the riverbank screen most of the proposed operations area when viewed from this location.

An abandoned stockman's hut to the south of the operation is in the approved extraction area and is very occasionally used by the landholder as a fishing base.

3.10 Archaeology

A comprehensive archaeological survey was carried out over an area of approximately 33 hectares, which included the proposed extraction area on the river floodplain as well as the dark sand extraction area in the pasture land.

The survey team comprised two archaeologists and three representatives of the Bodalla Local Aboriginal Land Council. A detailed Consultant's report has been included as Appendix B.

Six Aboriginal archaeological sites were found in the course of the survey, all of which were located to the east of the flood channel. The locations of these sites relative to the proposed extent of the works are shown by Figure 6 and in Appendix D.

The following summarises the main findings of the study:

No sites were located on poorly sorted gravel deposits and recent sand terraces west of the flood channel, and potential for sites to exist in these areas is considered to be low.

The terrace deposit which is located to the east of the flood channel and is made up of fine sands is considered to be an archaeologically sensitive zone.

Sites C1, C2 and sections C3 and C6 are unlikely to be affected by extraction activities.

Sites C4, C5 and sections of C3 occur on an alluvial terrace formation consisting of sandy silts. C4 and sections of C3 have been previously disturbed by extraction activity.

Sites C6 and portions of C3 have moderate archaeological potential and should be protected from extraction and associated impact.

A small levee deposit adjacent to C3 should also be conserved due to the potential for subsurface artefactual material in this area.

A "Consent to Destroy" from the NSW National Parks and Wildlife Service will be required for a portion of Site C4 to enable continued extraction and use of an existing stockpile area east of the flood channel.

Areas of fine sediment terrace deposits exist east of the flood channel and these have been identified as archaeologically sensitive. Subsurface testing of these areas by a qualified archaeologist will be required prior to the commencement of new extraction activities.

SECTION 4 DESCRIPTION OF THE PROPOSAL

4.1 Objective of the Proposal

The proposal is to seek formal approval for an existing extractive and processing operation producing sand, gravel, and crushed rock to supply the private market in the ACT and Queanbeyan area. The key elements of the proposal are:

- continuation of existing (approved) extraction of sand and gravel from the floodplain deposits;
- continuation of existing (approved) dark sand extraction on an adjacent upland site;
- operation of a rock crushing and screening plant; and
- operation of a proposed sand washing plant associated with the screener;
- progressive site rehabilitation works.

4.2 Extent of the Proposal

Area

Under the proposal, extraction works will occur on an area of up to 23 hectares. Within this total area, approximately 3.2 hectares will be permanently retained as undisturbed buffers to protect significant trees, shrub communities, visual screening, flood control and identified archaeological sites (refer Figure 6).

The increased operation capacity possible with an approved crusher and screening plant will generally be limited to a works area of 7 hectares over the next 10 years. A similar area may be involved for the works in the Years 2002 to 2012.

The approved sand and gravel operations (utilising loader and truck equipment) will continue throughout the site in the non-protected areas where the available material is suitable for market demands.

The existing access road will be retained and extended as required within the property generally along the existing track. This track system currently provides access to all existing works and close to any proposed activities (refer Figure 5).

Estimated reserves

The estimated maximum total volume of alluvial material potentially suitable for extraction is 700,000m^3 (excluding areas proposed to be undisturbed due to ecological, visual or archaeological considerations). This equates to approximately 19 years supply at an estimated annual rate of extraction of 37,000m^3. Further aggradation over this period will replenish materials. The estimates of current dark sand reserves are expected to be up to 28,000m^3, depending on the extent of the area extracted. This equates to approximately 7 years supply at an estimated annual rate of extraction of 4,000m^3.

TABLE 1: Estimated extraction rates for the operation

Material Type	Current (m^3 per annum)	Proposed (m^3 per annum)
Sand	5,000	8,000
Dark Sand	2,000	4,000
Gravel Aggregate	1,000	30,000
TOTAL	8,000	42,000

Note: The proponents have been operating at the site for less than 12 months and at variable rates of extraction. The current rates are based on average extraction rates.

The sand is generally extracted from the river bed or adjacent sand banks, plus on the alluvial flats where screening is often required to ensure consistent material.

The dark sand is extracted from 100 to 1,500mm below existing surface levels in the pasture area above the alluvial flats. Extraction is to an average depth of 1 metre. The topsoil layer of 100 to 400mm depth is stripped and stockpiled on-site for later restoration works. Stripping to this depth removes all soil that contains viable seeds. The dark sand, which includes fines, is mixed with the river sand on a 30% (dark sand):70% (river sand) ratio to produce a sandy loam suitable for a free draining sportsfield soil medium and planter bed soil. This mix meets the Type B topsoil particle size distribution requirements of the ACT Parks and Conservation Service for these uses.

The gravel, which includes crushed material, and screenings of 7, 10, 14 and 20mm aggregate gradings extracted from throughout the alluvial flats. The majority of material for the crusher will be obtained from the deeper pit excavation adjacent to the crusher. Excavation will be to an average depth of 4 metres. This progressively moves southwards both for efficient operations requirements and to minimise any erosion potential in major storm events. This material is generally used as aggregate in concrete production or as road base course. The finer material is suitable as bedding sand.

Past workings and the proposed sequence of works are shown by Figure 5 and Figure 7.

4.3 Type of Machinery

The sand and gravel extraction and processing material is extracted using a front end loader and/or a tracked excavator to load dump trucks for transport direct to market or to the screening plant as required. This uses an 7, 10, 14 and 20mm screen to separate the excavated materials into the product range.

The total operation machinery requirements are:

- one crusher (similar to Hanamag type) and associated screener (similar to Commander type)
- 2 front end loaders (similar to Terex 7281 type)
- 2 tracked excavator (similar to Kato 23 tonne and 29 tonne type) and
- up to 5 trucks (similar to $18m^3$ or 28 tonnes capacity including trailer) carting materials on the site or in transit to market.

A sand washing plant is proposed for periodic operation in conjunction with the screener. Either a spray bar over the conveyor or a waterwheel will be used. The spray zone would be hardpaved with a lined channel to a sediment pond. The pond would be regularly excavated to remove any fines residue buildup. This material would be removed offsite as either fine sand or mixed with other material as appropriate. The water required would be pumped from the river.

The separated materials are stockpiled to ensure adequate available supplies and efficiency of operation.

4.4 Hours of Operation

The proposed maximum hours of operation are from 6am to 6pm Monday to Friday and from 6am to 12pm Saturday morning for all equipment except that the crusher will not operate on weekends. The crusher and screening plant generally operate periodically throughout any working day depending on available material, demand for the product and mechanical condition. Trucking movements similarly occur intermittently on most working days. No blasting is envisaged in the operation.

4.5 Employment

The onsite workforce is not expected to exceed 4 persons, excluding the truck drivers used in cartage of the materials to market.

The 4 loaders and excavators will be interchanged depending on the most appropriate equipment at any time. The usual workforce will be 2 persons associated with the crusher and gravel extraction operation and 1 person associated with the sand extraction operation. Up to 5 truck drivers will be intermittently associated with the project depending on demand.

4.6 Water Quality Protection Measures

Measures will be undertaken to reduce the risk of adverse impacts on water quality. Runoff generated within the site will be controlled to reduce the risk of erosion. There are two fundamental elements to the proposed strategy.

The first is to redirect water away from areas within the site that constitute risks to water quality. Areas affected include the stockpiles, compacted surfaces, the fuel storage site and the topsoil stripping areas. Catchdrains and/or impervious bunding will be constructed to collect and divert overland flow away from these areas.

The second element is to control water and/or fuel spillages that come from within these areas. The stockpiles will be bunded using coarse gravel to allow water to pass through whilst trapping sediment. Water coming off compacted areas will be collected and redirected to adjacent areas of stable vegetation. Fuel that may be accidentally spilled outside the bunded area or most of the site will be prevented from entering the river via a water quality control pond that will trap water at the lowest point in the site.

4.7 Site Rehabilitation and Landscaping

Rehabilitation measures are proposed for areas not subject to annual flooding. Disturbed ground within these areas (eg where dark sand is being extracted in the paddock south east of the existing gravel pit) will be rehabilitated by grading to a suitable slope and, depending on extent, either sowing with an annual cereal crop such as rye (*Secale cereale*) or oats (*Avena sativa*).

On the alluvial flats the long term aim of rehabilitation will be to increase the cover of burgan, wattles and trees by encouraging regeneration from existing plants and from the seed source in stockpiled soil used in rehabilitation works. In the shorter term, the site will be stabilised using a dense cover of exotic species.

4.8 Access and Traffic Volumes

Access to the site is proposed to continue along the existing easement with an unsealed public road connecting to the Monaro Highway. The road crosses Reserve 96414 (for Future Public Requirements) on a public right of way immediately to the north of the site entry for a length of 550 metres.

The majority of traffic generated from the site operations heads northwards along the Monaro Highway to Canberra-Queanbeyan.

At the proposed level of operations, the maximum will generally be ten to fifteen truck movements in each direction. The daily average with 253 total working days (based on 5.5 days per week) is 9.22 truck movements per day in each direction.

SECTION 5 ENVIRONMENTAL EVALUATION

5.1 Key Environmental Issues

The key environmental issues are those associated with extractive industries generally, as well as those associated specifically with operations located within the river corridor.

General impacts of extractive industries include noise, dust, traffic, landuse and energy. Specific issues associated with the operation of extractive industries located within a river corridor include impacts on water quality/aquatic ecosystems, riparian vegetation, and recreation/aesthetics.

The following sub-sections discuss the proposal and its impacts on the environment.

5.2 Effects on River Profiles

The river flows quite slowly adjacent to the sand extraction areas, and therefore, except during floods, is unlikely to be erosive. Instead, it is likely that sand deposition will continue along the inner banks of the river. In fact, by increasing the channel carrying capacity, removal of sand from the sand beds in the river may prevent erosion of the steep western bank of the river and the subsequent undercutting of the toe of the hill at the south western end of the area.

The changed profiles on the floodplain will have an effect when river levels rise. Likely effects include changes in the locations of temporary channels flowing through the site as levels are reduced by extraction. These changes are unlikely to have major consequences outside of the site and are therefore not significant. The proposal is to stage any deep excavations from the northern (downstream end) working towards the southern (upstream end) so as to assist in minimising erosion potential.

5.3 Effect on Site Runoff and Water Quality

Alluvial flats

The free draining characteristics of the alluvial flats 'soils' and shallow grades mean that little overland flow will be generated within the areas close to the river. These areas have negligible topsoil deposits. However, removal of protective vegetation from additional areas, means the proposed operations have the potential to increase erosion, possibly leading to water quality impacts. The low percentage of fines in the sand deposits on the floodplain, will limit the likelihood that "dirty water" will be shed from these areas (Peter Fogarty, Department of Conservation and Land Management pers. comm). Only "clean" sand extraction operations are conducted on the part of the study area within 40 metres of the river which drains directly into the river. These works have been surveyed and assessed by the Department of Water Resources which approved the works (April 1992).

The sand washing plant will have a minimal impact on water quality as water used for washing will be collected and channelled to the sediment pond. Its operation is expected to occur only periodically.

The regular removal of any fines residue in the pond is an essential part of the management of this operation. The material is a valuable product and will be incorporated into the dark sand mix. The ability to sell this material will help to ensure that the cleaning works are carried out.

Water quality may be adversely impacted in major flood events, due to erosion of unstabilised areas. The potential impact increases the greater the exposed area affected or where overland flows above the flood traverse other disturbed areas. Previously worked areas on the site that have revegetated successfully are regarded as stable and able to withstand significant flood events. The stockpiles will be maintained on higher ground reducing the risk of erosion during floods.

Pasture above the alluvial flats

Extraction of the dark sand from the paddock on the eastern side of the site has the potential to increase river turbidity during heavy rain events unless there is appropriate control of runoff. Material in this area contains fine sediment, including some clay or fine loam to depths of up to 1.5 metres. All stockpiles and extraction areas will have structures in place to prevent sediment runoff from entering the river. These structures include cutoff drains, sediment traps, and the water quality control pond on the alluvial flats. Subsequent rehabilitation works will restore grades and a cover of protective vegetation to disturbed areas. The locations of these works are shown on Figure 8.

Thus, the risk of water quality impacts is minor. The water quality control principles described in Section 4.5 will prevent any significant impacts. These principles are developed into specific undertakings in Section 6.

5.4 Risk of Fuel Spillage

Diesel to operate the crushing plant and on-site equipment will be stored in tanks on the site. The proponent has held discussions with a representative of the Department of Minerals and Energy and has agreed to the construction of a bunded area surrounding the fuel tanks. (See Figure 8) The bunding will be impermeable and will have sufficient capacity to contain the spillage of a full fuel load. Tanks of total 5,000 to 10,000 litre capacity are envisaged.

The proposed water quality control pond will trap all water discharged from this area of the site, and therefore would provide an additional safety measure in the event of a fuel spill.

5.5 Effects on Aquatic Ecology

The likely effects of turbidity and sedimentation upon stream flora and fauna have been described by Greenham (1981), NCDC (1981), Pressey et al (1981) and Hogg and Norris (1988). The following:

1. Reduction in food and habitat as a result of damage to algae and vascular plants by abrasion, burying and light reduction;

2. Changes in faunal composition through direct effects such as clogging of gills, smothering and loss of breeding and sheltering sites (eg a number of the fish likely to occur in the river downstream of the study area spawn amongst stones and gravel in shallow riffle areas (Greenham 1981);

3. Alteration of the physical characteristics of the stream habitat such as bed depth, bed material and stream flow.

Hogg and Norris (1988) note that the presence of fine organic sediment interferes with invertebrate life processes such as feeding and respiration, particularly in groups such as dragonfly larvae, caddis flies and freshwater molluscs. they note that few species inhabit silty bottom areas with the exception of burrowing species such as worms, chironomids and some dragonfly larvae. Hogg and Norris note that most Australian rivers, including the Murrumbidgee River, are characterised by high turbidity. This may be true of the lower parts

of the river system, however above the ACT the river generally has clear waters except during periods of high flow. In fact heavy rains and widespread flooding can have a flushing effect on the river, removing fine deposited material from the stream bed (Hogg and Norris 1988). Once free from sediment river beds can be quickly colonised by drifting benthic invertebrates (Williams and Hynes 1977).

The course alluvium being removed from the present extraction pit and other areas is unlikely to present a threat to the river, except if a very high flood was to sweep through this area and mobilised the coarse sediments. Movement of sand in the river at times of high floods tends to have a scouring effect on the river and can damage algae and water plants by abrasion, burying and light reduction. Movement of sand and rock shingle is a normal sediment transportation process within a river and erosion of the outer sides of bends is also typical. Any erosion of the coarse alluvial sand and gravel will add to the sand and shingle load of the river (to some extent replacing any sand extracted from the river bed), but is not likely to increase turbidity.

5.6 Effects on Vegetation

As explained in Section 2, the most important terrestrial vegetation and wildlife habitat occurs on the immediate edge of the river within the riparian zone. Good planning and care in the execution of the works will be required to prevent further damage to this river edge habitat. This can be achieved if the operation of machinery is confined to areas within the proposed operational zone shown on Figure 8. Restriction on activities near this zone will avoid damaging the vegetation protecting the immediate river edge. The clearing of any trees and shrubs within 20 metres of the river requires a specific application to the Department of Conservation and Land Management.

Remaining woodland trees are also considered to be important aesthetic and habitat resources in the study area. Whilst it is not practical to retain individual trees within the operational zone, it is important to retain trees that provide a buffer and corridor along the edge of the higher sand and gravel terraces between the extraction pit and river flats. The extent of tree cover that will be retained as buffers is indicated on Figure 8. The retained trees will also provide an aesthetic buffer between the gravel pit and the river corridor.

5.7 Visual Impacts

As previously discussed, past disturbance means that the site does not have high aesthetic values. The existing types of minor visual impacts, including obvious evidence that extractive activities are occurring, would continue irrespective of whether the additional works are approved. The proposed rehabilitation works to be undertaken as part of the proposal would reduce these impacts by restoring more natural appearing landforms as part of the rehabilitation process.

5.8 Effects on Recreational Use

The limited uses of the floodplain in this location mean that impacts will also be minor. The fact that the site is not highly visible from the river, and that work does not occur on weekends or during holidays further reduces the likelihood of significant adverse impacts.

5.9 Flood Risk

The Department of Water Resources has operated a gauging station on the Murrumbidgee River at Billilingra, about 10kms upstream of Bredbo, since 1966. The following table gives the date and maximum depth of the 10 most significant floods recorded.

Date	Flood Depth (m)
07.02.71	6.20
26.05.74	6.23
29.08.74	8.90
22.06.75	8.01
26.06.75	7.04
16.10.76	7.51
21.03.78	7.27
09.06.91	6.01
13.06.91	7.50
11.07.91	9.86

As can be seen from the above figures, the flood of 11.07.91 was the most significant flood in recent times. This is further confirmed by information from the Department that, at Cooma, the 1991 flood was the highest recorded since the 1956 flood.

The proponent states that a portion of the site, located between the existing crushing plant site and the main river channel, was not inundated by the 1991 flood (Figure 6). This corresponds to land above the RL99 contour. Therefore, the proponent intends to relocate the crushing and screening plant to a site within this area as a further precaution against flood damage and water quality impacts.

5.10 Noise and Vibration

The experience of the Acoustical Consultant is that the background probable noise level at the house is 35 to 40dB(A). The noise level from plant (including the crusher, screener, excavator and loaders) is probably less than 40dB(A) at the nearest permanent dwelling under typically normal climatic conditions. At this distance (900 metres) the noise should be relatively broad band, therefore no correction for the characteristic of sound (tonal impact components, etc) have been made.

This appears to be within the recommended noise criteria of the L_{10} noise level not exceeding the background noise +5dB(A).

The probable noise levels at the two 'weekenders' nearer the operation are 50-55dB(A) under normal climatic conditions for the colourbond shack to the south west (150 metres from operations); and 45-50dB(A) under normal climatic conditions for the adventure camp to the west (300 metres from the crusher). Background noise is probably higher at these sites due to existing approved operations with loaders and trucks being usual noise over many years.

Front end loaders, diesel generators and vibrating screens all operate at 80 to 83dB(A) at 7.5 metres. The crusher sound levels are 95dB(A) under full load and 85dB(A) under partial load measured at 1 metre distance. The probable noise level at 7.5 to 10 metres is 80 to 83dB(A) under full load. The excavator operates at lower noise levels, unless very heavy work with impact hammering. The nature of the site material ensures this will be very limited.

Therefore the noise levels of proposed new operations equipment is similar to existing approved equipment. All proposed equipment has operated on the site albeit for a limited period, with no known complaints (Bruce Amey pers. comm).

The impact will be minimal due to the very limited weeked operations (currently approved activities) and the non-operation of the crusher on weekends and holidays. These buildings are generally occupied for limited weekend and holiday periods only.

There is no blasting associated with this operation, therefore no impacts from vibration are anticipated.

The noise impacts of the extraction operation are unlikely to affect surrounding permanent rural dwellings at all times, and adversely impact on the 'weekenders' when occupied.

5.11 Dust Nuisance

Any dust plume generated from processing, loading and extracting operations will impact on localised atmospheric quality. This will be minor due to the relative isolation of the operation from permanent dwellings and high traffic roads plus favourable site conditions. These conditions are the low level of fines in the sand and gravel material and sufficient moisture content reduces dust generation. The crushing and screening plant when operating on the site produced very little dust. The same equipment generated a thick dust plume when previously operating on a Federal Highway site (Paul Humphries pers. comm). The proponents are unaware of any complaints regarding dust generated from the operation or its transporting.

If any problems were to occur, the application of a wetting operation onto the processing materials, clearings and foods would be implemented.

Dust is unlikely to be a nuisance for any dwellings due to an increase in the capacity of the operation.

5.12 Transport Impacts

The proposed transport route is via approximately 3 km of gravel surfaced public road to the Monaro Highway; and then to the Canberrra/Queanbeyan region via the highway.

There are no private permanent residences in close proximity (<250m) of the gravel access road. Therefore noise, dust and vibration from trucks using the access road is not a significant problem. This conclusion is verified by the fact that the proponents have had no complaints concerning this aspect of their operation. Also the access road of the other sand and gravel operation goes to within half the distance of this house.

The average annual daily traffic figures for the Monaro Highway at Michelago, as advised by facsimile by the Roads and Traffic Authority, were 3,400 in 1990 and 3,100 in 1986. Sample counts undertaken on the highway indicate that about 10 percent of this traffic is heavy vehicles (ie approximately 340 heavy vehicle movements per day).

With a maximum of twenty truck movements per day in each direction, the extraction operation would at most contribute about 12 percent of the heavy traffic using the Monaro Highway between Bredbo and Canberra. Typically, however, this figure would be no more than 5 to 8 percent of the heavy traffic.

Discussions with a representative of the Roads and Traffic Authority on 7 July 1992, confirmed that the design standard of the Monaro Highway caters for a significantly higher traffic volume than currently exists. Consequently, a modest increase in heavy traffic

numbers as a result of this proposal would have a negligible effect on the condition and maintenance needs of the highway.

5.13 Intersection Safety at the Monaro Highway

Discussions with a representative of the Roads and Traffic Authority on 7 July 1992 with regard to their letter of 10 June 1992 indicated that some upgrading of the existing intersection would be required to improve traffic safety.

Provision needs to be made to allow southbound traffic to get past a right turning vehicle. In addition some sealing of the access road would be required to minimise dust and prevent the carriage of mud, gravel and finer material onto the highway pavement.

Accordingly the proponents are agreeable to contributing to the funding of these works. Taking the modest traffic volumes into account, it is proposed that the first requirement be met by a widening of the gravel shoulder on the eastern side of the highway adjacent to the intersection and sealing it such that the total seal width, measured from the existing centreline, at the intersection is increased from the existing 3.5 metres to 5 metres. The second requirement would be met by reconstructing the access road in the vicinity of the highway and the sealing of the first 30 metres.

Responsibility for the cost of such works should take into account the facts that the access road is a public road serving a number of properties and that it is also used by another commercial operator.

5.14 Disposal of Waste Material

Very little rubbish or other waste material would be generated on site. Rubbish will be stored above the RL99 level and collected for disposal at an approved landfill in the Canberra/Queanbeyan area.

5.15 Effects on Existing Land Use

The basic nature of this proposal, ie an extractive operation, has already been approved. These activities as well as the additional unapproved activities have been undertaken for periods of up to 18 years. In addition, there is another extractive operation that uses the same access road. The surrounding land uses patterns have therefore developed with these activities in place. Hence, no significant impacts are likely to result from the granting of formal approval to continue the current unapproved activities or increase capacity of the operation.

5.16 Effect on Archaeological Sites

The site survey located 6 sites within the study area. The consulting archaeologist's recommended management of these resources will be followed. Therefore, no significant impacts are anticipated.

5.17 Energy Consumption

The processing plant and vehicles used in this operation use diesel fuel. Anticipated consumption is 60,000 litres per annum for onsite equipment. Fuel consumption will be minimised by maintaining equipment to operate efficiently. Further fuel economies will be realised when this operation is compared with alternative, more distant sources of supply.

This is significant when viewed in the context of the amount of energy required to deliver these essential materials to the Canberra/Queanbeyan market.

No electricity power supply connection is required. Domestic water for drinking and washing will be brought to the site by the workforce.

5.18 Bushfire Risk

Extractive machinery has the potential, as does all farm machinery, for a spark ignition to occur that may start a fire. Generally, the risk is very low in this extractive operation as the majority of activity is undertaken on cleared sites. The lack of vegetation therefore ensures minimal combustible material. Similarly, throughout the site the majority of the vegetative cover is sparse due to previous clearings and/or the poor nutrient and soil structure of the alluvial deposits.

The low fuel load of the vegetation; existing tracks; suitable firebreak construction equipment onsite and existing fire buffers minimise the potential for a significant fire event to originate from the operation. The river to the west and south and the grazed pasture elsewhere provide excellent 'natural' firebreaks to all surrounding areas.

5.19 Cumulative Effects

There are two issue areas with the potential for cumulative effects. These issue areas concern impacts that can accrue as more activities are undertaken. Therefore, it is important to ascertain whether the additional impacts of the proposal, when added to impacts from other activities in the region, will collectively cause significant impacts.

The physical and biological processes of the river is one issue area with the potential for cumulative impacts. Transport and access is the second issue area.

Transport and access

The operation will generate approximately 5 to 8 percent of the heavy traffic on the Monaro Highway. The maximum expected would be 12 percent. The other extractive operations combine to be a significant proportion of the heavy traffic on the Highway. Delivery and service transport vehicles for town, ski resort, logging and rural interests would be of at least similar significance.

The Roads and Traffic Authority confirm that the design standard of the Monaro Highway caters for a significantly higher traffic volume than currently exists. The extractive operations also generally have reduced traffic volumes in the peak ski season weekend periods.

Physical and biological processes of the river

Five other extractive operations are understood to be currently operating between Cooma and Canberra on the Murrumbidgee River and its tributaries. These are:

- 16 kilometres south of Bredbo on the Numeralla River
- 7 kilometres south of Bredbo on the Murrumbidgee River
- 5 kilometres south of Bredbo on the Murrumbidgee River
- 6 kilometres south east of Bredbo on the Bredbo River
- 2.5 kilometres north of the site on the Murrumbidgee River.

Several other sites have been extraction operations in the past.

The current operations have the potential to have a cumulative impact on the bedload of the river. The quantity of material extracted relative to the total volume in the river system is very minor. The six operations occur over such a long length of river that the likelihood of these having an adverse impact on the stream energy in major flood events is minimal.

The proposed operations are generally in any case at levels well above almost all flow regimes.

5.20 Summary of Environmental Evaluation

The proposal is for a rock crusher and screening plant allied to increased extraction capacity at an approved sand and gravel operation. Some environmental impacts will therefore occur with the continued approved operation or have occurred from past works. The increased capacity is not expected to have any major adverse environmental impacts, as indeed is also applicable to the approved operation. The implementation of environmental safeguards, rehabilitation works and improved site management practices as outlined in Section 6 will address any potential adverse impacts.

The regional perspective is that the site is well located for servicing the Canberra-Queanbeyan construction industry with reasonable transporation costs and energy consumption. Transport impacts can be reduced by an intersection upgrading at the Monaro Highway.

The broader site context is that permanent dwellings are sufficiently distant to have minimal noise, dust and visual intrusion from the operation. The activity and any associated impacts have occurred for the last 18 years at various levels of operation and are therefore well established in the area. Weekenders, which are closer, will not perceive any variation from long established activities. The weekend operation will be limited to Saturday morning and the crusher will not be used.

The river corridor has limited recreation use in this area. The riverine environment will have only minor impacts in normal flow regimes due to appropriate safeguards, the limited fines in the alluvial flats site material and the location of extraction works generally at higher levels. Major flood events will have greater impact, as they do generally along the entire riverine corridor. The proposal is to locate potential adverse activities on the higher land where any impacts can be minimised.

The site is generally stable, subject to aggradation in floods and is proven as an extensive sand and gravel deposit. It has been able to sustain major extraction activity without too adverse an environmental impact in the past. The proposed safeguards ensure future practices will improve to lessen environmental impacts despite an increase in operational capacity.

Wooded Hill
(rises 50m to knoll 400m west)

Approx. Fenceline

Improved Pasture Paddock
(Grades approx. 1 in 25 and entire area above major 1991 flood)

Approx. 105 level

Woodland

BOUNDARY PORTION 22

ONLY SITE ACCESS USED

Main Pit Operations
(generally 3.5 metres depth)

OLD RIVER CHANNEL

Part sand operations area

Stockpile area

Operations area

Operations area

flow

MURRUMBIDGEE RIVER

CURRENT APPROVED SAND BANK EXTRACTION WORKS

LEGEND

Past Operations
Old workings now revegetated. Other smaller areas (scattered) not shown. Also significant workings in current main operations area.

Existing Operations
Current cleared areas and tracks.

Extent of extraction works and reprofiling approved by Department of Water Resources (April 1992) within 40 metres of river.

Proposed Operations
Maximum extent of extraction resources to be considered.

Sand and gravel

Dark sand

LEGEND

Surveyed eucalypts

Native trees

Willows/Poplars

Dense to medium shrub thickets

Sparse to medium shrub cover

Sand and pebble banks in river

Approximate locations of vegetation cleared areas as at May 1992. Tracks as surveyed.

Note:

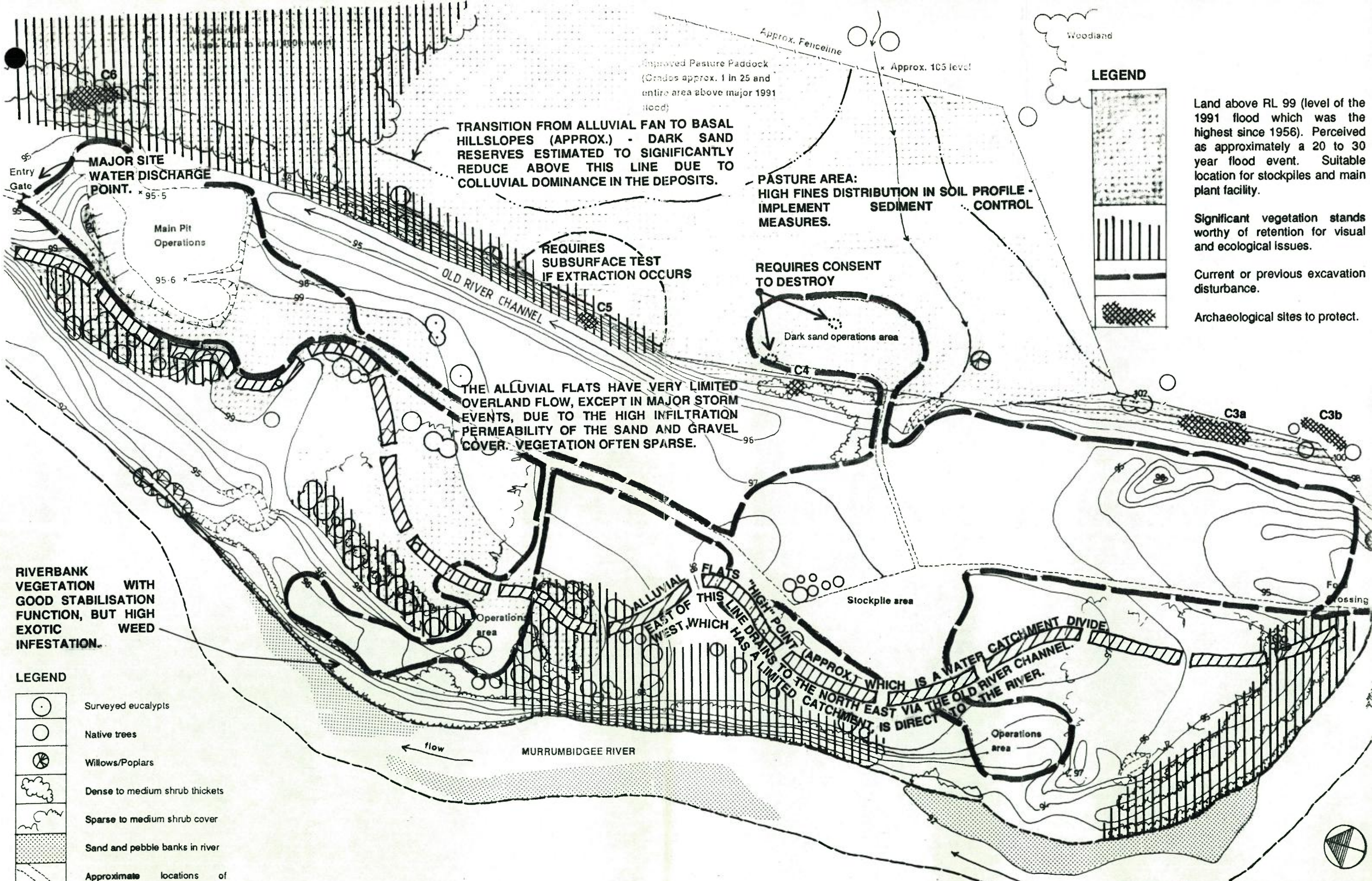
Survey undertaken March-April 1992. Datum 95m approximates 660m a.s.l.

COLINTON EXTRACTION OPERATION EIS

OPERATIONS HISTORY

Portion 22 Parish of Gungoandra Country Beresford
Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No. **5**



COLINTON EXTRACTION OPERATION EIS

OPPORTUNITIES AND CONSTRAINTS

Portion 22 Parish of Gungoandra Country Beresford Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No 6

SECTION 6 ENVIRONMENTAL SAFEGUARDS

6.1 Control of Environmental Impacts during the Operation

Issues and environmental safeguards have been addressed in Sections 4 and 5 that will be implemented to minimise any potential adverse impacts to acceptable levels. This is both for the existing approved operation and for the increased capacity outlined in this EIS. Refer Figure 8 - Environmental Safeguards and Site Management.

The environmental safeguards to be implemented both within the extractive area and on the access road are:

- A water quality control pond at the downstream extremity of the extraction area. This pond will provide safeguards against fine materials disturbed by the extraction and crushing processes being washed into the river by minor storm events. It will also further restrict passage to the river of any accidental fuel spills. The pond will be designed and operated to the requirements of the Environment Protection Authority. The pond will be regularly excavated to remove any fines residue.

- A water quality control retardation basin in the creekline at the base of the pasture paddock to trap fine materials disturbed in the dark sand extraction operation. A rock gabion embankment is recommended due to potential stormflows. Relatively limited fines occur on the site below this point. This will restrict any sediment loads on the alluvial flats in normal conditions.

- Cutoff drains or impervious bunding above any dark sand extractive area or stockpiles so as to direct water along stable grass cover at shallow grades without traversing disturbed areas. This will limit water flows on potentially erodable sites. **Note:** the high water infiltration rate and limited fines on the alluvial flats ensure no requirement for catchdrains in these areas.

- Catchdrains immediately below dark sand extractive areas to direct any sediment laden flows to the nearby water quality control retardation basin. This will be regularly excavated to remove any fines residue. The major pond will provide supplementary protection. The stockpiles will also be bunded on the low side using coarse gravel to allow water to pass through while trapping sediment.

- Straw bales, if necessary, across the direction of flow at discharge points of catchdrain contour banks and in the creekline to reduce runoff velocities and trap siltation.

- The sand washing plant will have a hard surface beneath the spray zone draining by a lined channel to a sediment pond above low flood events (greater than 1 in 10 year interval). This will be regularly excavated to remove any fines residue.

- An impermeable bund around the fuel tanks with a capacity in excess of the full volume of the tank in case of accident. The water quality control pond will provide additional protection.

- Retention of the major riparian vegetation communities (minimum 2.5 hectares) for visual, ecological and bank stabilisation benefits. Other more exotic dominant river edge vegetation (within 20 metres of river) to be authorised by the Department of Conservation and Land Management prior to any removal.

- All final batters to be at grades suitable for generally stable rehabilitation.

- All major stockpiles to be at higher levels (RL 96 which is over 4 metres above normal river level) so as to be above low to moderate storm events. They shall also be further than 40 metres from the river to meet Department of Water Resources requirements.

- The crushing and screening plant, fuel store, site sheds and temporary waste facilities to be above RL99 which was not unundated in the 1991 storm which was the highest since 1956. These facilities are also to be located east of the alluvial flat 'ridge' to ensure they drain through the water quality control pond and not direct to the river.

- The operation of the crusher is not to occur on weekends and other works are limited to Saturday morning to minimise any impacts on the nearby 'weekender' shacks, if occupied.

- Water spraying will be selectively implemented in the limited likelihood of unacceptable dust nuisance to ensure reduction to acceptable levels.

- Rubbish and other wastes to be removed on a regular basis to approved landfill areas or collection services.

- Archaeological sites nominated for protection to be preserved; those suitable to seek a Consent to Destroy to be officially approved and any further finds to be notified to the National Parks and Wildlife Service.

- The site will be progressively rehabilitated throughout the works to limit disturbed areas to current or continuing operations zones. Stockpiled topsoil or root zone strippings to be replaced to completed areas. These stockpiles to be stabilised and clearly defined from operations stockpiles to enable maximum retention of the good seed source and nutrient material for when required.

- Works adjacent to the river to be carefully managed to control any direct deposition of material into the river. A small levee bank to be retained as required by the Department of Water Resources.

- The Monaro Highway intersection to be upgraded jointly with other appropriate parties.

- The public right of way access across Reserve 96414 to be formalised by way of a licence with the Department of Conservation and Land Management including any requirements necessary to safeguard the Crown Land.

- The proponents will continue to undertake road maintenance works to ensure continuing serviceability of the access road.

6.2 Site Rehabilitation

The extraction area is expected to ultimately re-establish with a similar vegetative cover type as exists at present, albeit at reduced general levels. The dynamic nature of the majority of the site due to its location on a floodplain subject to natural cycles of scour and aggradation, make it impossible to determine final topography and vegetative cover density or species type.

Implementation of the environmental safeguards referenced in Section 5 will assist a successful rehabilitation. Final batter grades not exceeding 1 in 3 will assist stability, although variations in grade and smooth rolled over transitions will aid a more 'natural' shaping.

The dark sand extraction area is generally above even the highest flood levels. 100 to 400mm of onsite topsoil is to continue to be stripped and stockpiled for rehabilitation works in any

cleared area. The areas will be progressively rehabilitated and graded to a suitable slope. The disturbed area is not expected to exceed 1 hectare at any time. On completion of extraction in each nominated stage, the area is to be rehabilitated by grading to a suitable slope and then re-establishing to pasture. This may be by sowing with an annual cereal crop such as rye (*Secale cereale*) or oats (*Avena sativa*). The existing landuse will therefore continue with only a minimal loss of agricultural productivity due to the reasonable topsoil depths that are replaced.

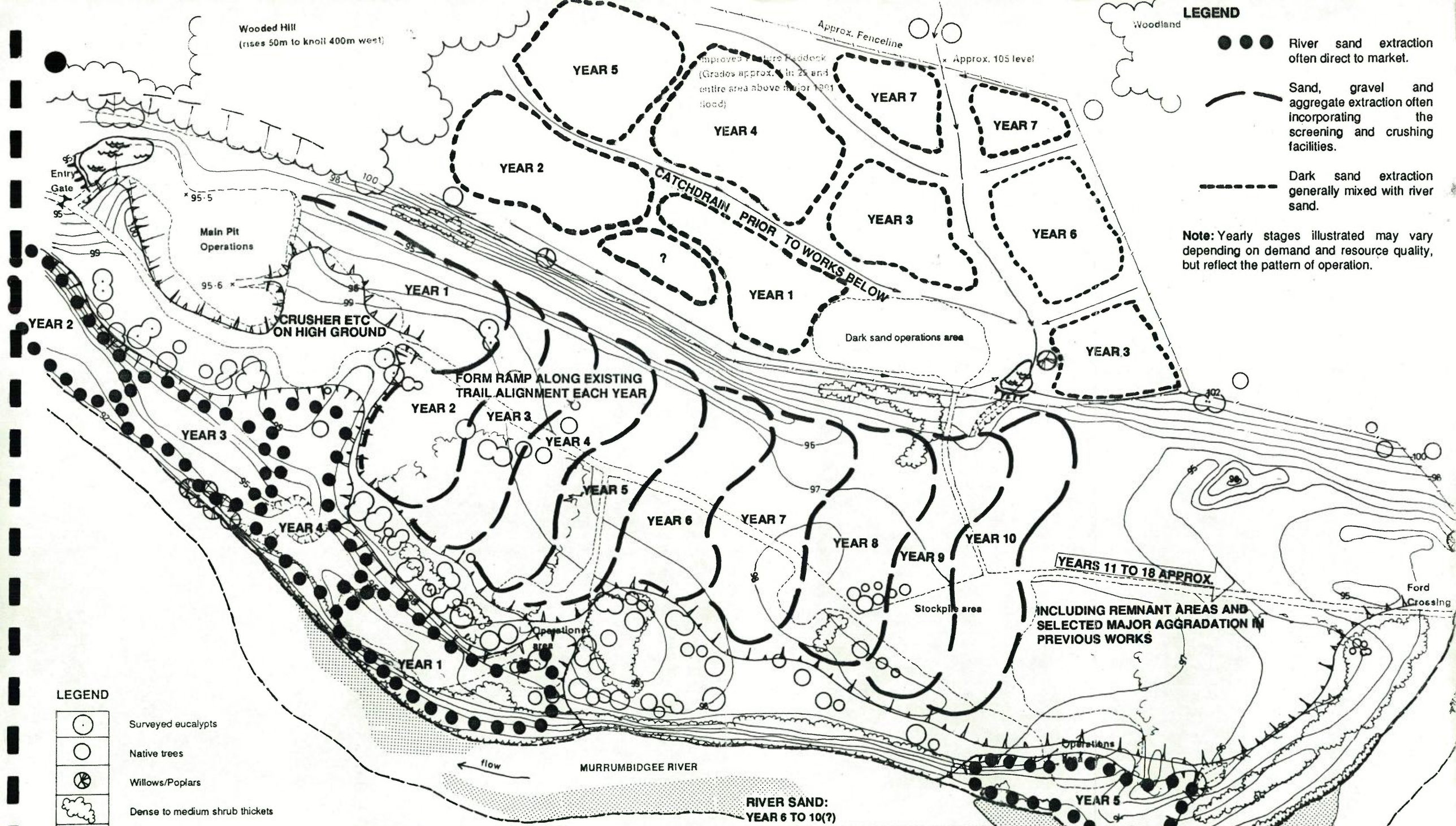
The alluvial flats are subject to more dynamic variables and have little or no topsoil development and nutrient status. Indeed placement of imported topsoil, such as from the pasture paddock, to aid rehabilitation could have an adverse impact. This would occur if the vegetative cover was not fully established and the soil was washed away in a flood event.

The replacement of the stripped root zone and surface sand and gravel on the alluvial flats is important. It is an excellent seed source and the existing grass cover is predominantly quick establishing exotics. These include African Lovegrass and serrated tussock. This reflects the 'disturbed history' of the site. Any compacted areas would be lightly cultivated.

With time, however, it is likely that burgan (tea tree) (*Kunzea ericoides*) will establish throughout the cleared area from remnant seeds in the 'soil' and seeds blown from established plants. Examination of aerial photographs from 1968 indicated that the alluvial flats at that time had a denser cover of scrub and trees. Current and past sand and gravel extraction has removed much of the shrub and tree cover. The aim of rehabilitation should be to increase the cover of burgan, wattles and trees by encouraging regeneration from existing plants. In the shorter term the dense cover of exotic grasses that is likely to establish should be viewed as a means of stabilising the site.

An additional option is to also broadcast over newly covered areas a mix of acacia and eucalypt seed from species with a relatively proven success rate in such harsh conditions. Unfortunately many of these are not indigenous to the site. This technique would therefore only be favoured in restricted areas where quick growth was essential.

The evidence on the site of regenerating native material establishing amongst the exotic grasses is favourable to a long term natural succession with a more indigenous cover than now exists. Planting is rarely successful in such harsh conditions. The exotic grasses in the interim have proven to be able to quickly establish and fulfil the essential function of a relatively stable surface cover. This is the first requirement for a successful site rehabilitation.



LEGEND

- River sand extraction often direct to market.
- Sand, gravel and aggregate extraction often incorporating the screening and crushing facilities.
- Dark sand extraction generally mixed with river sand.

Note: Yearly stages illustrated may vary depending on demand and resource quality, but reflect the pattern of operation.

LEGEND

- Surveyed eucalypts
- Native trees
- Willows/Poplars
- Dense to medium shrub thickets
- Sparse to medium shrub cover
- Sand and pebble banks in river
- Approximate locations of vegetation cleared areas as at May 1992. Tracks as surveyed.

Note:

Survey undertaken March-April 1992. Datum 95m approximates 660m a.s.l.

SAND (WITHIN 40 METRES OF RIVER)

This area is under detailed inspection and approval of the Department of Water Resources (Local Officer: Mr Barry Starr).

The proponents are under instruction to complete and rehabilitate the nominated Year 1 area that is currently under extraction. After that the general principle is to work from the upstream to the downstream end (N → S) and from the bank to the high side at each site.

The requirement is to leave a low levee bank at the river then to excavate for 40 metres back from the bank at grades not exceeding 1 in 5. Rehabilitation is to commence in each area prior to relocation to the next stage.

The staging nominated on the plan is notional as the recommended staging plan by the Department is not yet completed.

RIVER SAND:

YEAR 6 TO 10(?)

DUE TO HIGH AGGRADATION POTENTIAL, FURTHER WORKS IS LIKELY IN RIVER SAND BEDS AND REWORKING OF PREVIOUS STAGES.

COLINTON EXTRACTION OPERATION EIS

STAGING OF THE WORKS

Portion 22 Parish of Gungoandra Country Beresford
Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No. 7

SECTION 7 ALTERNATIVES TO THE PROPOSAL

7.1 Scope for Alternatives

The proponents are undertaking a currently approved extraction operation on the site and any alternative is likely to involve greater distance to market with subsequent increases in costs and energy use. The current operation will continue and a separation of the works will reduce efficiencies. The site has excellent sand and gravel deposits and the potential for minimal environmental impacts relative to fulfilling the community's demand for such resources. The minor impacts noted can be mitigated by appropriate environmental safeguards. As such, no feasible alternatives are available to the proponents on economic, environmental, site availability and long established extraction landuse considerations.

The proposed works are therefore an appropriate use of the site.

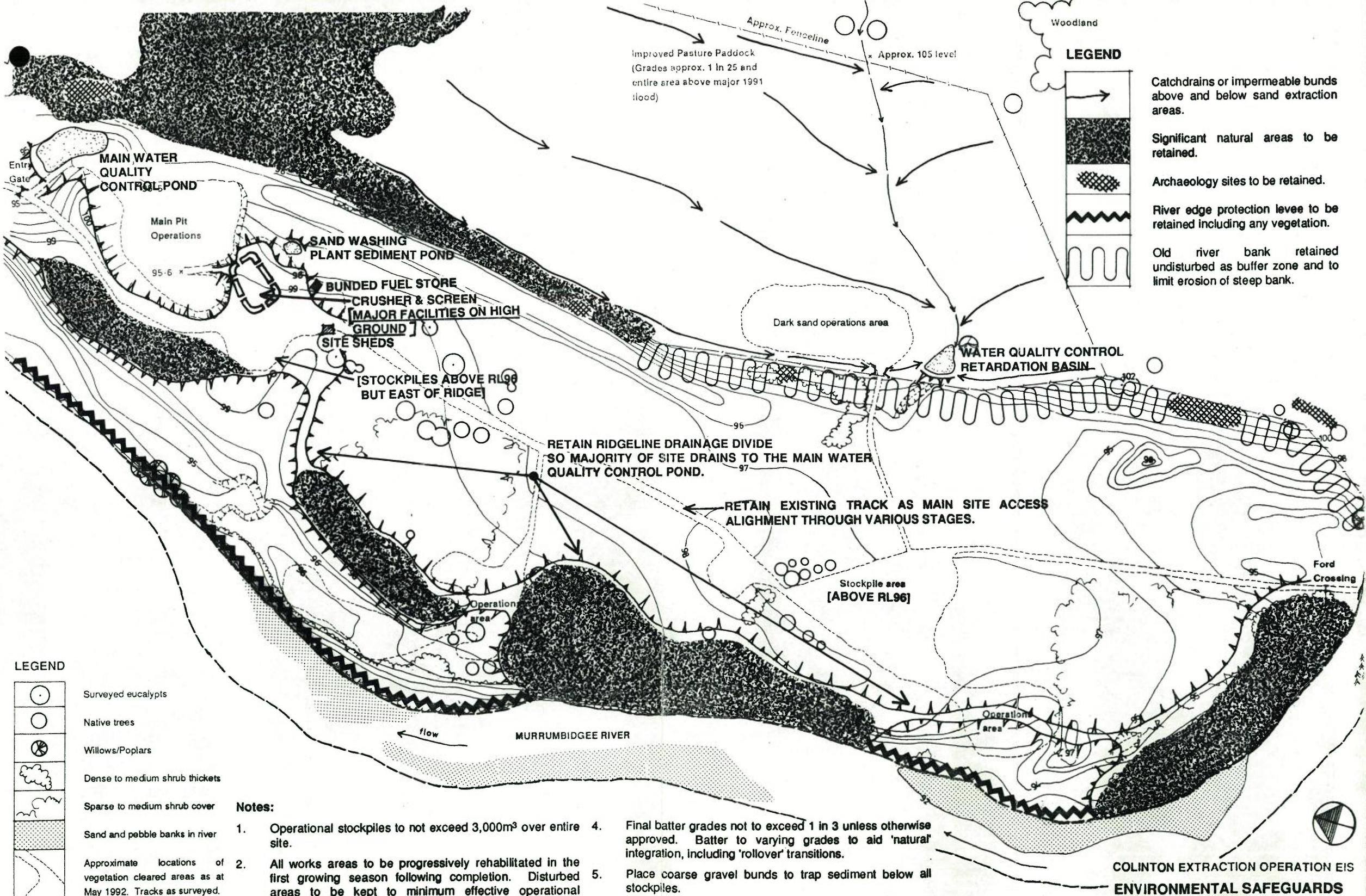
7.2 Alternative Site Layout

The proposed environmental safeguards and site management recommendations are based on providing reasonable operational efficiencies within the need to minimise environmental impacts.

An alternative could be locating the crusher screening plant and stockpiles in the low point of the old river channel to maximise visual screening and noise attenuation. This would be unsuitable due to potential damage in floods to machinery, fuel supplies and stockpiles.

Similarly an alternative layout may place vegetation buffers, archaeological sites and reasonable water quality control measures at risk.

The proposed layout, management and staging is regarded as an optimum use of the site balancing environmental and economic considerations.



LEGEND

- Surveyed eucalypts
- Native trees
- Willows/Poplars
- Dense to medium shrub thickets
- Sparse to medium shrub cover
- Sand and pebble banks in river
- Approximate locations of vegetation cleared areas as at May 1992. Tracks as surveyed.

Note:

Survey undertaken March-April 1992. Datum 95m approximates 660m a.s.l.

Notes:

1. Operational stockpiles to not exceed 3,000m³ over entire site.
2. All works areas to be progressively rehabilitated in the first growing season following completion. Disturbed areas to be kept to minimum effective operational requirements.
3. All root zone strippings and surface layers to be stockpiled in clearly demarcated and stabilised stockpiles for later rehabilitation works.
4. Final batter grades not to exceed 1 in 3 unless otherwise approved. Batter to varying grades to aid 'natural' integration, including 'rollover' transitions.
5. Place coarse gravel bunds to trap sediment below all stockpiles.
6. Construct culvert crossings where any operational tracks cross all catchdrains.

COLINTON EXTRACTION OPERATION EIS

ENVIRONMENTAL SAFEGUARDS & SITE MANAGEMENT

Portion 22 Parish of Gungoandra Country Beresford
Shire of Cooma-Monaro

Scale 1:2000 June 1992 Figure No. **8**

SECTION 8 CONCLUSIONS

The proposal is for increasing the capacity of an existing extraction area which has been operating for up to 18 years and to put in place improved environmentally sound management practices for the existing approved operation. The proponent's intention is to work the site out to its optimum profile within the constraints of retaining significant ecological, visual and archaeological zones. This is likely to take 19 years, and with further aggradation even longer.

This EIS has comprehensively examined a broad range of environmental issues. The proposed environmental safeguards ensure acceptable levels of environmental impact on all points, plus significant benefits over many alternative areas that provide this essential resource to the Canberra-Queanbeyan market. The site can be successfully managed with appropriate environmental controls. An increase in capacity of the operation allows funding for improved management practices and site rehabilitation works in line with current environmental standards, including rectification of those impacts remaining from previous operators.

The proposal has been planned to avoid sensitive areas and specific measures adopted to ameliorate any impacts that will occur. Subject to adoption of the planning and ameliorative measures put forward in this document, it is concluded that the proposed development will provide a net positive benefit to the community. It will not result in unacceptable adverse impacts to the riverine environment and surrounding landuses.

The final use for the site will be grazing of the existing pasture paddock. The alluvial flats will have limited economic use due to the limited palatable grass cover it can sustain. This area will therefore have the potential for further plant community succession to a more indigenous species cover and mix.

The proposal should therefore proceed with an increased extraction capacity until the site is worked to its final profile and rehabilitation.

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Note: References used in the Archaelogical Study are listed in that report (Appendix D).

APPENDICES

Consultation with
Government Authorities

APPENDIX A

In the course of preparing this Environmental Imnpact Statement, consultations by letter, telephone and/or meetings were held with the following government bodies:

- Cooma-Monaro Shire Council
- Department of Planning
- Environment Protection Authority
- Department of Conservation and Land Management
- National Parks and Wildlife Service
- Department of Water Resources
- Roads and Traffic Authority
- NSW Agriculture
- Department of Mineral Resources
- Forestry Commission of NSW
- Electricity Commission of NSW
- Cooma Rural Lands Protection Board
- ACT Planning Authority

Correspondence received from these government bodies is included in this Appendix.

New South Wales Government

Department of Planning

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX . 15 Sydney

Telephone : (02) 391 2000 Ext: 2081
Fax No : (02) 391 2111

Contact : P. Weiner

Our reference : Q92/00036

Your reference :

P.D. Rochford
Director, Margules Groome Poyry Pty. Ltd
P.O. Box 4362
KINGSTON ACT 2604

Dear Sir,

Proposed Rock Crusher and Screening Plant Allied to Increased Extraction Capacity on Portion 22 and 23, Parish of Gungoandra, County Beresford

Thank you for your letter of 16 April 1992 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. As development consent is required for the proposal and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, as amended, an EIS must accompany the development application to the Cooma-Monaro Shire Council. The EIS shall be prepared in accordance with clause 34 of the Regulation and shall bear a certificate required by clause 26(1)(b) of the Regulation (see Attachment No. 1).

3. In addition, pursuant to clause 35 of the Regulation, the Director requires that the following matters be specifically addressed in the EIS:

- A discussion of likely cumulative impacts of sand extraction on the Murrumbidgee River;
- Traffic generation and impact on the road system; and
- The results of consultation with the Department of Water Resources, Department of Conservation and Land Management - Division of Soil Conservation, and the Environment Protection Authority.

4. Attachment No. 2A and 2B are guides to the type of information most likely to be relevant to the development you propose. These guides are not exhaustive and not all of the matters raised may be appropriate for consideration in the EIS for your proposal.

5. In preparing your EIS you should approach the Cooma-Monaro Shire Council and take into account any comments Council considers may apply to its determination of the proposal.

6. Should you require any further information regarding this matter please do not hesitate to contact us again.

Yours faithfully

B Adams 19-6-92

B. Adams
Manager
Assessments and Major Hazards Branch
As Delegate for the Director

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS

In accordance with Part IV of the Environmental Planning and Assessment Act, 1979, an environmental impact statement (EIS) must meet the following requirements.

Pursuant to clause 34 of the Environmental Planning and Assessment Regulation, 1980, as amended, the contents of an EIS shall include the following matters:

(a) full description of the designated development proposed by the development application;
(b) a statement of the objectives of the proposed designated development;
(c) a full description of the existing environment likely to be affected by the proposed designated development, if carried out;
(d) identification and analysis of the likely environmental interactions between the proposed designated development and the environment;
(e) analysis of the likely environmental impacts or consequences of carrying out the proposed designated development (including implications for use and conservation of energy);
(f) justification of the proposed designated development in terms of environmental, economic and social considerations;
(g) measures to be taken in conjunction with the proposed designated development to protect the environment and an assessment of the likely effectiveness of those measures;
(g1) details of energy requirements of the proposed development and measures to be taken to conserve energy;
(h) any feasible alternatives to the carrying out of the proposed designated development and reasons for choosing the latter; and
(i) consequences of not carrying out the proposed development.

The EIS must also take into account any matters required by the Director of Planning pursuant to clause 35 of the Regulation, which may be included in the attached letter.

The EIS must bear a certificate as required by clause 26(1)(b) of the Regulation.

DEPARTMENT OF PLANNING
ATTACHMENT NO 2A

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR AN EXTRACTIVE INDUSTRY

A definition of extractive industry may be found in paragraph (n) to Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended). These industries are operations undertaken for the purpose of mining sand, gravel, clay, turf, soil, rock, stone or similar substances. The definition of extractive industry specifically excludes coal, petroleum or minerals which are prescribed under the Mining Act, 1973. Extractive industries may take the form of dredging operations, quarrying operations, turf farms or various forms of land excavation etc. Processing of extracted material on the same site as the winning of the material may also constitute an extractive industry.

Extractive industries have prompted considerable public controversy in the past since, among other things, they affect visual amenity, generate heavy vehicle movements, raise dust and cause disturbance through noise and blasting. This is the prime reason for designation of extractive industries under the Environmental Planning and Assessment Act, 1979.

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for extractive industries. It is intended to assist the preparation of the EIS. However, it is the applicant's responsibility to identify and address as fully as possible the matters relevant to the specific development proposal in complying with the requirements for EIS preparation (see Attachment No 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of an extractive industry. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the Council) and the Department of Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

2/...

The EIS should address the compatibility of the proposal with any regional strategy for extractive industries in the area and with the provisions of the Local Environmental Plans for existing and proposed development.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved (highlighting any proposed crushing or blasting), disposal of wastes, landscaping and site rehabilitation. A description should also be provided of associated operations such as the transport of materials and use of the end product if likely to have environmental implications.

Particular details that may be relevant include:

. Characteristics and economic significance of the resource.
. Possible availability of alternative resources.
. Quantity of materials to be extracted.
. Details of any blasting and/or crushing.
. Effects of vibrations.
. Type of machinery and equipment to be used for dredging and stockpiling operations and for any processing plant.
. Expected life of the operation.
. Hours of operation.
. Details of necessary stockpiling.
. Access arrangements - truck routes, truck numbers etc.
. Site drainage and erosion controls.
. Proposals for rehabilitation.

2. Description of the Environment.

This should provide details of the environment in the vicinity of the development site and also of aspects of the environment likely to be affected by any facet of the proposal. In this regard, physical, natural, social, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development.

3. Analysis of Environmental Impacts.

Environmental impacts usually associated with extractive industries are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

. The flow of any affected rivers or watercourses.
. The effect of the extraction on the sediment transport rate of any affected rivers or watercourses.
. The bed and bank stability of any affected rivers during and after completion of the operations and any need for recurrent maintenance dredging.
. Any possible siltation, sedimentation or downstream effects of the operation.
. Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.

- Details of floods and any likely effects of the operation on flood liability of surrounding lands.
- The possible effects of flooding on the operation.
- Effects on flora and fauna.
- The agricultural viability of the landholding.
- Likely noise/vibration disturbance caused by the operations, including transport operations, on nearby residences.
- Other impacts of trucking movements, including access over railways and onto highways.
- Dust nuisance likely to be caused.
- Effects on water quality of nearby watercourses.
- Disposal of waste material.
- Effects on the visual environment.
- Any likely affectation of sites of Aboriginal archaeological or European heritage value if located in the vicinity of operations.
- Impact of the operations on navigation aspects for all types of shipping (commercial, recreational, etc).

In addition, any potential for hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- The Environment Protection Authority in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- The Department of Mineral Resources concerning its responsibilities under Sydney REP No 9 Extractive Industry;
- The Department of Water Resources concerning the implications of the proposal on their jurisdiction;
- The Department of Conservation and Land Management (Soil Conservation Service) regarding appropriate erosion control and rehabilitation procedures;
- The Department of Agriculture if prime agricultural land may be affected by the proposal;
- The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if aboriginal places or relics are likely to be affected.
- The Maritime Services Board in relation to navigational aspects of shipping; and
- The Public Works Department in relation to hydrological impacts and relevant legislative requirements.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

DEPARTMENT OF PLANNING

ATTACHMENT NO. 2B

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR CRUSHING GRINDING OR MILLING WORKS

An EIS is required to be completed, pursuant to paragraph (k), Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended), for crushing, grinding or milling works, being works in which more than 200 tonnes per annum of rock, ores, minerals, chemicals or natural grain products are processed by crushing, grinding, milling or separating into different sizes. The reason for designation is that developments of these types have the potential to create considerable public nuisance due to noise, dust, odours and wastes which affect air and water quality.

(N.B. When determining the capacity of the works in this regard, it is considered reasonable to take into account the daily working hours, the working week and working year normal for such a plant and the maximum production rate of the plant to be installed).

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for a crushing grinding or milling works. It is intended to assist the preparation of the EIS. It is the applicant's responsibility to identify and address, as fully as possible, the matters relevant to the specific development proposal in complying with the statutory requirements for EIS preparation (see Attachment No. 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of such work. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the council) and the Department of Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works, existing and proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

The extent to which the supply of raw materials and access to markets for the finished product has determined the location of the plant in preference to alternative sites should be stated.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved, wastes created and landscaping. A description should also be provided of associated operations such as the transport of materials and the use of the end product if such use is likely to have environmental implications.

Particular details that may be relevant include:

- Characteristics and economic significance of the product.
- Plans of operation.
- Any proposals for future expansion, including staging and timing.
- Capacity of plant now and in the future.
- Sources and quantities of raw materials.
- Type of machinery and equipment to be used.
- Expected life of the operation of the plant.
- Number of persons to be employed.
- Hours of operation.
- Means of storage, location, quantity and details of necessary stockpiling.
- Types and quantities of finished products and details of any storage required.
- Access arrangements - truck routes, truck numbers, parking, etc.
- Site drainage and erosion controls.
- Water supply requirements.

2. Description of the Environment.

This should provide details of the environment in the vicinity of the development site and also of aspects of the environment likely to be affected by any facet of the proposal. In this regard, physical, natural, social, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development.

3. Analysis of Environmental Impact.

Potential environmental impacts usually associated with these types of operations are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

- Likely noise disturbance caused by the operations, including transport operations, on nearby residences, particularly at night.
- Other impacts of trucking movements, including access across railways and on to highways.

. Potential for air pollution, including odours, organic vapours and particulate matter.
. Water management: including water requirements and the separating of clean and contaminated runoff before discharge; water treatment; quality and quantity of effluent for disposal.
. Treatment and disposal of waste material.
. Effects on the visual environment.

In addition, any potential for fire hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

. The Environment Protection Authority in regard to air, water and noise impacts and relevant pollution control legislation requirements;
. The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if Aboriginal places or relics are likely to be affected;
. New South Wales Agriculture should be contacted if prime agricultural land may be affected by the proposal.

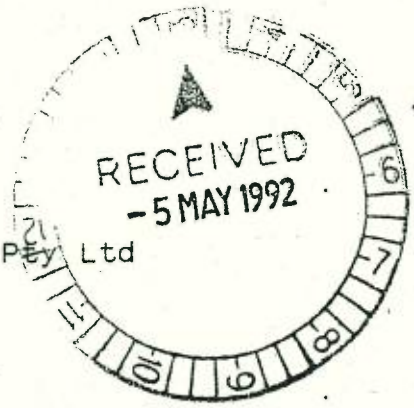
It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

EPA

Environment
Protection
Authority
New South Wales

Unit 1
Robert Lowe Building
30 Lowe Street
PO Box 622
Queanbeyan
NSW 2620

Telephone .062. 99 3330
Facsimile .062. 99 3525



The Director
Margules Groome Poyry Pty Ltd
PO Box 4362
KINGSTON ACT 2604

Our Reference: 290,036A/1
Your Reference: TJK:SMM

ATTENTION: MR J DAWSON

Dear Sir,

I refer to your letter dated 16 April 1992 concerning a proposal to expand production and facilities at Amey Bros., Bredbo premises.

The Authority's requirements in relation to the Environmental Impact Statement (EIS) for the proposal concern the minimisation or prevention of air, water and noise pollution and the methods proposed to achieve this.

In addition to the proposal, the EIS should address the deficiencies of the current operations and incorporate proposals which will remedy these deficiencies.

Further to obtaining Council Development Consent, the proponent will be required to obtain the Authority's approval under Section 17 of the Pollution Control Act before commencing installation of the proposal.

The Authority's approval will not be granted until such time as Council has granted its Development Consent, however the application could proceed concurrently with your Development Application. In general, an application for Pollution Control Approval will require similar information to that given above, but needs to be supported with technical details sufficient to demonstrate the prevention or minimisation of pollution.

If you have any enquiries, please do not hesitate to contact this office on (06)2993330.

Yours faithfully,

T J KNOWLES
for Director-General

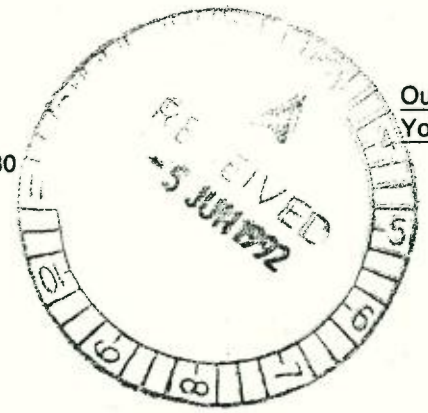
- 4 MAY 1992

New South Wales Government

Soil Conservation Service

QUEANBEYAN DISTRICT OFFICE

2nd Level, Morrissett House
7-9 Morrissett Street, Queanbeyan.
Postal Address: PO Box 189, Queanbeyan. 2620
Phone: (06) 2976477 & 2976677 Fax: (06) 2972280



Our reference:
Your reference:

Mr Jamie Dawson,
Margules Groome Poyry P/L,
PO Box 4362,
KINGSTON NSW 2604

Dear Mr Dawson,

EIS FOR PROPOSED ROCK CRUSHER AND ASSOCIATED INCREASED EXTRACTION VOLUME, COLINTON.

The Department of Conservation and Land Management is now concerned with matters relating to both soil conservation and public land management. The EIS should cover the points listed below, which incorporate both of the aforementioned functional areas.

1. Soil Conservation Considerations

i) the nature of the land and soil resources at the site, highlighting erosion potential, topsoil depth and any other qualities relevant to the management of the operation;

ii) measures to be employed to ensure soil loss during the life of the operation is minimised. This would include the programme for staging the extraction and the associated programme for rehabilitation, topsoil management and native vegetation retention;

iii) final rehabilitation of the site;

iv) Protected Lands - land within 20 metres of mean water level are designated as "protected" under Section 21 of the Soil Conservation Act, and any clearing of trees and shrubs within this zone would need to be the subject of an application to this Department.

2. Public Land Management

i) the track leading from the pit to the highway traverses Crown Land. Use of this track should be formalized by way of a licence, upon which certain conditions may be set to safeguard the Crown Land. The Goulburn Office of the Department should be contacted to obtain the relevant approvals (Mr Robert Cole, 048 230655).

ii) the Department may prepare a Land Assessment under the Crown LAnds Act (1989) over the Crown Land in the medium term. Subject to the conclusions of that assessment, it may be necessary in the future to review the licence for access.

iii) the extractive operation should not adversely affect the bed or banks of the Crown Land to the north of the site.

If you have any queries on this matter, please do not hesitate to contact me.

Yours faithfully,

2.6.92

Peter Fogarty,
Soil Conservationist.

File No.: F2018

Our Ref.: SF0071:KN

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Director
Margules Groome Poyry Pty Ltd
PO Box 4362
KINGSTON ACT 2604

25 May 1992

Dear Sir/Madam

Re: Environmental Impact Statement for Rock Crushing Operation, Portions 22 and 23, Parish Gungoandra, Cooma-Monaro Shire.

I refer to your letter of 16 April 1992 seeking advice on Service requirements in regard to this development.

The Murrumbidgee River system has a very high potential for containing Aboriginal Sites; specifically assemblages of stone artefacts. These may be stratiful in alluvial context and are therefore of high scientific values.

The sand extraction operation has never been subjected to an archaeological survey because it was established many years ago. It is not known therefore, whether sites have been or are being destroyed.

You are advised that an archaeological survey will be required of all areas to be affected by the installation of screening and crushing plants, road construction and any extension of the boundaries of the existing sand pit. This inspection should be undertaken by a qualified archaeologist in consultation with the relevant Local Aboriginal Land Council.

Secondly, the natural heritage values of the site also require consideration in the EIS. The vegetation and faunal values of the area need to be assessed with particular attention to the possibility of the occurrence of native grassland remnants and/or rare fauna species or their habitat including legless lizards such as *Delma impar* or *Aprasia paraphulchella*, other reptiles such as the Dragon *Tympanocryptis lineata*, or rare mammals such as the Squirrel Glider, Koala and Platypus, all of which are known from the broad area.

Yours faithfully

Sue Feary
Regional Archaeologist
for Director

South Eastern Region
Level 1, 34 Lowe St
Queanbeyan NSW
2620 Australia
P.O. Box 733
Queanbeyan 2620
Fax: (06) 297 4851
Tel: (06) 297 6144

Roads and Traffic Authority
South Coast Division

RTA

153 Auckland Street
Bega
New South Wales 2550
Telephone (064) 92 1600
Facsimile (064) 92 3369
PO Box 399
Bega NSW 2550
DX 4908

Our reference:88/M407 RSC:MJC
(Enquiries: Robert Clarke)
Your reference: NK

P D Rochford
Director
Margules Groome Poyry Pty Ltd
PO Box 4362
KINGSTON ACT 2604

Attention J Dawson

PROPOSED ROCK CRUSHER AND SCREENING PLANT ALLIED TO INCREASED EXTRACTION CAPACITY AT APPROVED SAND AND GRAVEL OPERATION, COLINTON, NSW. PROPOSED EIS.

Dear Sir

In your EIS please consider the impact of the development on the Monaro Highway traffic safety.

This should include intersection layout and sealing for 50 m along the access road at the junction with the Monaro Highway so as to minimise mud and dust settling on the highway pavement.

Yours faithfully

for Damien Naughton
Divisional Engineer

FILE: DESIGN/88M407 MJC

New South Wales Government

NSW Agriculture

Central West, South East and Illawarra Region

P.O. Box 53,
ORANGE, NSW 2800
AUSTRALIA

Telephone: (063) 638 250/251
Facsimile: (063) 638 356

Margules
Groome
Poyry Pty Ltd
PO Box 4362
KINGSTON ACT 2604

Our Ref: AJD/KG

12 June 1992

Dear Sir,

RE: Proposed Rock Crusher and Screening Plant at Colinton, NSW

The site of this proposal has been inspected by an officer of NSW Agriculture. The following site specific issues have been identified as needing addressing in the proposed Environmental Impact Statement.

1. A full rehabilitation program for the site needs to be addressed in the Environmental Impact Statement. The protection of the riparian vegetation strip has been identified as critical to the maintenance of river water quality.

2. The control of the spread of noxious weeds over the disturbed quarry site requires addressing in the Environmental Impact Statement.

3. Stabilization of any stored topsoil and the prevention of silt reaching the river also requires addressing.

4. The fuel and lubricants used in the extraction process need to be stored in a secure bunded compound.

5. NSW Agriculture would be pleased to review the Environmental Impact Statement when it is completed.

Yours faithfully,

D J McDonald
REGIONAL DIRECTOR
NSW AGRICULTURE

DEPARTMENT OF MINERAL RESOURCES

NEW SOUTH WALES GOVERNMENT

MINERALS AND ENERGY HOUSE
29-57 CHRISTIE STREET
CORRESPONDENCE PO BOX 536
ST LEONARDS NSW 2065
DX 3324 ST LEONARDS
TELEPHONE (02) 901 8888
FACSIMILE (02) 901 8777

Margules Groom Poyry Pty Ltd
PO Box 4362 Kingston ACT 2604

Attention: Mr Paul Rochford

Dear Sir,

RE: Environmental Impact Statement, Sand Extraction at Colinton

I refer to your letter of April 16 concerning the EIS being prepared for sand extraction at a site north of Bredbo.

It should be noted that as sand is not classified as a mineral under the Mining Act, 1973, this Department has no statutory control over the mining of this commodity other than the responsibility, under the Mines Inspection Act, 1901, for ensuring the safe conduct of mining operations. However the Department is the principal government authority responsible for assessing the State's construction material resources and for advising State and local government on the planning and management of these resources.

In your letter you mention that the purpose of the study is to assess the impact of increasing current production from 7000 cubic metres to 30,000 cubic metres per year. You further indicate that a rock crusher and screening plant is to be installed.

In the following section I have listed the issues of concern to this Department which should generally be addressed in an EIS for this type of extractive operation. All of these items should be addressed in your study.

* The characteristic of the sand resource, particularly its size and quality.

* Details of the exploration methods used in determining the resource size (with reference to any supporting documentation.

* Quantity of material to be extracted and the rate of extraction.

* Proposed operation period.

* A Mine Plan including methods of extraction and final pit shape.

* Location and size of stockpiles and the disposal of waste materials.

* Proposed transport routes.

* An assessment of noise, vibration, dust and visual impacts and details of measures proposed to minimize such impacts.

* Proposed rehabilitation procedures, during and after completion of extraction operations. The proposed final use for the site.

* The document should demonstrate that the proponents are aware of their responsibilities under the Mines Inspection Act 1901, as amended.

Please note that the Mines Inspector with responsibility for this site is Mr Paul Raferty, who is based in Wollongong (telephone 042-26 8359). Mr Raferty should be consulted on any matters related to the requirements of the Mines Inspection Act.

As this proposal is an extension of an existing operation no specific items need to be addressed other than those listed above. If you have any further enquiries then please contact Peter Lewis, Senior Geologist/Southern Region, telephone 02-901 8372.

Yours faithfully,

25·5·92

Mr G. Oakes/Acting Programme Manager
for Director General

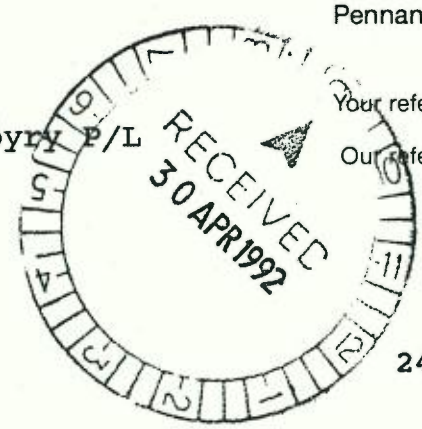
*

Forestry Commission of N.S.W.

LETMM3
7096G-BB

Building 2
423 Pennant Hills Road
Pennant Hills, N.S.W. 2120

The Director
Margules, Groome, Poyry P/L
P.O. Box 4362
KINGSTON ACT 2604



Your reference: 16.4.92

Our reference: 7096G EAU
B.BROOKER:MM
(02) 980 4285

24th April 1992

Dear Sir,

**PROPOSED SAND AND GRAVEL DEVELOPMENTS,
COLINTON, NSW**

Your advice has been forwarded to the Regional Forester, Batemans Bay, who is responsible for the particular area and will respond to you direct.

Yours faithfully

PETER S. SMITH
Manager, Envir.
Assessment Unit

ADDRESS ALL MAIL TO:
BOX 139, YASS 2582

Southern Region Yass
Perry Street, Yass
Telephone (06) 226 9666
Facsimile (06) 226 2806

Quote Ref.: GRID/YASS/PL/WLB

Mr P D Rochford
Margules Groome Poyry Pty Limited
PO Box 4362
KINGSTON ACT 2604

Dear Sir,

Re: Proposed Rock Crusher and Screening Plant at Sand and Gravel Operation Colinton, NSW

I refer to your letter of 16 April, 1992 and the locality map attached.

Pacific Power has no transmission lines in the immediate vicinity of the proposed development. Consequently the Pacific Power has no specific requirements pertaining to the form and content of the environmental impact statement, nor any objection to the proposed development.

Yours faithfully,

J B LEWIS
ACTING AREA MANAGER/YASS
11th May 1992

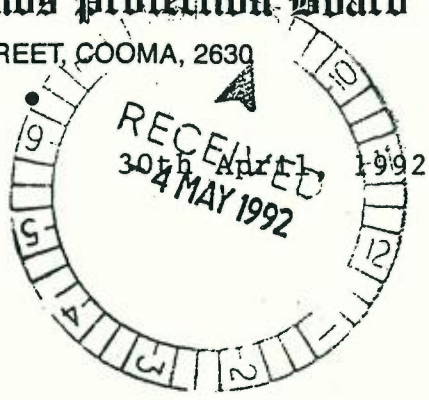
TELEPHONE: COOMA (064) 52 1122
VETERINARY INSPECTOR (064) 52 1202
FAX (064) 52 4982

Address all Communications
to the Secretary
P.O. Box 29
Cooma 2630

Cooma Rural Lands Protection Board

5 DAWSON STREET, COOMA, 2630

POC:DM



30th April, 1992

The Director,
Margules Groome Poyry Pty Ltd
P.O. Box 4362
KINGSTON A.C.T. 2604

Dear Sir,

Subject: Proposed increased extraction Colinton N.S.W.

Following discussion of the propsal as per your correspondence of the 16th April, 1992, the Directors of the Board have instructed me to inform you that they have no objections to the proposal outlined.

Thanking you for your consideration in this matter.

Yours faithfully,

P.O. Crowley
Secretary.

1974 Correspondence approving
Sand and Gravel Extraction

APPENDIX B

MONARO SHIRE COUNCIL

COUNCIL CHAMBERS, BOMBALA STREET, COOMA

Your Reference_____

Our Reference 98/2/49(ss)

Telephone Enquiries J.G.Tynan

Telephone: 21799 Cooma

Communications to be addressed to:

THE SHIRE CLERK,

Box 172,

COOMA, N.S.W., 2630

30th July, 1974

Subject: Development Application - Removal of Sand and Gravel from Portions 22 & 23, Parish Gungoandra, County Beresford.

Dear Sir,

It is advised that your application to remove sand and gravel from Portions 22 and 23 Parish Gungoandra, County of Beresford will be approved by Council subject to the following conditions:

1. There shall be no pollution of the Murrumbidgee River or any watercourse caused by any action taken in the removal of the material.

2. The maintenance of the public road of access, commencing at State Highway 19 and including ramps and gateways if used by the haulage trucks, shall be the sole responsibility of the applicant. Regular maintenance is to be carried out and the road is to be maintained to the standard required by Council.

   (It is pointed out that you must obtain the consent of the Lands Department before any work is carried out on the section of public road within the reserve.)

3. Adequate measures are to be taken to control any dust or noise nuisance.

It would be appreciated if you could indicate your acceptance of the above requirements in writing when the matter will be determined.

Mr. C.V.Povey,
"Glenroy",
COLINTON. N.S.W. 2694

Yours faithfully,

(A.M.Garrard)
Shire Clerk

MONARO SHIRE COUNCIL

COUNCIL CHAMBERS, BOMBALA STREET, COOMA

Your Reference_____

Our Reference 98/2/49(ss)

Telephone Enquiries A.M.Garrard

Telephone: 21799 Cooma

Communications to be addressed to:

THE SHIRE CLERK,

Box 172,

COOMA, N.S.W., 2630

27th February, 1975

Subject: Develo-ment Application - removal of sand and gravel from Portions 22 and 28, Parish Gungoandra, County Beresford.

Dear Sir,

Your letter of acceptance of the terms and conditions of operation of the above development dated 2nd September, 1975 is acknowledged and Council now confirms its approval of the said operation.

Yours faithfully,

(A.M.Garrard)
Shire Clerk

Mr. C.V.Povey,
"Glenroy",
COLINTON. N.S.W. 2694

Fauna and Flora
Species Listing

APPENDIX C

TABLE C.1 - Vegetation Species List

Sites: 1 river edge; 2 alluvial flats; 3 low escarpment slope east of pit; 4 regenerating woodland on higher slopes; 5 improved pasture.

Life form FAMILY *Species name* * = introduced species	Common Name	Sites 1	2	3	4	5
Trees						
CUPRESSACEAE						
Callitris endlicheri	Black Cypress Pine		2	3	4	
MYRTACEAE						
Eucalyptus bridgesiana	Apple Box		2	3	4	
Eucalyptus melliodora	Yellow Box				4	
Eucalyptus pauciflora	Snow Gum		2		4	
Eucalyptus viminalis	Manna Gum		2			
SALICACEAE						
* *Populus* sp.	Poplar		2			
* *Salix* sp.	Willow	1				
Shrubs						
ASTERACEAE						
Cassinia longifolia	Cauliflower Bush			3		
Cassinia quinquefaria	Cassinia		2	3	4	
DILLENIACEAE						
Hibbertia obtusifolia	Guinea Flower		2	3	4	5
EUPHORBIACEAE						
Bertya rosmarinifolia				3		
MALVACEAE						
Gynatrix pulchella	Hemp Bush		2			
MIMOSACEAE						
Acacia dealbata	Silver Wattle	1	2	3	4	
Acacia rubida	Redleaf Wattle	1	2	3	4	
MYRTACEAE						
Callistemon sieberi	River Bottlebrush	1				
Kunzea ericoides	Burgan	1	2	3	4	
Leptospermum obovatum	River Tea-tree	1				

Herbs

AMARANTHACEAE						
Alternanthera denticulata		1				
APIACEAE						
Daucus glochidiatus	Australian Carrot		2			
ASTERACEAE						
* *Carthamus lanatus*	Saffron thistle					5
Centipeda cunninghamii	Common Sneezeweed	1				
* *Cirsium vulgare*	Spear Thistle		2			5
* *Conyza albida*	Tall fleabane		2			
Gnapthalium luteo-album	Jersey Cudweed	1				
Helichrysum apiculatum				3		
Helichrysum semipapposum			2	3	4	
* *Hypochoeris radicata*	Flatweed		2	3	4	5
* *Onopardum acanthium*	Scotch thistle		2			5
Senecio linearifolius	Fireweed Groundsel		2			
* *Sonchus oleraceous*	Common Sow Thistle		2			
Vittadinia sp.			2	3	4	
* *Xanthium spinosum*	Bathurst Burr		2			
BORAGINACEAE						
* *Echium vulgare*	Viper's Bugloss		2	3	4	5
BRASSICACEAE						
* *Hirschfeldia incana*	Hoary Mustard		2			5
CAMPANULACEAE						
Wahlenbergia communis	Bluebell		2			
CARYOPHYLLACEAE						
* *Petrorhagia nanteuilii*	Proliferous Pink		2	3	4	
* *Saponaria officinalis*	Soapwort	1	2			
Stellaria pungens	Prickly Knawel		2	3		
CHENOPODIACEAE						
* *Chenopodium album*	Fat Hen	1	2			
CUCURBITACEAE						
* *Citrullus lanatus*	Bitter Melon	1	2			
* *Cucumis myriocarpus*	Paddy Melon	1	2			
EUPHORBIACEAE						
Euphorbia drummondii	Caustic Weed		2			
FABACEAE						
Glycine clandestina	Twining Glycine		2	3		
* *Trifolium arvense*	Haresfoot Clover			3		
GERANIACEAE						
Geranium solanderi	Native Geranium		2	3	4	
HYPERICACEAE						
* *Hypericum perforatum*	St. John's Wort		2	3		
PAPAVERACEAE						
* *Argemone ochroleuca*	Mexican Poppy		2			
* *Escholzia californica*	Californian Poppy		2			
PLANTAGINACEAE						
* *Plantago lanceolata*	Ribwort Plantain		2			
POLYGONACEAE						
* *Acetosella vulgaris*	Sorrel		2	3	4	5

	Persicaria lapathifolia	Pink Knotweed	1	2		
	Polygonum prostratum	Creeping Knotweed	1	2		
	Rumex brownii		1	2		
RANUNCULACEAE						
	Clematis microphylla var. *leptophylla*			2	3	4
RUBIACEAE						
	Asperula conferta	Common Woodruff			3	4
SCROPHULARIACE						
*	*Verbascum thapsus*	Great Mullein		2	3	4 5
SOLANACEAE						
*	*Datura stramonium*	Common Thornapple	1	2		
*	*Solanum nigrum*	Blackberry Nightshade		2		
*	*Solanum triflorum*	Three-flowered Nightsh		2		
URTICACEAE						
	Urtica incisa	Scrub Nettle		2		
VERBENACEAE						
*	*Verbena bonariensis*	Purple Top	1	2		

Graminoids

CYPERACEAE						
	Carex appressa			2		
*	*Cyperus eragrostis*	Umbrella Sedge	1			
	Bolboschoenus medianus		1			
	Schoenoplectus validus	River Club Rush	1			
JUNCACEAE						
	Juncus usitatus	Common Rush	1			
LILIACEAE						
*	*Asparagus officinalis*	Asparagus	1			
	Dianella revoluta			2	3	4
POACEAE						
	Agropyron scabrum	Common Wheat Grass		2	3	4
	Agrostis avenacea	Blown Grass	1			
*	*Bromus diandrus*	Great Brome		2		
*	*Bromus madritensis*	Lesser Brome		2		
	Danthonia caespitosa	Wallaby Grass		2	3	4
	Danthonia laevis	Wallaby Grass		2	3	
	Danthonia racemosa var. *racemosa*			2	3	
	Dichelachne micrantha	Short-haired Plume-Gr		2	3	4
*	*Eragrostis curvula*	African Lovegrass	1	2	3	4 5
*	*Nassella trichotoma*	Serrated Tussock		2		
	Panicum effusum	Hairy Panic		2	3	4
*	*Paspalum dilatatum*	Paspalum	1	2		
	Paspalum distichum	Water Couch	1	2		
*	*Phalaris aquatica*	Phalaris	1	2		
	Phragmites australis	Common Reed	1			
	Poa labillardieri	Tussock Snow Grass		2		
	Poa sieberana var. *sieberana*	Snow Grass			3	4
	Stipa scabra ssp. *falcata*	Spear Grass		2	3	
	Themeda australis	Kangaroo Grass			3	4

XANTHORRHOEACEAE				
Lomandra longifolia	Spiny Matrush	2	3	4
Ferns				
ADIANTACEAE				
Cheilanthes sieberi	Rock Fern		3	

TABLE C.2 - List of birds observed in the study area in May 1992

Little pied cormorant	*Phalacrocrax melanoleucos*
Pacific black duck	*Anas suerciliosa*
Australian hobby	*Falco lingipennis*
Wedge-tailed eagle	*Aquila audax*
Dusky moorhen	*Gallinula tenebrosa*
Black-fronted plover	*Charadrius melanops*
Crimson rosella	*Platycercus elegans*
Red-rumped parrot	*Psephotus haematonotus*
Welcome swallow	*Hirundo neoxena*
Flame robin	*Petroica phoenicea*
Scarlet robin	*Petroica multicolor*
Jacky winter	*Microeca leucophaea*
Golden whistler	*Pachycephala pectoralis*
Grey shrike-thrush	*Colluricincla harmonica*
Superb fairy wren	*Malurus cyaneus*
White-browed scrubwren	*Sericornis frontalis*
Weebill	*Smicrornis frontalis*
Brown thornbill	*Acanthiza pusilla*
White-throated treecreeper	*Climacteris leucophaea*
Brown-treecreeper	*Climacteris picumnus*
Yellow-faced honeyeater	*Lichenostomus chrysops*
Yellow-tufted honeyeater	*Lichenostomus melanops*
Brown-headed honeyeater	*Melithreptus brevirostis*
White-naped honeyeater	*Melithreptus lunatus*
Spotted pardalote	*Pardalotus punctatus*
Silvereye	*Zosterops lateralis*
Red-browed firetail	*Emblema temporalis*
Australian magpie	*Gymnorhina tibicen*
Australian raven	*Corvus coronoides*
Blackbird *	*Turdus merula*
Starling *	*Sturnus vulgaris*
European goldfinch *	*Carduelis carduelis*

TABLE C.3 - **Vertebrate wildlife species (excluding birds and bats) which may occur in, or near, the Murrumbidgee River in the study area. For information on birds see (Taylor (1987)).**

*Introduced species.

FISH	
Macquarie perch	*Macquaria australasica*
Murray cod	*Macullochella macquariensis*
Golden perch	*Plectroplites ambiguus*
Silver perch	*Bidyanus bidyanus*
Mountain galaxias	*Galaxias olidus*
Western carp gudgeon	*Hypseleotris klunzingeri*
Gambusia *	*Gambusia affinis*
Rainbow trout *	*Salmo gairdneri*
Brown trout *	*Salmo trutta*
European carp *	*Carassius cyprinus*
AMPHIBIANS	
Lesueur's stream frog	*Litoria lesueurii*
Whistling tree frog	*Litoria verreauxi*
Eastern banjo frog	*Limnodynastes dumerili*
Common eastern froglet	*Crinia signifera*
REPTILES	
Long-necked tortoise	*Chelodina longicollis*
Red-bellied black snake	*Pseudechis porphyriacus*
Eastern brown snake	*Pseudonaja textilis*
Water dragon	*Physignathus lesueuri*
Striped skink	*Ctenotus robustus*
Water skink	*Eulamprus heatwolei*
Three-toed skink	*Hemiergis decresiensis*
Delicate skink	*Lampropholis delicata*
Grass skink	*Lampropholis guichenoti*
Red-throated Skink	*Leiolopisma delicata*
MAMMALS	
Platypus	*Ornithorhynchus anatinus*
Grey kangaroo	*Macropus giganteus*
Common wombat	*Vombatus ursinus*
Common brustail possum	*Trichosurus vulpecula*
Bush rat	*Rattus fuscipes*
Eastern water rat	*Hydromys chrysogaster*
Black rat *	*Rattus rattus*
House mouse *	*Mus musculus*
Rabbit *	*Oryctolagus cuniculus*
Fox *	*Vulpes vulpes*
Cat *	*Felis cattus*

Archaeological Survey

APPENDIX D

AN ARCHAEOLOGICAL SURVEY OF A SAND AND GRAVEL EXTRACTION AREA, COLINTON, NSW.

Kelvin Officer and Kerry Navin

June 1992

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Report to Margules Groome Pöyry Pty Ltd

TABLE OF CONTENTS

SUMMARY

A comprehensive archaeological survey was carried out over an area of approximately 33ha, in Portion 22, Parish of Gungoandra. The survey team comprised two archaeologists and three representatives of the Bodalla Local Aboriginal Land Council.

Six Aboriginal archaeological sites (C1-C6), were found in the course of the survey, all of which were located to the east of the flood channel. No sites were located on the poorly sorted gravel deposits and recent sand terraces west of the flood channel. The potential for sites to exist in these areas is considered to be low.

Sites C1, C2 and sections of C3 and C6 are unlikely to be affected by quarrying activities.

Sites C4, C5 and sections of C3 occur on an alluvial terrace formation consisting of sandy silts. C4 and sections of C3 have been previously disturbed by quarrying activity.

Sites C6 and portions of C3 have moderate archaeological potential and should be protected from quarrying and associated impact.

A 'Consent to Destroy' from the Director of the NSW National Parks & Wildlife Service will be required for a portion of Site C4, to enable continued quarrying and use of an existing stockpile area east of the flood channel.

Application should be made to the Director of the NSW NPWS for a permit to collect artefact no.1 at the C1 site.

The terrace deposit which is located to the east of the flood channel is considered to be an archaeologically sensitive zone. When and if quarrying of the terrace sediments is anticipated *beyond the existing quarry exposure*, subsurface testing by a qualified archaeologist must be conducted prior to the commencement of quarrying.

A small levee deposit adjacent to C3 should also be conserved due to the potential for subsurface artefactual material in this area.

INTRODUCTION

A sand and gravel extraction operation has been conducted within Portions 22 and 23, Parish of Gungoandra, County of Beresford, in the Cooma-Monaro Shire since 1974. It is now proposed to install a crushing plant to process material extracted from the quarry.

The NSW National Parks and Wildlife Service (NPWS) noted that to date no archaeological survey had been carried out within the extraction area. The Service advised the proponent of the development that the Murrumbidgee River corridor had a very high potential for containing Aboriginal sites - specifically assemblages of stone artefacts in alluvial contexts which may be stratified. Such sites would be of high scientific value. Consequently a survey of all the areas to be affected by the installation of screening and crushing plants, road construction and any extension of the boundaries of the existing sand pit was recommended by the NPWS .

This report documents the archaeological survey for Aboriginal sites within Portions 22 and 23. The report was commissioned by Margules Groome Pöyry Pty Ltd and forms part of the EIS for the proposed development.

The objectives of the archaeological study were:

- to carry out an archaeological survey of the study area,
- to identify and record any Aboriginal sites and relics within the study area,
- to assess likely impacts and make appropriate recommendations to mitigate impact on any identified sites, and
- to consult with the Bodalla Local Aboriginal Land Council (BLALC).

Report Outline

This report:

a). Describes the environmental setting of the study area,

b). Provides an archaeological background for the study area,

c). Describes the field survey and results,

d). Documents consultation carried out with the BLALC, and

e). Provides management recommendations for the study area.

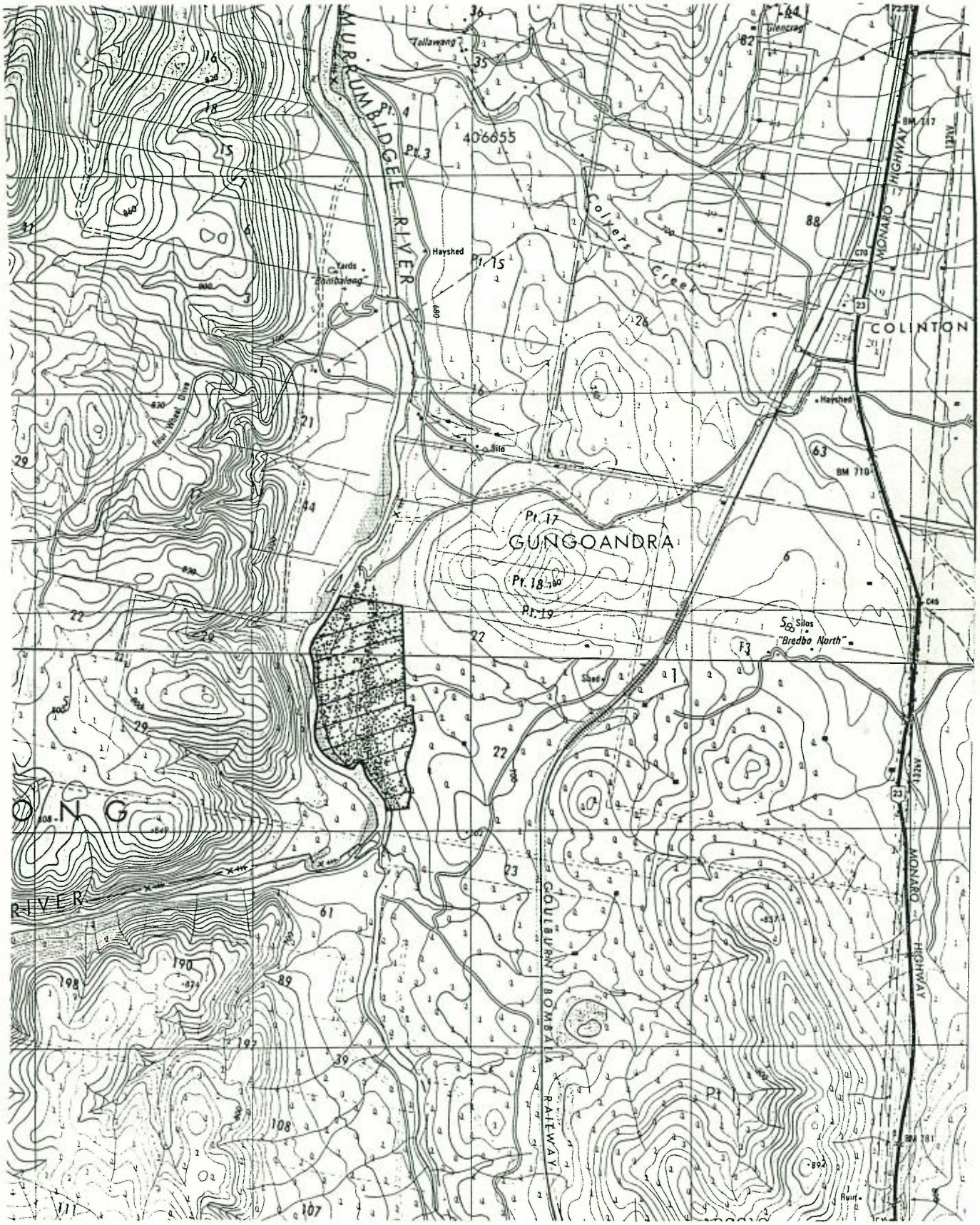

Figure 1: Location of Study Area, showing transects and varying intensity of survey coverage (stippled). (Colinton and Bredbo 1:25000)

ENVIRONMENTAL CONTEXT

Regional Overview

The Murrumbidgee River forms the major fluvial corridor within the southern portion of the Southern Tablelands. This region of the tablelands is characterised by a series of roughly north-south orientated ranges and valleys which correspond to underlying tectonic blocks of folded metamorphosed and igneous rocks. As the dominant drainage alignment in the region, it is not unreasonable to theorise that the Murrumbidgee River corridor would have been a major access route and economic focus during the prehistoric occupation of the area.

The course of the Murrumbidgee River has been defined by the topographically dominant Murrumbidgee faultline. The river generally runs parallel and adjacent to the faultline which is described by the steeply inclined slopes and ranges immediately to the west. These hill slopes form an erosional scarp that mark the eastern extent of the steeply graded country of the Murrumbidgee Batholith. The fluvial corridor is relatively narrow and alternates between narrow flat bottomed valleys typified by flood plain alluvial features, and steep-sided valleys with minimal sedimentation or valley fill deposits.

The study area occurs within a narrow portion of flood plain adjacent to Colinton, and associated with the west flowing tributary valleys of Colyers and Gungoandra Creeks. Immediately to the west of the river, the Mt Clear Range rises abruptly along the Murrumbidgee faultline to 700m above the valley floor. The Colinton floodplain averages 1km in width and is typical of the discontinuous sections of valley infill sediments which make up the Quaternary facies of the Monaro, and Canberra Graben. Immediately upstream and downstream of Bredbo the Murrumbidgee flows through a steep-sided valley within the high relief granitic landscape of the Murrumbidgee Batholith. This culminates in a straight river section called the Colinton Gorge, prior to turning north into the Colinton floodplain.

The topography of the floodplain is characterised by various alluvial, aeolian and colluvial sedimentary features such as alluvial fans and terraces. These sediments have been laid down during the Quaternary according to a complex sequence of depositional and erosional phases corresponding to fluctuations in fluvial sediment loads, slope stability and 'glacial' climatic variations.

There is no published geomorphological research which is specific to the terrace and associated valley infill features of the Murrumbidgee River fluvial corridor adjacent to the Murrumbidgee faultline. The age and palaeo-environments represented by these features therefore remain the subject of conjecture. However, geomorphological research conducted within the wider southern tableland region has identified a number of phases of valley infilling during the Late Pleistocene and Holocene caused by instability and high mobility of surficial sediments (Butler 1967, Walker and Coventry 1976, Coventry and Walker 1977, Williams 1978). The majority of deposits are considered to be glacial and post-glacial in age, and can be grouped generally into three broad age categories: 30-20,000 years ago (late Pleistocene), 12-2,000 years ago (early Holocene), and post European (<200years).

As a generalisation, the last glacial maximum of the late Pleistocene, was a period of high energy sediment deposition and unstable slope conditions. The

drier conditions and sparser vegetation cover of the glacial maximum were replaced in the early Holocene by wetter conditions, more stable landscapes and finer transported sediments. European land clearance and farming techniques have increased the erosion of soils and re-mobilised sediments in increased runoff. As a result, pre-settlement land surfaces have been superimposed by recent layers of sands and silts in actively aggrading landscapes and the bedload of the Murrumbidgee has changed from small cobbles and coarse gravels to sands and fine gravels.

The potentially long time depth of sedimentary accumulation in the alluvial features of the Murrumbidgee fluvial corridor provide considerable potential for archaeological sites to be located within valley fill sediments. However, extended periods of slope instability would also indicate that any open sites not located in an aggrading context, or low energy environment would be unlikely to survive. Similarly, the continuous erosion of terrace features by flooding and the meandering river alignment within a narrow valley context will have minimised the survival of early sites.

Several local areas with a discernible sequence of alluvial terracing have been summarily recorded by Packard (1987a, 1987b). On the eastern bank, three kilometres north of the study area, Packard (1987b) recorded the following sequence:

1a: active river bed

1b: a narrow low terrace, approx. 2m above river level, consisting of relatively poorly sorted beds of sands, silts and gravels. A poorly formed low levee occurs at the riverward edge. The terrace is frequently inundated. Interpreted as relatively recent in origin, possibly post-European.

1c: a well developed relatively level 'middle' terrace, 3-8m above river level, consisting of well sorted sandy silts with grey-brown humic upper levels grading into paler and redder lower beds. A distinctive low levee occurs in places. Bank sections of 3m+ revealed a 'possibly pre-European' soil buried under 50cm of poorly sorted flood deposit containing water deposited charcoals. The terrace has been inundated several times in the last 20 years.

1d: a higher and older terrace was interpreted to be indicated by small discrete pockets of pinkish-brown sandy silt.

Artefacts were only located on the middle and higher terraces. In situ artefacts were recorded 35-50cm below the present surface of the middle terrace feature.

In an area immediately north and bordering the study area, Packard (1987a) noted only two terraces:

2a: a low terrace, 4-6m above river level, consisting of poorly sorted grey-brown silty sands with a slightly raised levee. The terrace has been extensively quarried but shows signs of regular flooding and recent rebuilding.

2b: a higher and older terrace, 10-14m above river level. Sections revealed pale red-pinkish brown sandy silts with no significant pedogenic features apart from a shallow organic upper horizon. A

late Pleistocene or early-mid Holocene age was suggested for this terrace.

Artefacts were noted as occurring within the older terrace but no in situ material was recorded.

Within the ACT, the presence of elevated gravel terraces and flood splay deposits have been noted as providing evidence of greater river flow competence during earlier Holocene or Pleistocene river regimes (NCDC 1988: sites SU5 and SU8: p14, 21).

Considerable archaeological survey work has been conducted on the sand bodies of the Southern Tablelands, as these are the main source of construction sands for the Canberra region. The Tableland sand bodies fall into three main categories, each including several variants: *alluvial*, either poorly sorted river-bed deposits, or sandy silts and gravels within floodplain deposits; *lacustrine*, either variably sorted beach ridge deposits, or deltaic deposits; *or aeolian*, well sorted deposits occurring in either source bordering dunes adjacent to rivers (sandy) or lakes (sandy and/or clay rich), or broad sand sheets and mantles (Packard 1986a).

This report concerns the proposed quarrying of alluvial sources of sands and gravels. They consist of river-bed sand deposits, point bar and relict deposits of sands and gravels, and sands and sandy silts from various alluvial terrace contexts.

The Study Area

Location

The study area is located on the Murrumbidgee River, 8km north of Bredbo. Figure 1. The area consists of approximately 33ha along a 1.5km section of the eastern bank of the River, situated immediately downstream of the 'Colinton Gorge', and 3km southwest of 'Colinton' on the Monaro Highway. The study area falls within, and includes the western boundary of portion 22, Parish of Gungoandra, in the County of Beresford.

Geology

Bedrock within the study area consists of the 'Colinton Volcanics' which include rocks of Silurian age including dacite, shales, and tuff (Browne 1943, Strusz 1979). Low surface outcrops occur in the southern portion of the study area associated with the present river bed and banks.

Geomorphology

The study area includes the present river bank and flood channels, shoal and point bar deposits, and associated terraces and basal slopes located within an inside curve of a moderate meander of the Murrumbidgee River. A portion of bedrock controlled hillslope on the preceding outside meander curve is also included. An intermittent tributary drains to the river in the middle of the study area. Low ridges descend to the river at the northern and southern margins of the study area.

The study area can be divided according to four landform groups: the present riverbed and flood channels; associated fluvial terraces and deposits; an alluvial fan; and valley basal slope deposits.

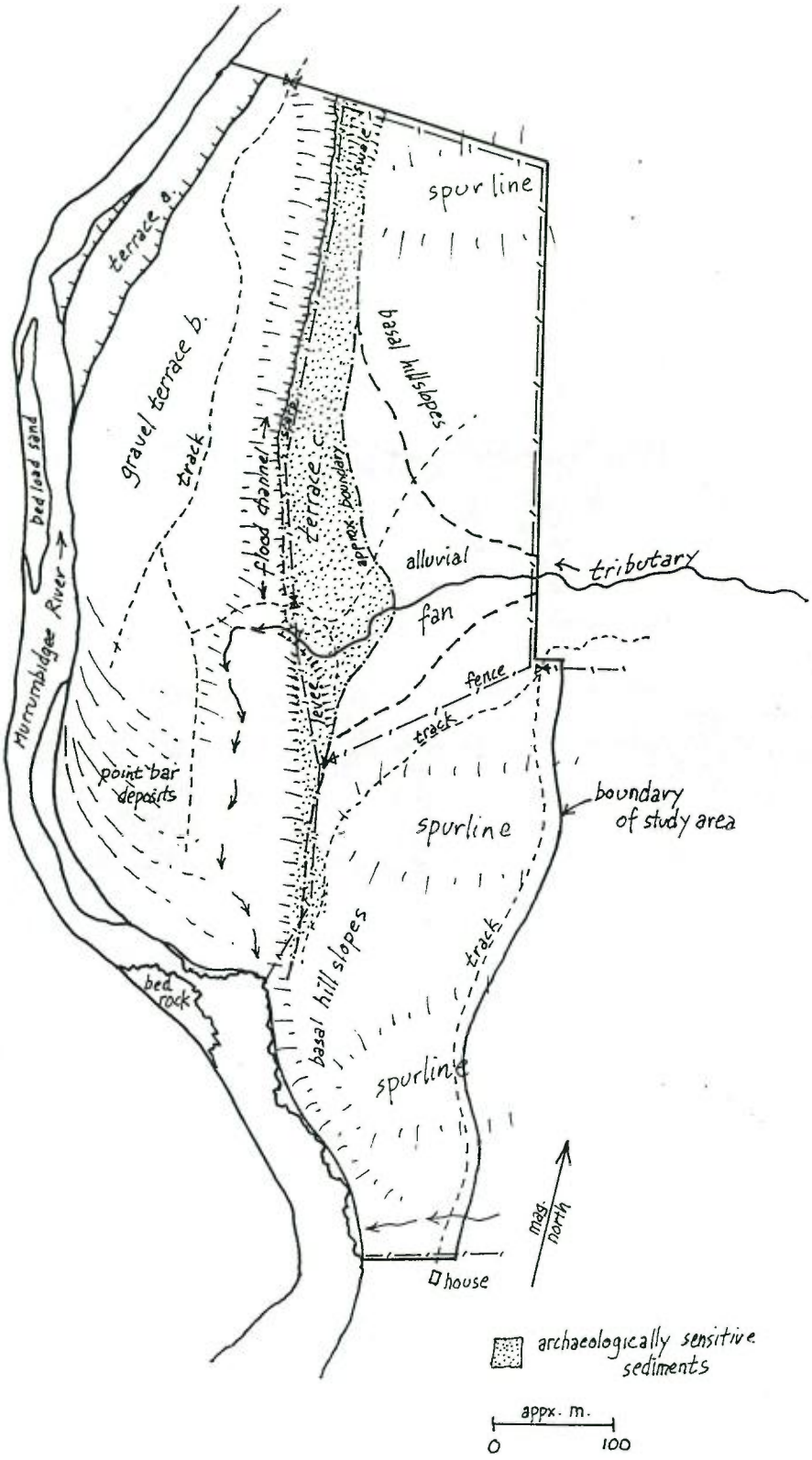

Figure 2: Sketch plan of study area (based on aerial photographs) showing different landscape units and the location of archaeologically sensitive deposits.

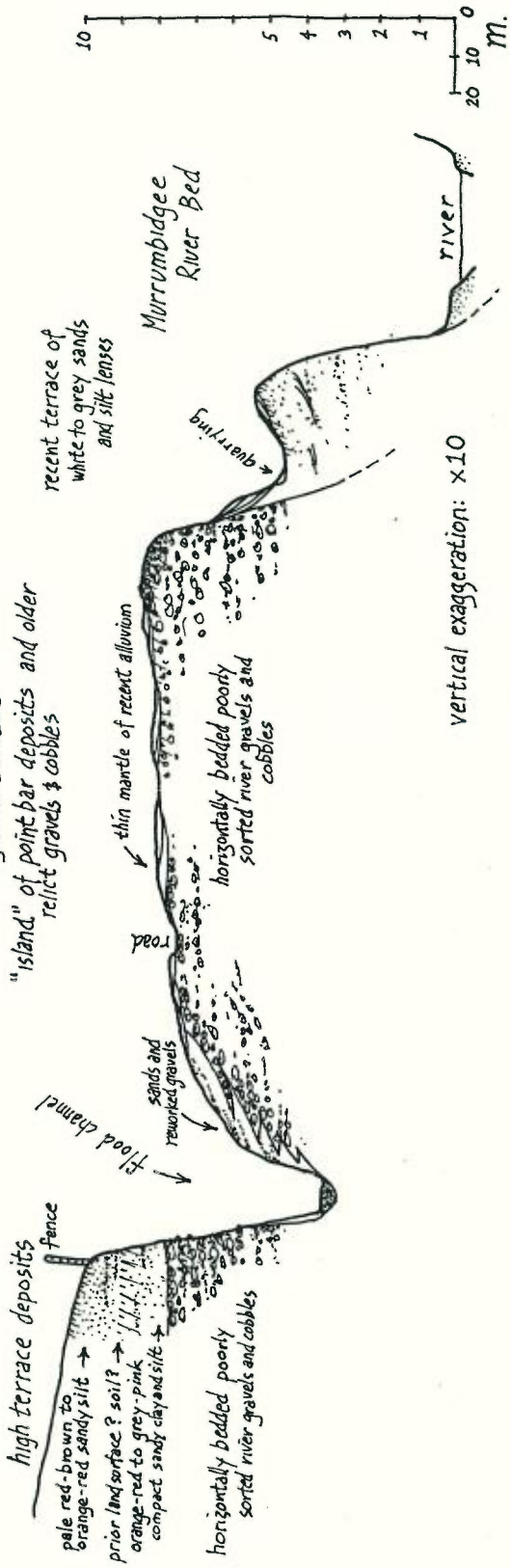

Figure 3: Actual section through alluvial terraces located in the northern end of the study area (location shown in Figure 6).

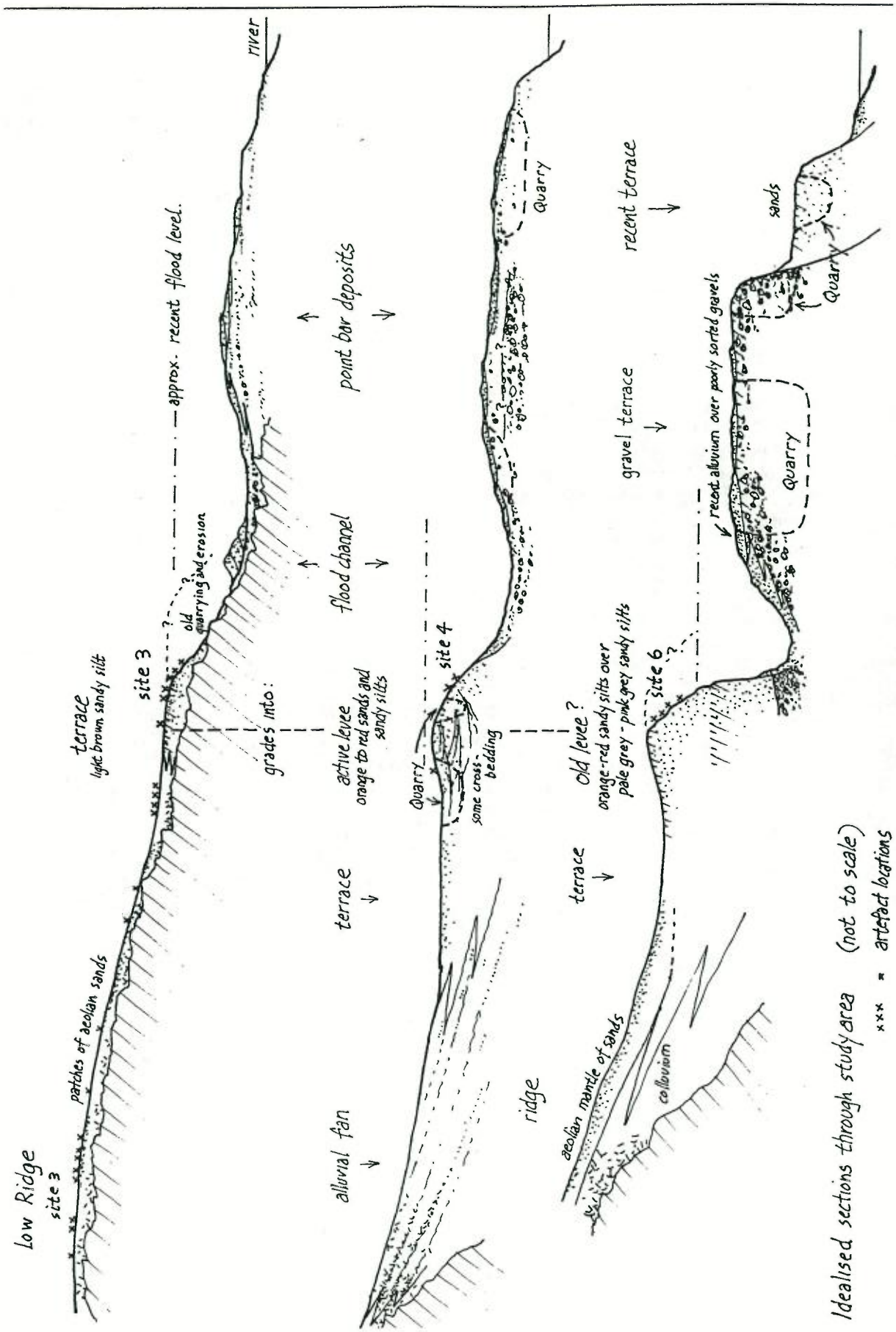

Figure 4: Idealised sections (not to scale) through the southern, middle and northern sections of the study area, showing site locations relative to the varying sediments and depositional units revealed in the eastern bank of the flood channel.

The present riverbed is characterised by a bedload of sand and fine gravels. Plate 1. Relatively shallow discontinuous deposits of grey to white sands occur within the contemporary high energy flood zone. Plate 2. A flood channel, up to 2.5m above the present river level, truncates the meander which forms the western study area boundary. Figures 2-4, Plates 6-7 & 12. The channel has created a section through various terrace sediments up to 10m high. The eastern bank of the flood channel forms the eastern boundary of the present river high energy flood zone . Well sorted sandy silt deposits occur to the east, poorly sorted gravels and recent sand deposits occur to the west.

At least three terrace formations are identifiable in the study area.

a: The youngest is a low and narrow terrace, up to 4m above the present river level, best developed as a narrow margin to the present riverbed in the northern end of the study area. Figures 2-4 & 6, Plates 2-3. The terrace consists of grey to white sands and fine gravels with narrow lenses of silt toward the top. The terrace appears to be frequently inundated and is related to the present bedload sedimentary regime. It is therefore interpreted to be recent, and potentially post-European in origin. This terrace is probably continuous with Packard's 2a terrace.

b: Behind the recent terrace is a higher compact deposit of horizontally bedded but poorly sorted silts and sands, fine and coarse gravels, and small cobbles. The deposit forms a terrace around 6m above the present river level which dips to the east and south. There is no evidence of buried soil horizons and only a slight build-up of humic material has occurred in the upper layers. Figures 2-4 & 6, Plate 4. The deposit has accumulated in a high energy environment and probably represents an accumulation of flood deposits together with shoal and point bar deposits within an inside river curve. The coarse fractions in these gravels are no longer transported in the contemporary bed load of the river. The degree of rounding on even the largest cobbles indicates a long transport history and the terrace appears to be a relict feature relating to an earlier period when the river had a greater competency and transported coarser material.

   Within the eastern bank of the flood channel the gravel deposit is exposed in section and is overlain by an extensive accumulation of sandy silts. Plate 5.

c: The eastern bank of the flood channel has exposed a long section of variable terrace sediments. Figures 2-4 & 6, Plates 6, 8-12. The bank varies in height from 7-12m above the present river level. Disturbance from channel erosion and sand mining have obscured morphological clues about the sequence or the potential discreteness of depositional units. The embankment thus presents a vertical progression of slightly differing facies. The southern portion consists of a light brown sandy silt, 8m above the present river level, which directly overlies bedrock.

   This grades into a well formed levee immediately south of the mouth of a small tributary. Plate 10. The levee is less pronounced on the northern side of the tributary and disappears as the bank increases in height. The levee is probably actively aggrading during high flooding events. The northern portion of the levee and terrace has been trenched by mining operations revealing brown loams and sandy silts overlying brown-orange silty sands. A thin layer of water transported

charcoal can be traced through this deposit, indicating a previous land surface with a medium sloped creek gully. The adjacent contemporary creek gully is now more entrenched. The upper brown sediments are probably indicative of post-European deposition, however this was the only section showing this type of recent sediment. Away from the creekline, and toward the north, the terrace sediments consist of orange-red to pinkish brown sandy silts. An extensive section in a sand quarry trench has exposed shallow crossbedding in at least the upper layers, with varying amounts of grey silt. Plates 8-9.

Further northward the channel bank increases in height and the terrace sediments exposed in the section become clearly differentiated. The underlying poorly sorted gravels have been previously mentioned. Above these at least two lighter grey horizontal horizons can be distinguished within an orange-red to grey-pink sandy silt. Plate 12. These units may represent periods of land surface stability and consequential pedogenesis. The units appear to have undergone leaching and contain a considerable clay fraction within the sandy matrix. These layers are overlain by pale red-brown to orange-red sandy silts. The upper layers are a darker red, possibly indicating less leaching and a younger age. The highest portion of the bank at the northern end of the study area, (around 13m above present river level) appears to retain a remnant of a relict levee associated with the formation of the uppermost sediments. Plate 13.

The terrace sediments exposed in the bank of the flood channel appear to represent various depositional phases and probably represent a considerable time depth. Packard's 2b terrace unit, recorded in the adjoining northern land portion, may be identical with the northern bank sediments. His 1c, and possibly 1d, terraces 3km further north contain similar sediments and may also be related. The original deposition of the gravel terrace may date to the late Pleistocene or early Holocene. The later sandy silt terrace deposits could extend from a similar age into the mid to late Holocene.

Beyond the terrace deposits bordering the flood channel is a small alluvial fan associated with the limited catchment of the small tributary. The fan sediments probably interdigitate with the fluvial terrace facies.

The basal slopes of the river valley contain sandy soils with a large component of aeolian sands, presumably blown from the sand deposits of the fluvial corridor. Soils appear to be thicker on the slopes at the northern end of the study area, and relatively shallow on the low ridge at the southern end.

Vegetation

The area has been substantially cleared of original vegetation. Relict patches of trees and low shrubs provide a scattered open woodland within an extensive pasture grassland. *Eucalyptus Bridgesiana* is the predominant tree type. Poplar trees have been planted in some areas. Willow trees have become established along the river banks. Introduced pasture grasses and weeds such as African Love Grass and exotic weeds dominate the ground cover.

ARCHAEOLOGICAL BACKGROUND

The Aborigines of the Bredbo region were the Monaro tribe who spoke the Ngarigo language (Tindale 1974, Eades 1976). Their territory extended over most of the Monaro Tablelands and covered over 15,000km^2 (Tindale 1974). In the early 19th century, at the time of first European contact, the population of the Ngarigo was estimated at around 500 to 600 (Helms 1895:388; Hancock 1972:67). The Aboriginal population of the Monaro district quickly declined with the increase in the white population, and the inevitable affects of European diseases and alienation from tribal lands. The last `full blood' Aborigine is reported to have died in Cooma around 1916 (Cooma-Monaro Historic Society 1959:2 in Djekic 1982).

Summary of Previous Studies in the Region

Archaeological surveys and investigations have been carried out in the Southern Tablelands region for many years. Studies have been conducted within both academic research and commercial cultural resource management frameworks.

Flood's pioneering work of 1973, later published in 1980, presented an overview of the state of knowledge concerning the highland Aboriginal culture at that time. Flood noted a number of factors which may be responsible for the location of campsites and argued for a settlement pattern which focused on riverine corridors. She concluded that sites were generally located on well-drained and elevated ground within 100m of a water source, but rarely at the waters edge (Flood 1980:158-168).

Results from several subsequent studies tend to support Flood's model. Barz & Winston-Gregson (1981) in their survey of the Murrumbidgee River Corridor (MRC) located sixty two prehistoric sites between Angle Crossing and Kambah Pool. They concluded that 'in a statistically significant number of cases sites were located at a median altitude in relation to the surrounding terrain: neither at the bottom of the valleys nor on the top of hills' (p27). It appears that site locations were focused on flattened hilltops and small terraces above the valley floor, these areas providing warm sheltered locations above the cold air drainage of the river valley bottom.

Unifacially flaked quartzite river pebble choppers were the most common artefact type found, while cores, notably chert horsehoof cores, were the second most common artefact type. Raw materials also included quartz, chalcedony, jasper and sandstone 'grinding plates' (Barz and Winston-Gregson 1981:22-23).

Navin (1991) located several sites in equivalent locations on the Murrumbidgee River near Oaky Creek, approximately 11km north of the intersection of the (northern) ACT border and the Murrumbidgee River.

Various other surveys have, however, identified sites immediately adjacent to creeks and on low ground. These include Attenbrow and Hughes (1983), Attenbrow (1984) and Paton (1984 & 1985). Paton (1985) suggests that micro-regional variations in the archaeology of the southern tablelands are responsible for sites being located in these areas.

Paton (1985) located fourteen surface scatters of artefacts, one stone quarry and six isolated finds during a survey of the Cooma to Royalla 132kV transmission line route. He concluded that river valleys generally, though

not necessarily including the actual river bed and banks, have a high archaeological potential.

Comber (1989) investigated a number of stone quarries on the Southern Tablelands. One site, referred to as the Bredbo Quarry (NPWS Site No:57-5-21), is located 700m south of Cappanana Creek and 8km southeast of Bredbo. Ordivician chert was quarried at the site, however bedding planes within the lithic material limited its use to small tools. The material was transported away from the site in blocks (blade blanks) which were then fashioned into tools (pers comm Comber). Comber's research identified differing intensities of quarry exploitation and a local distribution of transported material.

Sand and gravel mining areas on the southern tablelands have been the subject of investigations by a number of archaeologists including: Baker et al (1984); Baker & Feary (1984); Ferguson (1988); Gaffey (1991); Hamm (1987); Hughes et al (1984); McBryde (1975); Officer & Navin (1991); Packard (1984a, 1984b, 1986a 1986b, 1987a, 1987b and 1988); Stone (1988) and Thomas & Gillieson (nd).

Several of these surveys have been conducted in the Bredbo area. Packard (1986b) surveyed a 12ha area comprised almost entirely of river sands and fine gravels on the Bredbo River, 3km south-east of Bredbo. No sites were located in the course of the survey. Hamm (1987) carried out a preliminary survey of an area on the Bredbo River, 5km south-east of Bredbo. No sites were located. Gaffey (1991) did not locate any sites in a survey of an area approximately 210 x 240m, 3kms north of Bredbo.

Officer and Navin (1991) surveyed an area of approximately 76ha, including part of Portion 99 and all of Portion 100, Parish of Callaghan, and adjacent river gravels within the Murrumbidgee River channel, approximately 9km south of Bredbo. Two open artefact scatters were located in the course of this survey. One of these sites (Murrumbucca 2) was estimated to contain 300-500 artefacts located (discontinuously) over an area of approximately 19ha. The almost exclusive exploitation of the adjacent and extensive point bar deposits of gravels and cobbles was indicated. This site was located on the level shoulder of a ridgeline and associated low relief spurs and gullies.

Officer and Navin (1991:14) predicted that similar river cobble exploitation sites would occur elsewhere in the local region where elevated well drained ground is situated adjacent to extensive Murrumbidgee River gravel deposits.

In August of 1991 an Aboriginal burial involving two individuals and significant grave goods was found in an alluvial terrace northeast of Bunyan, 30km south of the present study area. This burial is the first of its kind to be archaeologically recorded within a terrace context in the northern Monaro (Feary and Pardoe 1992). Skeletal material was dated to around 6000 years before present and was located within a terrace of fine black sediments estimated to date to a period between 10-2,000 years ago. The find reinforces the potential for burials to be located within terraces made up of fine sediments within the Murrumbidgee River valley.

Recent studies conducted by ANU students in the Numeralla River valley have suggested that high site densities and dense artefact concentrations can be expected in close proximity to the major fluvial corridors of the Monaro (Ian Farrington pers.com. 1992).

Archaeological Sites in Sand Bodies

Packard's detailed studies of archaeological sites in sand deposits (1984a, 1984b, 1986a) have indicated that:

* while river-bed sand deposits and immediate river-bank deposits do have the potential to contain significant sites, their potential is generally lower than that of other types of deposits;
* sand deposits with slopes up to 7°contain a wide range of sites while those with slopes much steeper than this rarely contained any substantial sites which could be considered archaeologically significant;
* surface artefact densities are often much lower or negligible compared with sub-surface densities;
* sub-surface artefactual material in sand bodies has mostly been found between 10-50cm below the surface, with some material found at 70cm;
* most sites so far located have been inferred to be mid to late Holocene or younger in age;
* observed differences in artefactual densities both within and between local sand deposits may be interpreted as being the result of such variables as site slope, location, micro-climate, age of deposit, degree of disturbance or sediment removal;
* although ethnographic records indicate that in this region burials occurred in rocky, gritty (sandy) or clayey deposits, burials in sand deposits are of such low numbers that they have very low archaeological visibility.

Previously Recorded Sites Within the Local Area

A computer search of the NSW NPWS sites register database revealed one recorded site within a 10km radius of the study area. The site, NPWS Site No 57-5-2, is located near Cockatoo Creek, several kilometres north east of the present study area, and to the east of the Monaro Highway. The site comprises 15 stone artefacts (Paton 1985).

Packard (1987a & b) carried out a preliminary archaeological assessment of the bed and true right bank of the Murrumbidgee River from the boundaries of the present study area north for approximately 3km. These areas comprise Portions 19, 18 and 17, Parish of Gungoandra (1987a) and Portions 35, 36, and 55, Parish of Colinton and Portion 3, 4, 15 and 16 Parish Gungoandra (1987b).

Moving from north to south Packard located

* artefacts exposed *in-situ* 35cm-50cm below the surface in the undercut banks at the very northern extent of the middle terrace [1c]. 'Along approximately 40m of exposed bank there were several small quartz flakes and split quartz pebbles, 1 hammerstone and one possible grinding stone or manuport' (1987b:4).
* 'a general low density scatter of flaked quartz and siliceous river pebble artefacts and three small areas of greater raw material density that were relatively *raw material distinct* along a well developed middle terrace [1c], 3m-8m above river level in Portions 35 and 36 (1987b:4).

  Packard describes these concentrations as comprising '5 flaked quartz river pebbles and one silcrete flake in an area of 10m x 15m. Fifty metres south a concentration of 8 red silcrete flakes and flaked pieces and 1

quartz flake was found. The third concentration was found towards the end of the southern quarried area. This consisted of more than 15 red silcrete microblade technology artefacts...at a density of approximately 1/3m^2' (1987b:4).

* 'A very few artefacts (less than 1/500m^2) were found in the exposed ground on a track on the original upper surface of the middle terrace' [1c], (1987b:4).
* 'a few siliceous artefacts' on the surface exposures of small, discrete, gently sloping pockets of pinkish-brown sandy-silt above the middle terrace, [1d], (1987b:5).
* two isolated artefacts, 'one a flaked quartz pebble lying at the foot of the eroding banks, the other a small flake on fine grained siliceous rock' lying in disturbed ground on the top of the river banks just outside of his development area in Portions 15 and 16 (1987b:1).
* an 'area with flaked stone artefacts scattered at low densities (approximately 1/25m^2)' along the steep eroding face of a terrace 10-14m above river level in 'the middle part of the area [2b].... These were mostly flaked pieces and flakes from quartz river pebbles although a few flakes and flaked pieces from siliceous river pebbles were also found. In all less than 20 artefacts were found' (1987a:1,2).
* a very low density scatter of artefacts located on the hillslopes above the terraces, situated along an existing graded track upslope from the fence marking the boundary (1987a:2).
* one isolated find in the 'extensively quarried area to the south' [the present study area], (1987a:2).

None of these sites have been entered on the NPWS Site Register. The exact locations of these sites and artefacts are not discernible from the reports as only general landscape descriptions are given, and grid references and maps are not provided.

Where Packard's descriptions allow, it appears that no artefacts were recorded as originating from contexts below middle or higher terraces. The occurrence of both microblade and post-Bondian technologies suggest that site locations are not necessarily related to the geological age of their landscape contexts. It was noted that sites were more likely to survive in sediments protected from subsequent fluvial erosion such as by the aggrading context of inside river meanders. Local area cold air drainage and shadowing by adjacent hills were also suggested as factors influencing the small number of sites located.

Packard concluded that the artefact bearing terrace deposits in portions 35, 36 and 55 could be 'considered to have some degree of archaeological potential' (Packard 1987b:5).

ABORIGINAL PARTICIPATION

The study area falls within the boundaries of the Bodalla Local Aboriginal Land Council (BLALC) which is based at Bodalla, on the NSW south coast.

Ms. Janelle Rotumah, Co-ordinator of the Land Council, was contacted prior to the commencement of fieldwork. The project was discussed with Ms Rotumah and a representative of the BLALC was invited to participate in the field survey of the study area.

Subsequently Ms Rotumah, Mr Alan Mongta (Chairperson of the BLALC) and Ms May Terare participated in the field survey of the area. Recommendations were discussed with these representatives and a written report commissioned from the Land Council.

A copy of the consultants report will be forwarded to the Land Council for their consideration.

THE INVESTIGATION

Review of Existing Documentation

A range of documentation was used in assessing the state of archaeological knowledge for the Bredbo area. This material was reviewed prior to field survey in order to determine if known sites were located in the vicinity of the area under investigation, and to place the area within an archaeological and resource management context. Sources included information contained in archaeological survey and investigation reports archived in the NSW NPWS Register of Aboriginal Sites.

Field Survey and Sampling Strategy

The study area was systematically surveyed on foot in one day by two archaeologists and three Bodalla Land Council representatives. Survey was conducted both systematically, by straight line transects with personnel spaced on average 20m apart, and using less structured traverses, allowing individual and opportunistic inspection over broad and less defined areas. The intensity of survey inspection is graphically indicated in Figure 1.

In areas of severe disturbance created by previous quarrying and earth works, only those features judged to be relict landforms or in-situ deposits were examined in detail. An estimated 60% of the total study area was covered in the survey. Of this, an estimated 40% displayed adequate visibility.

Maps and photographs used during the investigation included:

* 1:25,000 Bredbo topo 1st Edition
* 1:25,000 Colinton topo 1st Edition
* Surveyed plans of the extraction area
* Aerial photos (B&W) Australian Capital Territory Run 29 7584-7604 5/4/68
* Aerial photos Namadgi National Park AUS/C 275 Run 8 690-700 6/4/1991

Visibility

Field survey and its effectiveness is necessarily related to surface visibility, which is a measure of the bare ground visible to the archaeologist during the survey. The predominant factor affecting surface visibility is the degree of vegetation and ground litter. However, secondary deposition of eroded material can also impact visibility.

Visibility in the study area varied but was generally fair. An estimated 40% of the study area afforded adequate visual surface inspection, due mainly to erosion scars on banks, along drainage lines and in quarried areas, stock and vehicle tracks, and denuded areas around stock yards. The nature of the predominant pasture grasses also facilitated ground survey, with grasses growing in tussocks with bare, or sparsely vegetated ground between.

In areas of previous quarrying and earth movement, particularly along sections of the flood channel and associated deposits, visibility ranged from 50-90%. The most effective exposures (in terms of visibility and spatial extent) were encountered in scalds at the break of slopes and to a lesser degree along drainage lines. These provided a fortunate degree of exposure within areas considered to have the greatest archaeological potential.

RESULTS

Six sites were located within the study area, all of which were open artefact scatters. Site locations are shown in Figures 4, 5 & 6.

Colinton One (C1)

Grid Reference: 69236.602716 Bredbo 1:25000 topo.

C1 is located close to the southeastern end of the study area on the basal slopes of a spurline at the edge of an outside curve of the river channel. Artefacts are visible in small discontinuous exposures within an eroded area approximately 10m wide, (extending from the break of slope) and 40m long. The soil appears to be relatively shallow with small bedrock exposures occurring sporadically through the site area. A hatchet head was located on an overgrown and indistinct track which runs along the bank at this point. Plates 14-16. Average artefact density is estimated to be $1/2m^2$. Visibility in the area of the site is 20-40%. Vegetation in the site area comprises scattered medium sized shrubs and a grass cover comprising mostly African Love Grass with some exotic weeds. This site contains a minimum of twenty artefacts.

Recorded Artefact Sample

1. fine grained volcanic alluvial pebble hatchet head (axe): asymmetrically bilaterally ground; percussion marks along 2/3 of margin; fracturing on distal end compatible with use as hammerstone; 85% pebble cortex; 128 x 88 x 39mm. Plates 14-16.
2. oval medium grained volcanic alluvial pebble hammerstone: 100% pebble cortex; percussion marks - battering - around 100% of margin; 84 x 70 x 29mm
3. milky quartz flaked piece: 20 x 10 x 6mm
4. milky quartz flaked piece: 14 x 13 x 7mm

Colinton Two (C2)

Grid Reference: 69261.602727 Bredbo 1:25000 topo.

C2 is a low density artefact scatter located in the southern end of the study area on a low spur approximately 100m upslope from the confluence of the flood channel and the present riverbank. Artefacts occur sporadically in limited soil exposures over an area of approximately 10m x 20m. Surrounding vegetation comprises an open woodland of sapling regrowth and scattered low shrubs. Plate 17. Grass cover consisted predominantly of African Love Grass. The area appears to have been repeatedly ploughed in the past. Visibility in the area varied from 10-30%.

Artefacts

1. red/grey silcrete backed blade: edge damage; 24 x 12 x 5mm
2. milky quartz tabular core: 2 platforms; retouch; usewear; platform preparation; 50 x 41 x 27mm

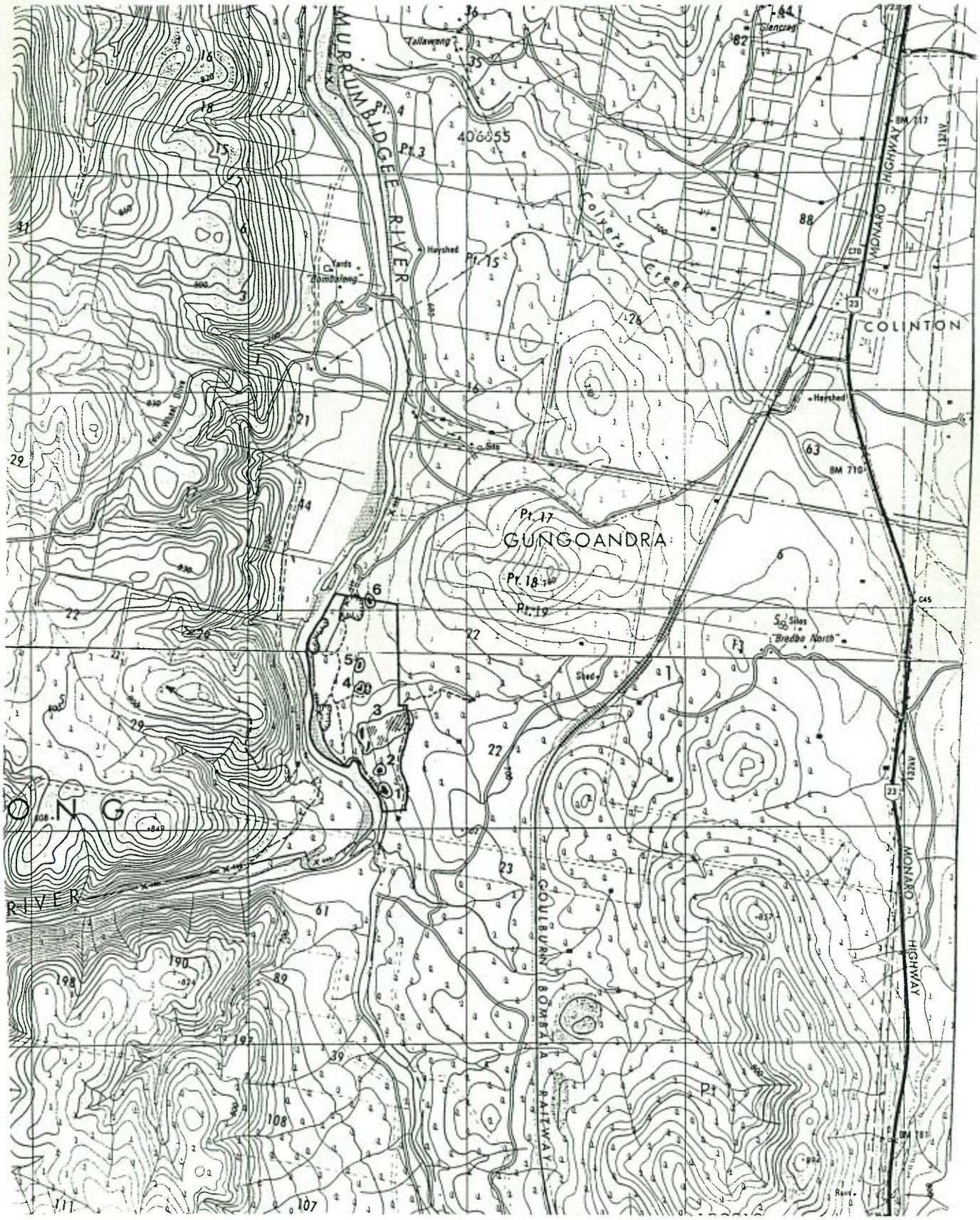

Figure 5: Location of sites recorded during survey (Bredbo and Colinton 1:25,000 topo).

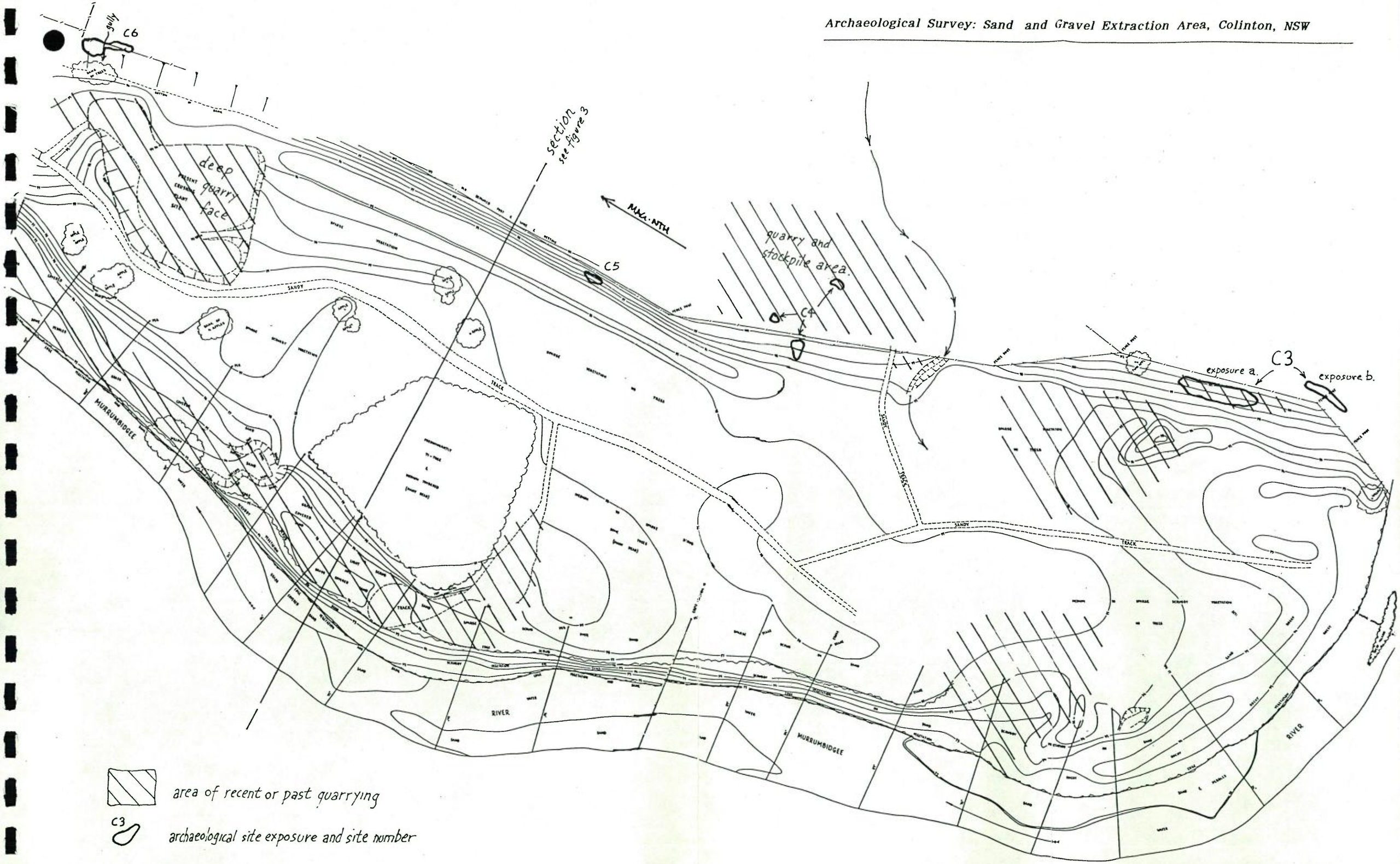

Figure 6: Large scale 1:2000 contour map of deposits situated between the flood channel (right) and the present riverbed (left). Site locations and areas of previous quarrying are shown.

3. fine grained volcanic anvil stone; tabular alluvial pebble; pitting on one surface; probable plough damage; 205 x 140 x 30mm
4. fine grained volcanic hammerstone: 55 x 47 x 50mm

Colinton Three (C3)

Grid Reference: 69255.602740- 69273.602750 Bredbo 1:25000 topo.

C3 consists of six exposures of artefacts located within a total area of 250m x 150m. Plates 7, 17-19. The westernmost exposure (a) is located on a relict portion of an alluvial terrace which now forms the eastern bank of the flood channel. The remaining five exposures are located on basal hillslope contexts behind the terrace, variously located along a low, broad and indistinct spurline. Excepting exposures a and b, all artefact scatters show evidence of considerable disturbance from ploughing and surface ripping. Vegetation consists of pasture grasses with scattered or isolated Eucalypts.

Towards the terrace end, (exposures a and b), groundcover was dense and visibility was only afforded by artificial exposures caused by recent mechanical damage or tracks. It is probable that the site extends beyond the recorded exposures and is located sub-surface within the relict terrace deposits to the south and into the levee formation to the north. Elsewhere, and further upslope, grass cover was more variable and visibility ranged from <10% to 40%. This was a result of shallower soils and a history of ploughing.

Artefacts

Exposure a:

An exposure created by mechanical damage, scraping and possible quarrying along the bank of the flood channel. Plate 19. The exposure covers an area of at least 50m x 10m. Artefacts are distributed across the exposed bank and appear to have been located in the upper layers of the terrace sediments to a depth of around 10-20cm. The sediments consist of a light brown sandy silt, 8m above the present river level, which directly overlies bedrock.

The exposure includes at least 15 artefacts. The following recordings are a random selection.

1. green/blue chert flaked piece: 40 x 25 x 8mm
2. crystal quartz flaked piece: 40 x 21 x 17mm
3. fine grained black chert flake: bulb; platform; 10% pebble cortex; 17 x 19 x 3mm
4. medium grained black chert broken flake: bulb; platform; 30% pebble cortex; 22 x 23 x 4mm
5. green/blue chert flake: recent damage: 55 x 24 x 20mm

Exposure b:

This is an exposure caused by the erosion and downcutting of a vehicular track adjacent to a bend in a fenceline. It is located on basal hillslope deposits adjacent to terrace sediments further downslope. Plate 18. The exposure measures approximately 20m x 5m. Visibility is negligible outside of the exposure.

c10 artefacts were noted within the exposure including quartz, chert and silcrete flakes. The majority of the flakes were less than 40mm in length and may relate to a microblade technology.

Exposure c:

An estimated 5-10 artefacts scattered over an area of around 100m^2 in an area of ploughed pasture, upslope from exposure b.

1. green/blue chert flake: bulb; platform; platform preparation; 34 x 25 x 7mm

2. green/blue chert flake: 55 x 32 x 10mm.

Exposure d:

A low density surface scatter of mostly quartz artefacts in an area of ploughed pasture, north of exposure c and south of the fenceline. An estimated 5-10 artefacts in an area of around 200m^2.

Exposure e:

A low density scatter of artefacts associated with a small area of remnant Eucalypts along the crest of the spur, west of the stock yards and up to and including the access track. The area has been ploughed. the artefacts occur over an area of around 40m x 50m

c15-20 artefacts - chert, quartz

Exposure f:

A low density surface scatter of quartz and chert artefacts within and in the vicinity of the stock yards. An estimated 5 artefacts.

1. large chert core;

Colinton Four (C4)

Grid Reference: 69251.602764 Bredbo 1:25000 topo.

C4 is located on an alluvial terrace and has been recorded in two exposures. The first consists of an eroded grader scrape cut into the bank of the terrace (6m x 4m), 6m north of a gate providing access to a sand extraction area. The section forms part of the eastern bank of the flood channel. Two artefacts (nos 1 & 2) were located on an eroded surface apparently in situ, and possibly 10cm below the original surface. To the east of the fenceline which parallels the flood channel, is an extensive area of recent surface stripping (up to 10cm below present surface), where dark sand and gravels are stockpiled and mixed together. Plates 6, 8-9 & 11. The area is approximately 150m x 80m. Three artefacts were noted within this area (nos 3-5). One in a small ridge of graded soil adjacent to the fenceline, and two in the middle of the scraped area, 30m southeast of the first exposure.

Visibility was negligible outside of the grader scrape situated on the terrace bank. Outside of the large exposure Visibility was relatively good ranging from 10-40%. Within both site exposures visibility ranged from 50-100%. The large scraped area included numerous mechanically imported gravels, making the identification of prehistoric material difficult.

Despite good visibility within an adjacent ploughed field this site was only recorded in mechanically scraped areas. The site is thus interpreted to be substantially sub-surface but probably low(?) in artefact density.

Artefacts

1. fine grained dark grey/blue volcanic core/adze blank: flaked on all sides; rectangular; 10% pebble cortex; in-situ approximately 5-10cm below ground surface; 85 x 50 x 25mm
2. fine grained dark grey/blue volcanic flaked piece: 50 x 50 x 25mm
3. milky quartz core: recent tractor damage; three platforms; 50 x 40 x 38mm
4. milky quartz flake: platform; bulb; 28 x 30 x 9mm
5. milky quartz flake: platform; 32 x 26 x 8mm

Colinton Five (C5)

Grid Reference: 69251.602776 Bredbo 1:25000 topo.

C5 comprises four quartz and one chert artefact exposed along the top 50cm of the terrace embankment in an eroded area 10m x 3m. Plate 20. The bank forms the eastern bank of the flood channel. The terrace sediments comprise orange/red sandy silts which grade into a light brown loamy sand. Visibility ranged between nil and 80% within the exposure and <10% elsewhere. However, 5m to the east, on the eastern side of the fenceline visibility averaged between 5-20% in a ploughed and grassed paddock. No artefacts were found. This site may extend sub-surface to the east of the fence.

Colinton Six (C6)

Grid Reference: 69257.602803 Colinton 1:25000 topo.

C6 is located at the northern end of the study area, at the top of the flood channel embankment, at its intersection with the northern boundary of portion 22. The site consists of a scatter of artefacts mostly located on the upper slopes of a steep embankment and scarp. The artefacts occurred over an area of approximately 30m x 7m. The bank provides a section up to 10m in depth through alluvial terrace sediments, see Plate 13. Despite relatively good visibility (between 0-30%) only four artefacts were found in animal scratchings and tracks above the scarp. The majority of the artefacts are situated on the eroding face of the bank, suggesting that the site may extend sub-surface beyond the scarp. The maximum depth of the material is guesstimated to be around 20cm. The land surface descends away from the scarp to a broad swale, suggesting the convex profile of a relict levee bank.

There is an estimated 30 artefacts exposed at this site, at least a third consisting of milky quartz flakes.

Artefacts

1. quartz flake: 22 x 12 x 4mm
2. grey chert flake: platform preparation; 31 x 24 x 6mm
3. coarse grained milky silcrete flaked piece: 32 x 23 x 19mm
4. milky quartz flake: 53 x 32 x 18mm

5. chert flake (broken): heavily patinated; 20 x 24 x 5mm
6. granular quartz scraper: platform; retouch; 62 x 42 x 20mm
7. coarse grained silcrete flake: platform; bulb; 24 x 22 x 8mm

SURVEY EVALUATION

The comprehensive coverage afforded by the survey strategy, (Figure 1), combined with the relatively good levels of visibility encountered are considered to have provided an effective survey coverage of the study area. The results of the survey fall within the expected archaeological resource for the region and are considered to provide an accurate indication of the nature and location of Aboriginal sites in the study area.

Consistently high visibility levels were encountered on the deposits located within the present high energy flood zone between the present riverbanks and the flood channel. Visibility was afforded by actively worked and previously quarried areas, Figure 6, together with recently flood scoured areas. The majority of these sediments were deposited in high energy environments or post date European settlement. The absence of recorded sites in this zone is therefore considered to be an accurate survey result and is consistent with comparable surveys elsewhere on the local and wider Southern Tablelands region (Packard 1986a & b, 1987a & b; Hamm 1987; Officer & Navin 1991).

An adequate level of visibility was afforded elsewhere in the study area by ploughed or mechanically scraped land surfaces and quarry trenches. An excellent opportunity to inspect the sub-surface deposits of the terrace to the east of the flood channel was provided by a recently excavated trench 20m long and 2.5m deep. Plates 8-9. No artefacts were located in this section. Despite this exposure, and the extensive natural section provided by the flood channel, no artefactual material was found at any significant depth (beyond 50cm for example).

The present investigation supports the results of previous surveys within the local and wider district, which have indicated that sites are most likely to be exposed within fine sediment terrace embankments situated above the high energy zones of the fluvial corridor, or along descending spurs and elevated ground adjacent to large alluvial cobble and gravel deposits.

SITE ASSESSMENT

This section deals with the process of evaluation of the significance of Aboriginal archaeological sites and places of cultural significance.

General

Significance of Aboriginal sites can be assessed according to a range of criteria including:

* scientific or archaeological significance,
* significance to Aboriginal people,
* aesthetic value,
* educational value, and
* representativeness

Many sites will be significant according to several criteria, and these will vary according to the nature and purpose of the evaluation.

Aboriginal significance is the value placed upon a site or site complex by the local or regional Aboriginal community. A site's significance can be the result of several factors including: continuing cultural links with an historic, archaeological or landscape feature, concern for the protection and custodianship of burials, and the value of sites as tangible links with the lifestyle and values of their ancestors.

There are three types of Aboriginal site significance: contemporary, archaeological and sacred.

There are two major components used in assessing *scientific significance*:

1. The potential of a site or suite of sites for scientific research and excavation. The research potential of a site is assessed in terms of its ability to provide information on aspects of Aboriginal culture such as:

   a. broad environmental occupation patterns;

   b. the relationship between adaptations to environmental zones in close proximity such as the mountain and tableland systems;

   c. specific localised patterns of resource exploitation;

   d. variations in specific or localised site usage over time and space;

   e. Aboriginal population density, distribution and movement;

   f. Aboriginal material culture;

   g. post-European Aboriginal history.

2. The representativeness of a site. Site representativeness is a measure of the degree to which sites in the area of investigation are characteristic of sites known elsewhere in the immediate and surrounding region.

The principle aim of cultural resource management is the conservation of a representative sample of site types from different environment areas. Sites with inherently unique features, or which are poorly represented elsewhere in similar environment types, are considered to be archaeologically significant.

The scientific value of a site is most effectively classified according to its degree of archaeological significance within a geographic context. In this way a site can be of low, moderate or high significance within a local, regional or national context.

A site that contains undisturbed cultural evidence, such as *in-situ* sub-surface material, has a high potential for research and future excavation and is therefore of major significance.

The Study Area

The Recorded Sites

Sites **C1**, **C2**, and *exposures c-f* in site **C3** are all indicative of shallow predominantly surface scatters of artefacts. The potential for undisturbed sub-surface material is considered to be low. These sites and exposures are low in artefact density and have probably undergone varying degrees of vertical and horizontal displacement from ploughing, vegetation clearance, and soil erosion. Based on present quarry plans, and the absence of any sediment depth in the vicinity of these exposures, these sites will not be impacted by quarry activities.

Based on the results of this survey, the results of Packard's surveys of adjacent parcels of land and other river corridor surveys in the district, it can be reasonably predicted that this type of site will occur frequently in similar contexts in the local region. These sites and exposures are considered to have low archaeological potential within a local context. The presence of a hatchet head at C1 is noteworthy and the salvage of an accurately provenanced artefact of this type would be desirable.

Exposures a and b in site **C3**, and sites **C4**, **C5** and **C6**, appear to have potential for undisturbed sub-surface artefactual material. However, based on present exposures, only sites C3 and C6 appear to provide any potential for have anything other than low or very low artefact densities. Both of these sites occur in relict terrace features and may have considerable archaeological potential. The potential for a microblade or Bondaian assemblage in **C3** is also of significance. The *a and b exposures* of the **C3** site, together with **C6** are thus considered to have moderate archaeological significance in a local, and potentially regional, context.

Although the **C4** site appears to be substantially sub-surface (based on the presence of artefacts only in erosion or surface stripping), the exposure has been substantially disturbed east of the fenceline by recent quarry activities. Only a small area of unploughed or relatively undisturbed ground occurs west of the fenceline and is subject to bank erosion from flood scouring. Surface indications suggest a very low artefact density. Based on the probable extent of disturbance and the low density, this site is considered to be of low archaeological significance within a local context.

The **C5** site is in a similar topographic context to **C4**, except that the area has not been subject to the same degree of disturbance. The artefacts are exposed in a bank section, and probably continue to the east sub-surface beyond the adjacent fenceline. Like **C4**, artefact density appears to be low. This site could conceivably be impacted by future quarrying of the terrace sandy silts on the eastern side of the fence. Until the sub-surface potential of this site is tested, this site must be considered as having moderate archaeological potential within a local context.

The Colinton sites conform to previously identified regional site location models which emphasise the importance of elevated well-drained ground adjacent to permanent water sources, and the economic significance of the Murrumbidgee corridor (Flood 1980, Bartz and Winston-Gregson 1981, Koettig 1981, 1983, Paton 1985, Officer & Navin 1991).

Archaeologically Sensitive Areas

The sediments occurring between the base of the flood channel and the present riverbed are not considered to be archaeologically sensitive.

The results of the survey indicate that the fine sediments of the terrace which extends to the east of the flood channel must be identified as being archaeologically sensitive. Figure 2. This is based on the focus of artefactual material in this landscape unit, the potential for sub-surface and in situ material associated with the present site exposures, and the optimal location of the terrace as an elevated portion of ground adjacent to permanent water and a source of lithic raw material. The terrace also has the potential to contain burials, although no indication of exposed burials, in the past or in the contemporary context was received by the consultants.

Of particular significance are those portions of the terrace unit and associated levee formations adjacent to sites C3 and C6. Figure 2 & 6. These areas should not be quarried and should be protected from any indirect impacts from quarrying or other land use impacts.

The archaeological sensitivity of the remaining terrace area does not necessarily preclude quarrying activities from these sediments. However it will be necessary to test new or proposed quarry areas in order to gauge the likely impact to potentially occurring archaeological material.

RECOMMENDATIONS

Recommendations in this report are made on the basis of:

* Legal requirements under the terms of the National Parks and Wildlife Act 1974 (as amended) which states it is illegal to deface, damage or destroy a relic or Aboriginal place in N.S.W. without first obtaining the written consent of the Director of the N.P.W.S.

* The results of the investigation as documented in this report.

* Background research into the extant archaeological record for the study area and other sand/gravel extraction areas on the southern tablelands and highlands.

* Consideration of the impact of the activities being carried out within the study area.

* Consultation with the Bodalla Local Aboriginal Land Council.

It is concluded that:

1. There are no archaeological constraints to the future or existing quarrying of those sediments situated between the base of the eastern bank of the flood channel (located approx. 200m east of the present river-bed) and the eastern bank of the present bed of the Murrumbidgee River.

2. The valley infill and terrace sediments situated to the east of the flood channel pose several archaeological constraints to existing and potential future quarrying operations.

It is recommended that:

1. Sites **C1**, **C2**, **C3**, and **C6** should be protected from impact from quarrying activities. Quarrying and associated activities such as stockpiling, access tracks and equipment storage should be excluded from these areas.

2. The portion of the **C4** site located between the fenceline and the flood channel should be protected from impact from quarrying activities. To the east of the fence, the **C4** site has apparently been extensively disturbed by present quarry activities.

3. Application be made to the Director of the NSW NPWS for a consent to destroy that portion of the **Colinton 4** site which lies to the east of the fenceline and which occurs within the ***existing*** area of surface disturbance (150m x 80m) and trenching associated with present quarrying, stockpiling and mixing.

   The consent should be conditional upon an appropriate course of action being implemented (see Recommendation no. 9) in the event that a previously undetected site is uncovered during quarrying. This is of particular importance if a burial is uncovered.

4. The **C5** site exposure (located in the eastern bank of the flood channel, immediately west of the fenceline) should be protected from impact from

quarrying activities. Any proposed extraction of terrace sediments situated within 50m inland of the exposure should be preceded by sub-surface testing by a qualified archaeologist. The sub-surface investigation should be conducted with the aims of identifying the extent of the C5 site, and assessing the degree of site disturbance and its archaeological significance.

5. Application be made to the Director of the NSW NPWS for a permit to collect the ground edge hatchet head recorded as artefact no.1 at the **Colinton 1** site. Subsequent to collection by an appropriately qualified person, this artefact should be recorded and drawn using laboratory techniques (such as microscopic inspection and usewear analysis). After detailed recording the artefact should be provided to the Bodalla Local Aboriginal Land Council for permanent storage and use as an educational aid.

6. Provided an application for consent to partially destroy site **C4** is applied for and consented to by the Director, as per recommendation no.3, and not withstanding recommendation no.9, there are no archaeological constraints to the continuation of quarry operations in the ***existing*** area of surface stripping and grader disturbance located to the east of the flood channel and adjacent fenceline.

7. Any proposed impact to terrace and valley infill sediments outside of existing quarry areas, and located to the east of the flood channel, should be preceded by a program of sub-surface testing by a qualified archaeologist, in order to assess the impact of the works on potentially occurring sub-surface archaeological sites. The extensive use of trenches as sample transects across the proposed impact area is considered to be a feasible methodology, given the nature of the exposed archaeological material, and the sedimentary features. This program could be conducted in conjunction with any geological testing of the sediment deposits.

8. The well preserved levee formation which extends southward from the mouth of the small tributary to the western exposures of site **C3** should be protected from impact and excluded from any future quarrying.

9. The continued extraction of sediments from the study area should be conditional upon the lease owners and operators reporting to NPWS any previously undetected archaeological site, artefact or relic uncovered or unearthed during extraction operations. Discoveries of this sort should be reported immediately to Ms. Sue Feary, Cultural Resource Officer, N.P.W.S., and advice sought on an appropriate course of action.

10. The owner of the portion 22, parish of Gungoandra, should be informed of the need to protect the sites and sensitive areas identified in this report from disturbance from farming activities such as track construction and ploughing.

11. The attention of both the NPWS and the Cooma Monaro Shire Council is directed toward the need to protect sites: **C1, C2, C3, C4, C5,** and **C6** from other sources of disturbance apart from quarrying impact.

12. The attention of the NPWS, the Yarrowlumla, and Cooma Monaro Shire Councils is directed toward the urgent need for a regional cultural heritage management study directed at the fluvial corridor of the Murrumbidgee River. The sediments of this corridor represent a unique potential for prehistoric sites. The assessment of archaeological sites in

the context of increasing sand and gravel quarrying would be greatly facilitated by a regional overview of geomorphological and archaeological factors.

13. All correspondence with the N.S.W. N.P.W.S should be directed to:

    Ms. Sue Feary
    Cultural Resource Officer,
    S.E. Region and Queanbeyan District Office
    NSW National Parks & Wildlife Service
    P.O. Box 733,
    QUEANBEYAN N.S.W. 2620

14. Three copies of this report should be forwarded to Ms. S. Feary for consideration by the N.S.W. N.P.W.S.

15. A copy of this report should be forwarded to:

    Ms. Janelle Rotumah
    Co-ordinator
    Bodalla Local Aboriginal Land Council
    46 Princes Highway
    BODALLA NSW 2545

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APPENDIX A

PLATES

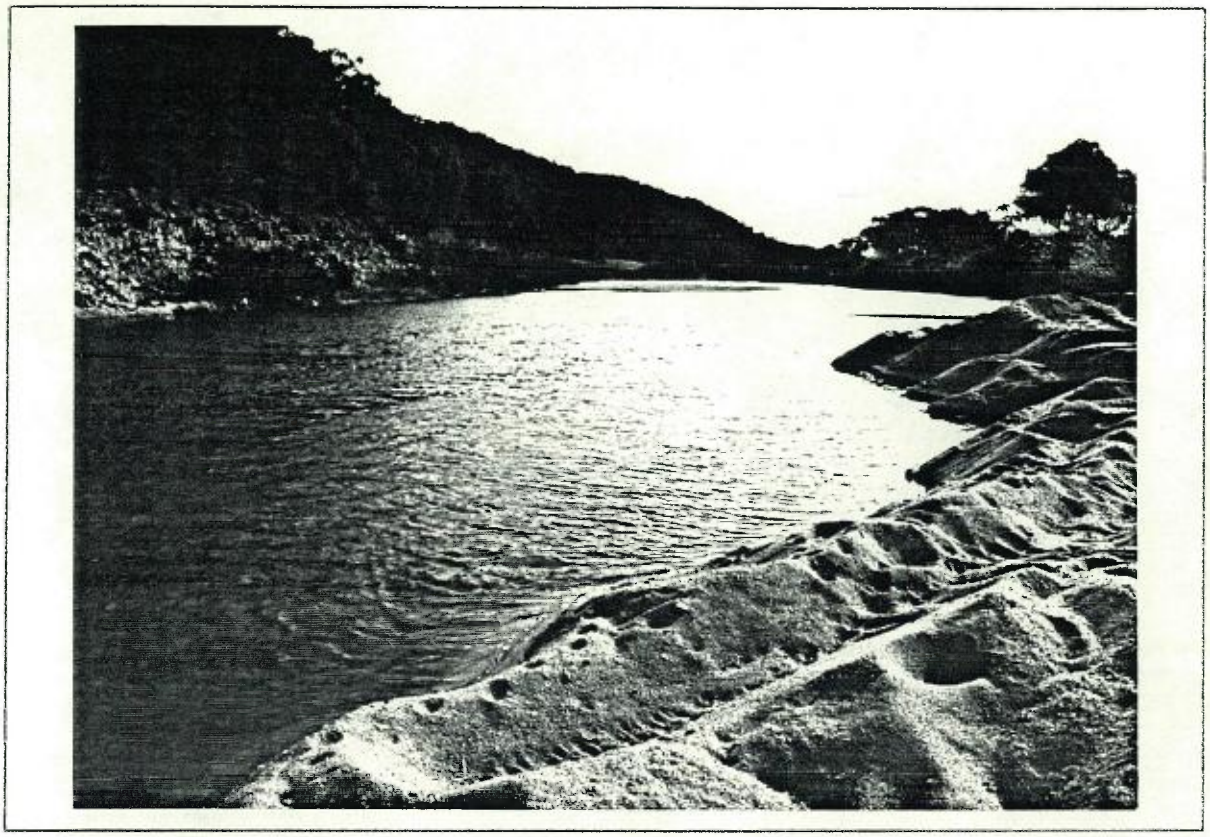


Plate 1: The Murrumbidgee River looking downstream. Note the recent deposition of sand which is characteristic of contemporary bedload sediment.

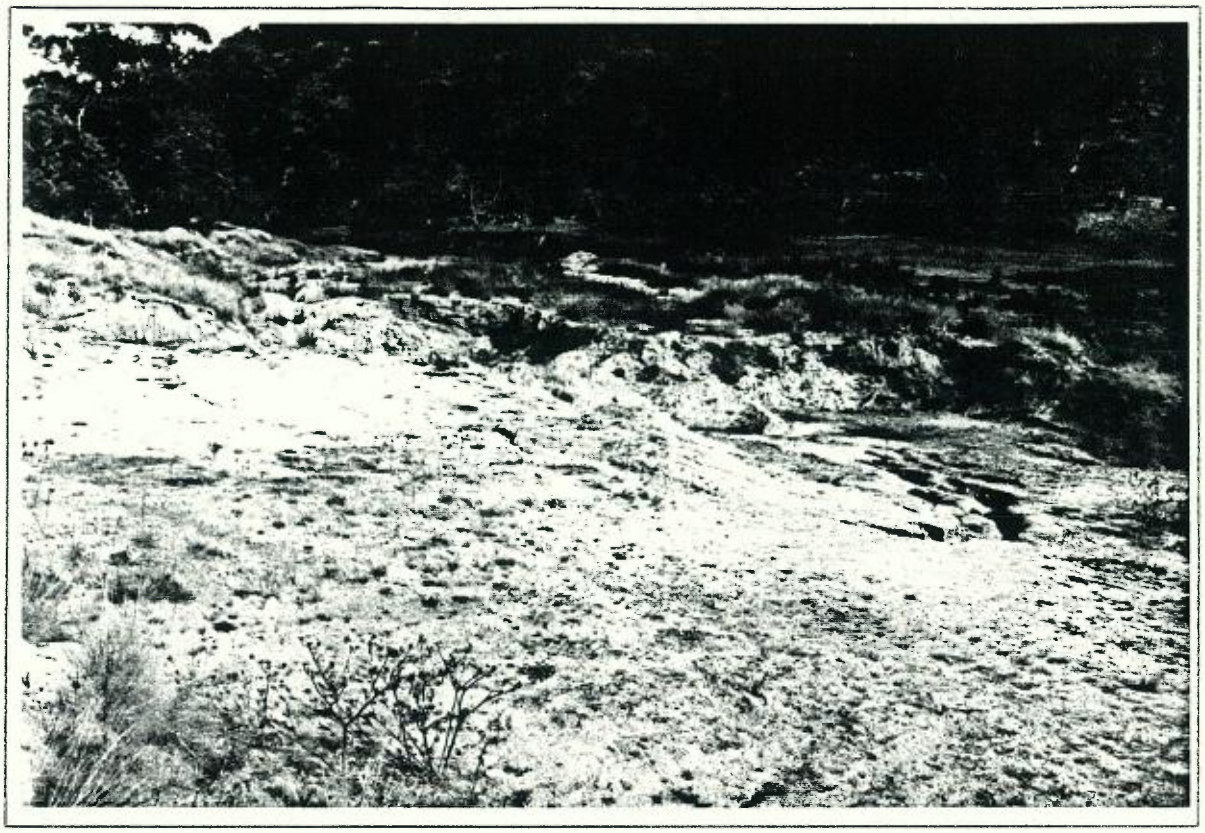


Plate 2: View of quarry area in sand terrace (a) located adjacent to riverbank.

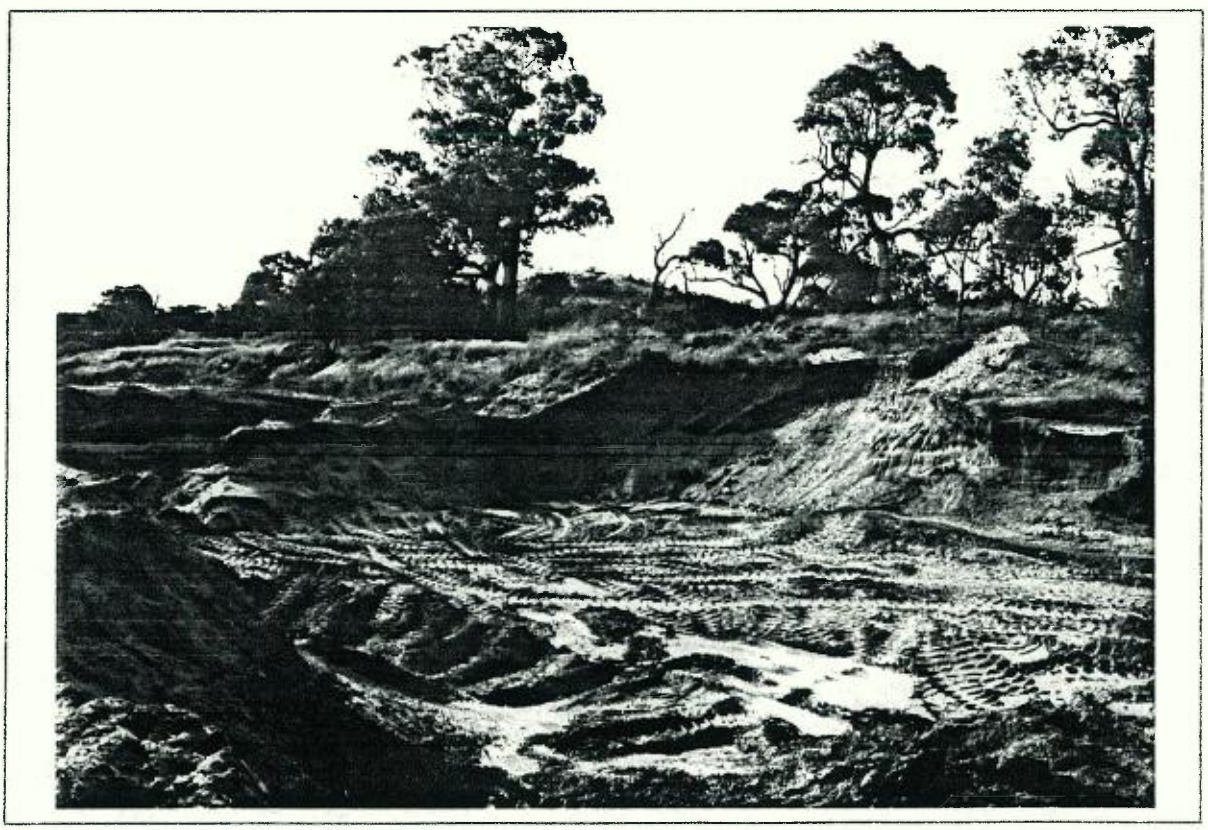


Plate 3: View of a quarry face in sand terrace (a). Note soil development in upper horizon. The gravel terrace (b) forms the higher land surface in the middle foreground.

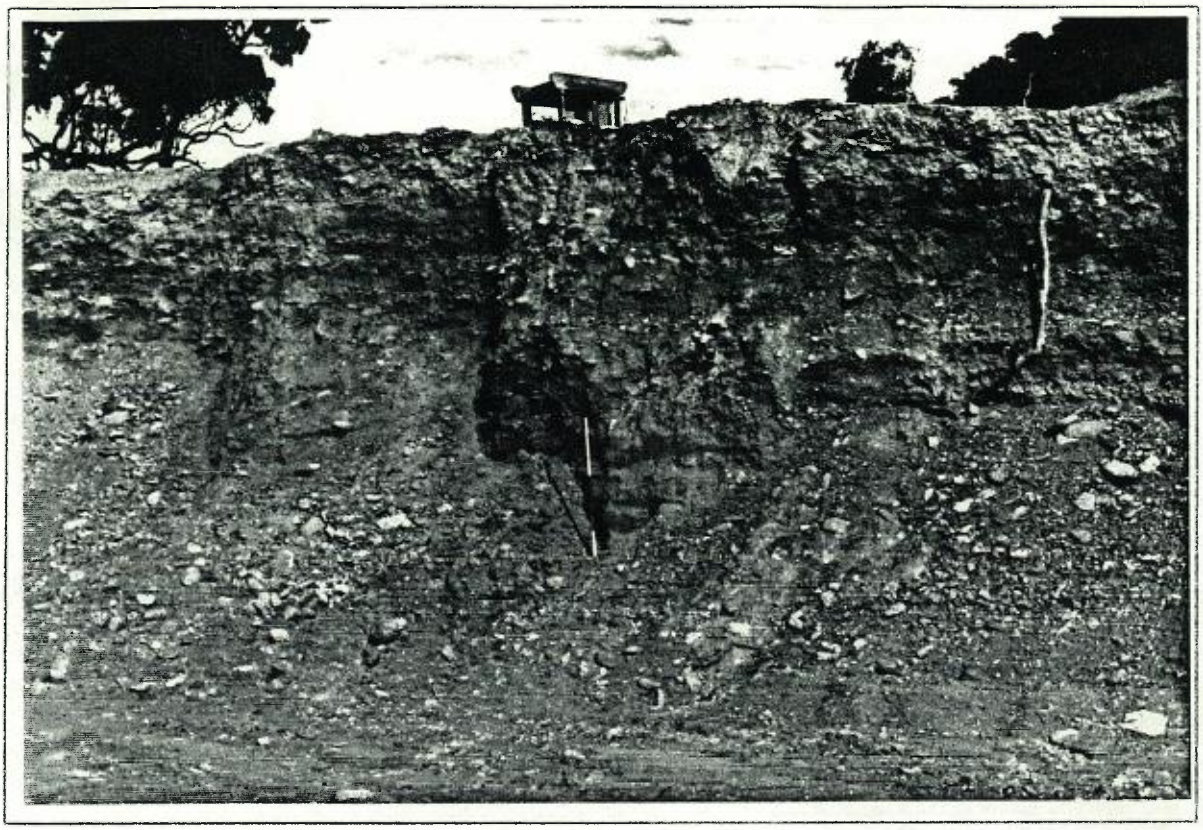


Plate 4: The southern quarry face in the gravel terrace deposit (b). Note poorly sorted silts and gravels, and horizontal bedding characteristic of a high energy depositional environment.

Plate 5: Stratigraphy exposed in the eastern bank of the flood channel. Note lower gravel deposit (terrace b facies) underlying finer sediments in upper portion.

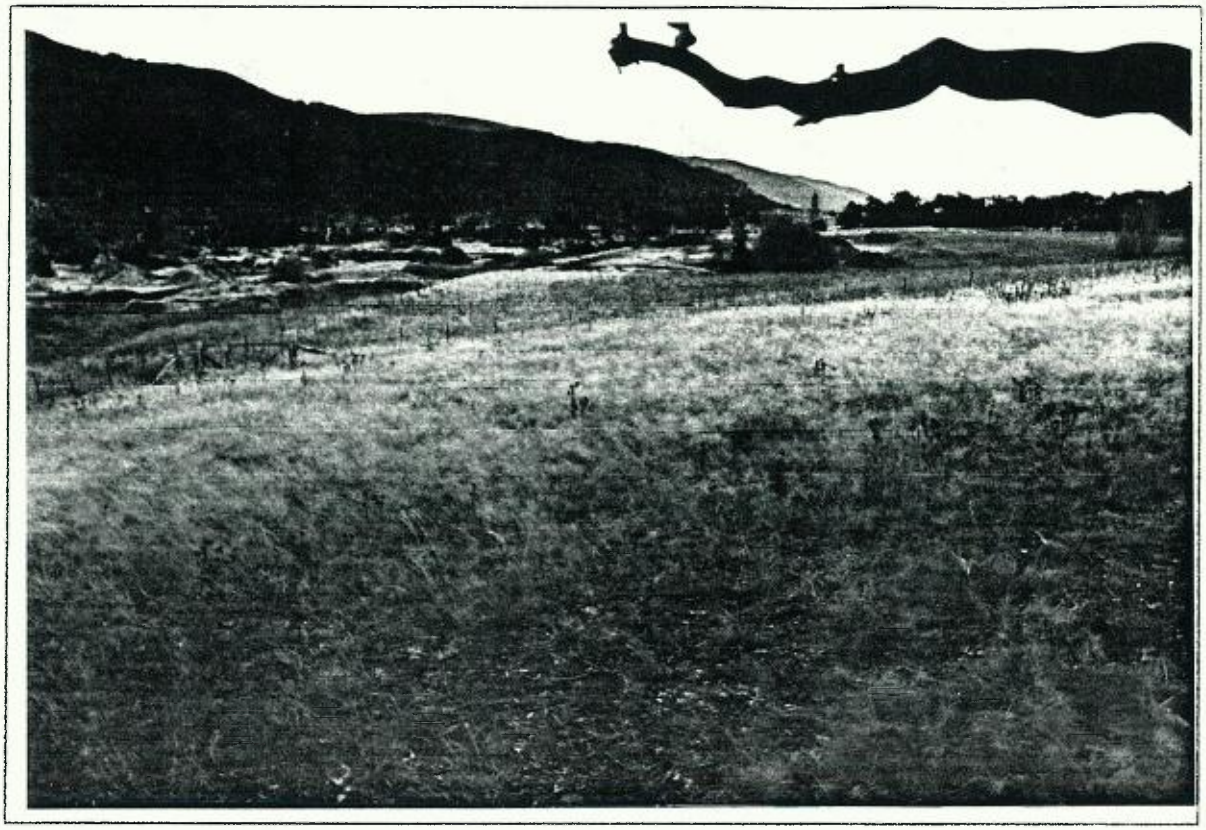


Plate 6: View of study area, looking NW across valley of small tributary and towards sandy silt terrace (c). Site C3 exposure 'd' in foreground. Stockpile and sand quarry area behind willow tree.

Plate 7: View of southern portion of study area, looking across flood channel toward site C3. Note mounds in middle foreground associated with previous quarrying.

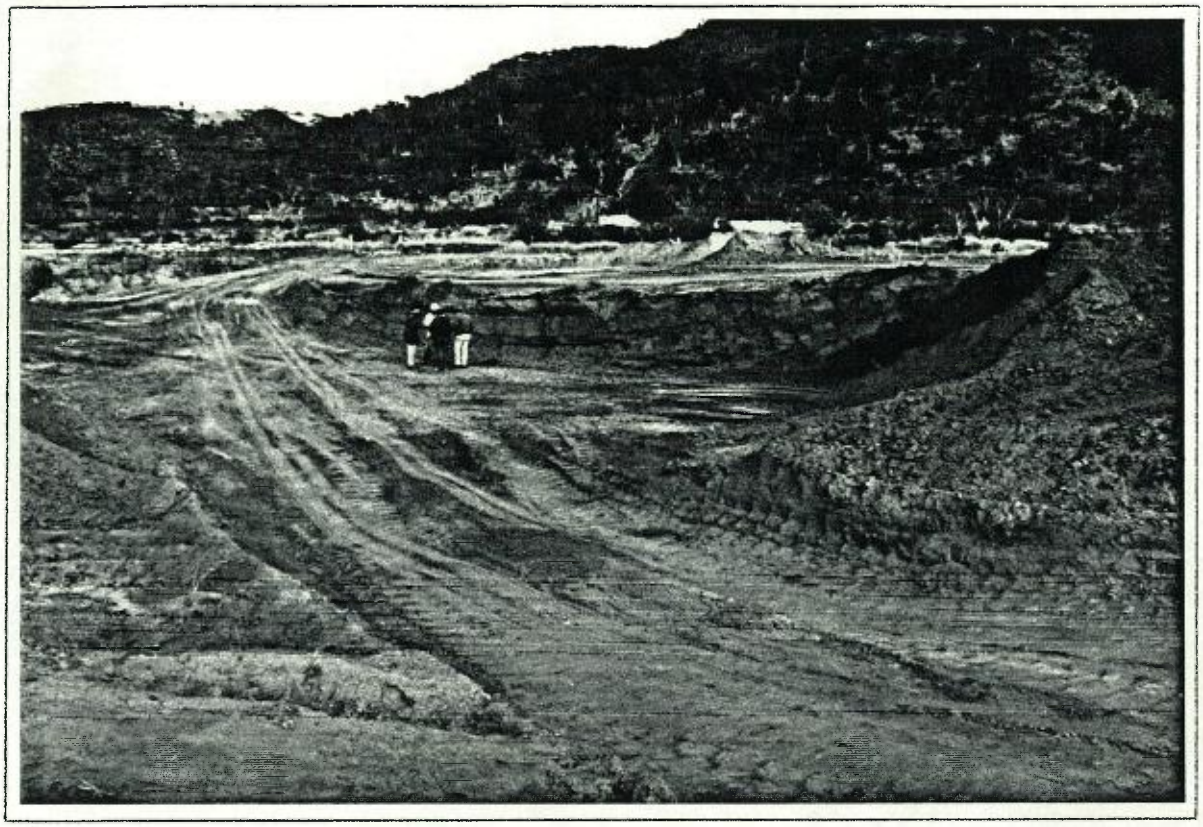


Plate 8: The western quarry face in the sandy silt deposits of terrace (c).

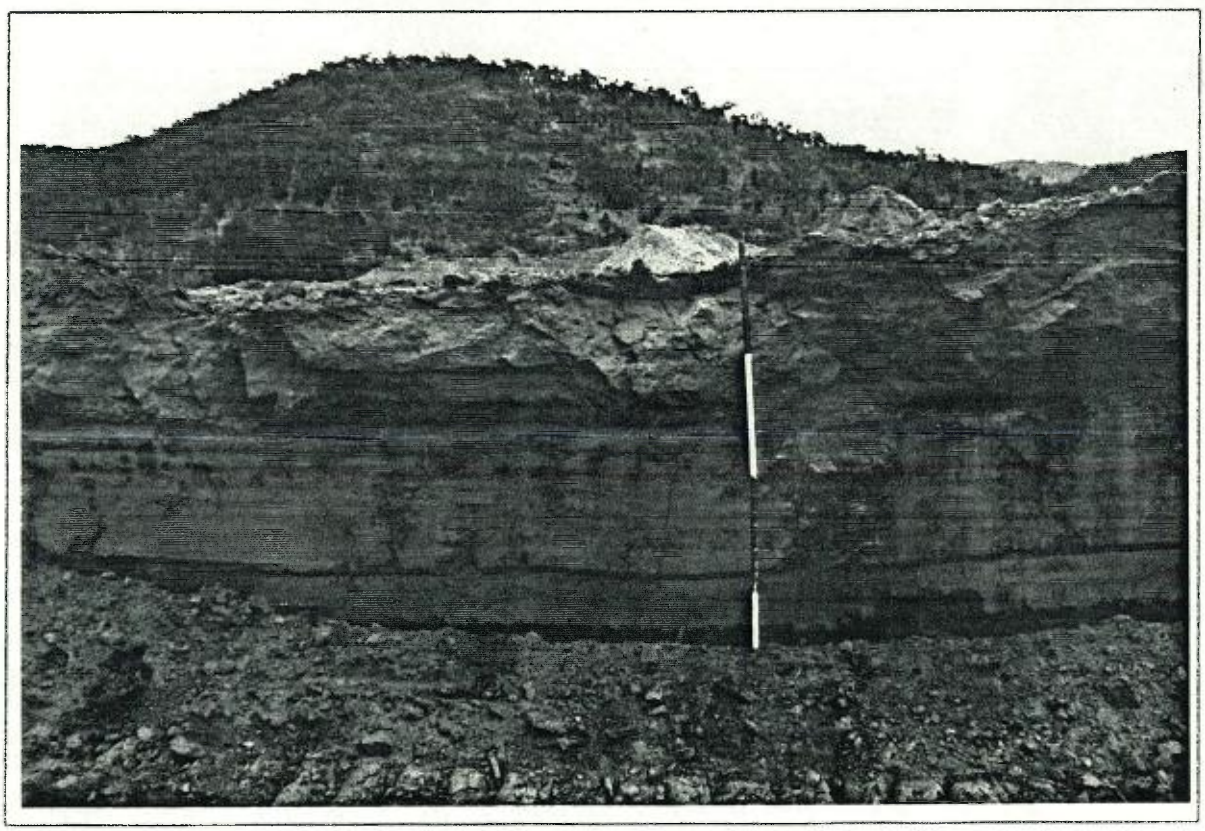


Plate 9: Detail of section shown in Plate 8. Note thin silt lenses and cross bedding consistent with an alluvial terrace and levee deposit.

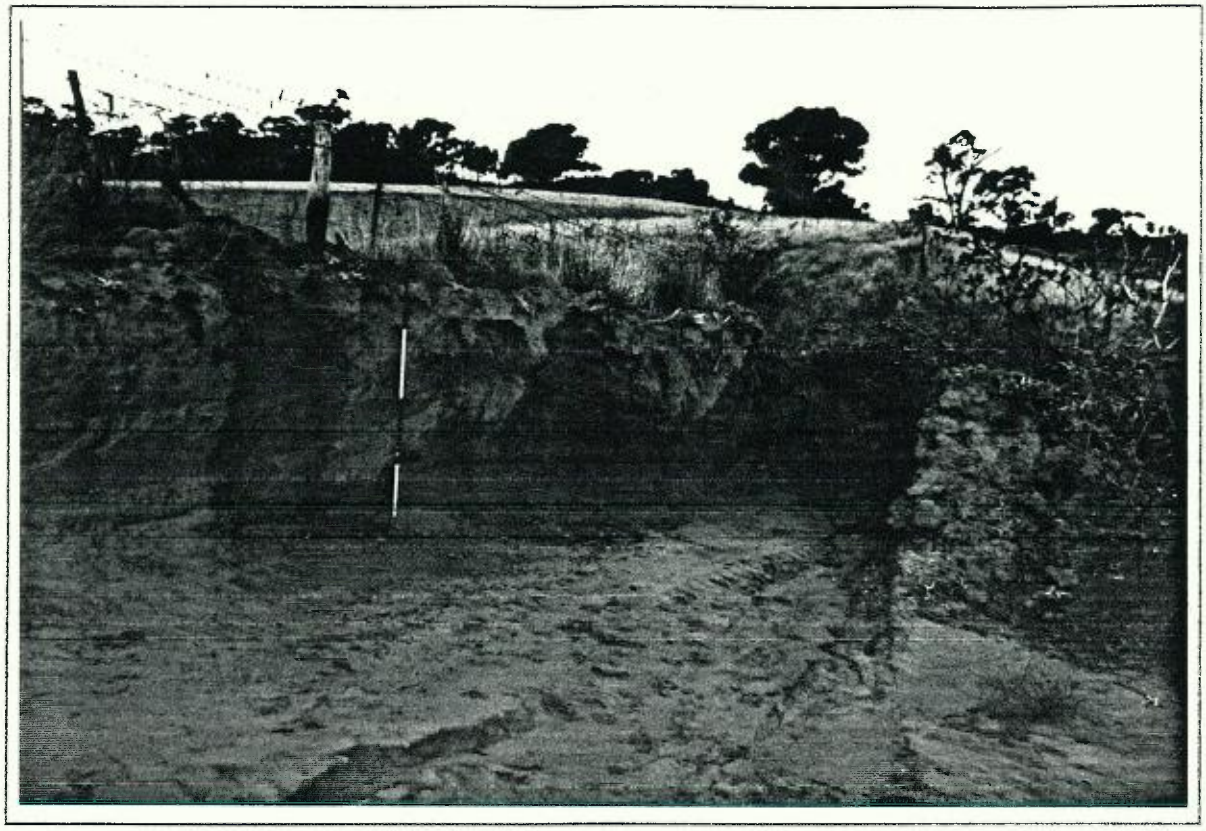


Plate 10: Quarry face immediately north of tributary confluence with flood channel. Note possible historic deposition of silts in upper layers, and thin horizon of charcoal outlining previous land surface.

Plate 11: Stockpile area and associated surface stripping on terrace (c). Artefacts (site C4), were located near bag (top middle left) and by the fenceline (far left).

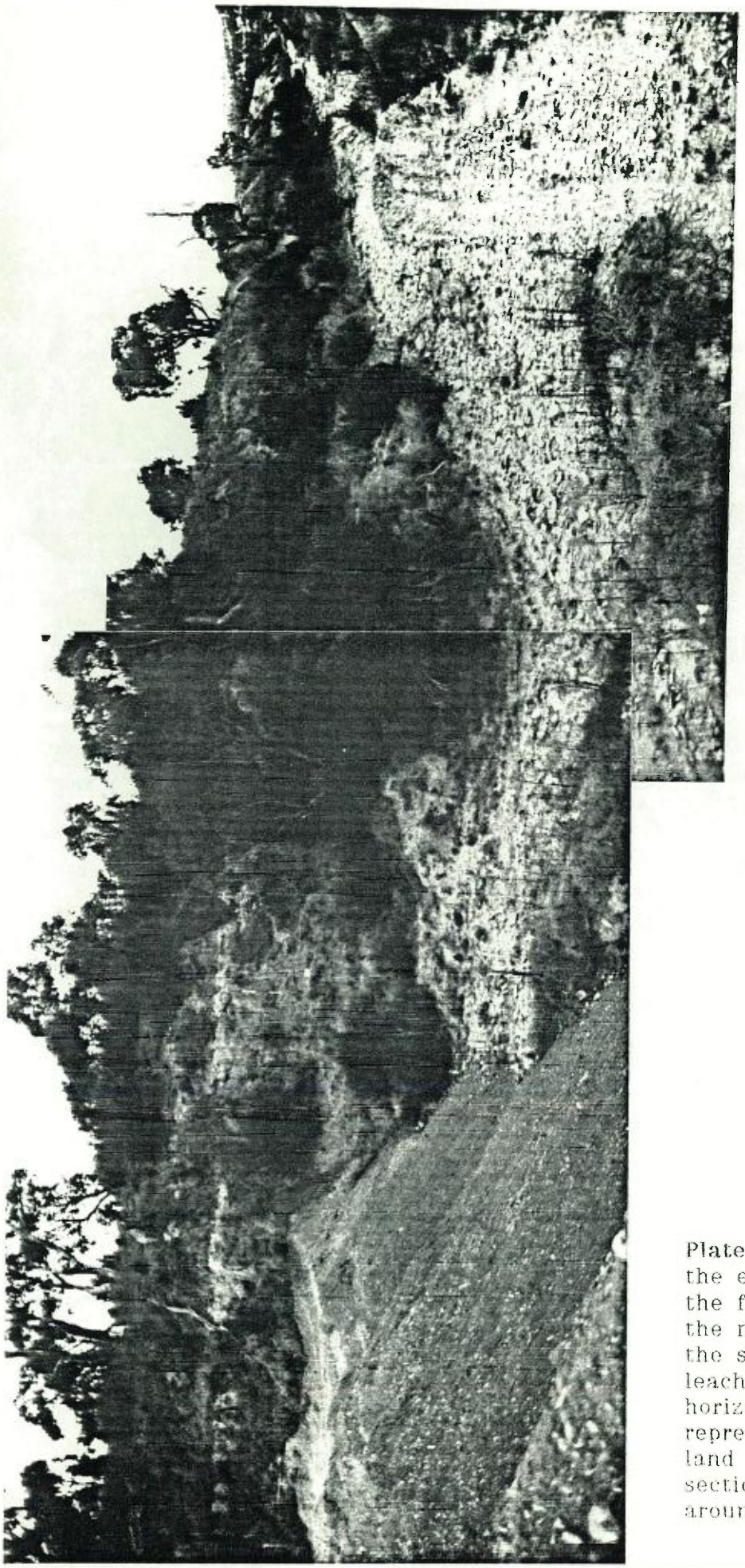


Plate 12: A portion of the eastern bank of the flood channel at the northern end of the study area. Note leached (grey soil?) horizons which may represent previous land surfaces. Total section depth is around 10m.

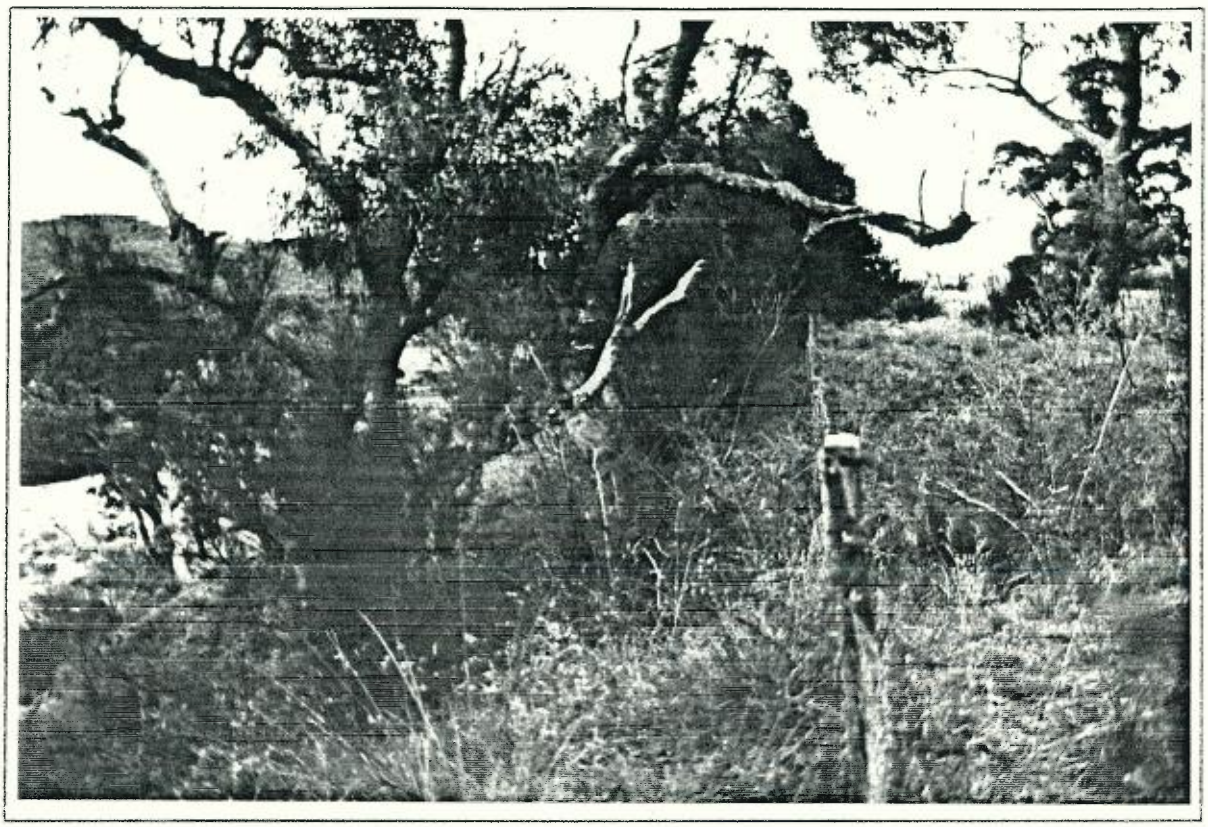
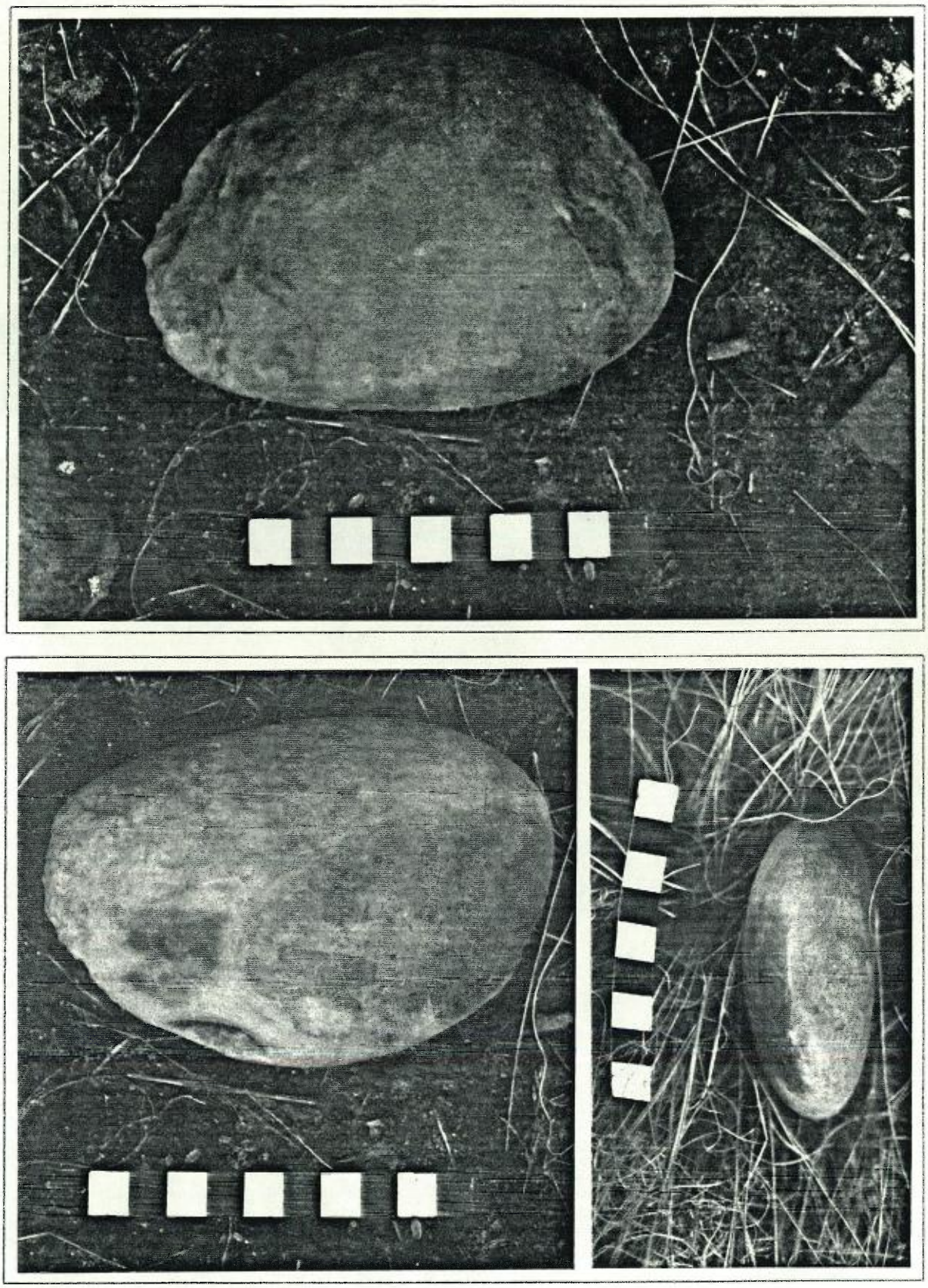


Plate 13: View of site C6 looking north towards northern boundary of study area. Most artefacts occur on the slope and eroded scarp to the left of the fenceline. Note convex slope descending to the right, possibly indicating a relict levee deposit.



Plates 14, 15 & 16: The ground edge hatchet head located on the surface at site C1.

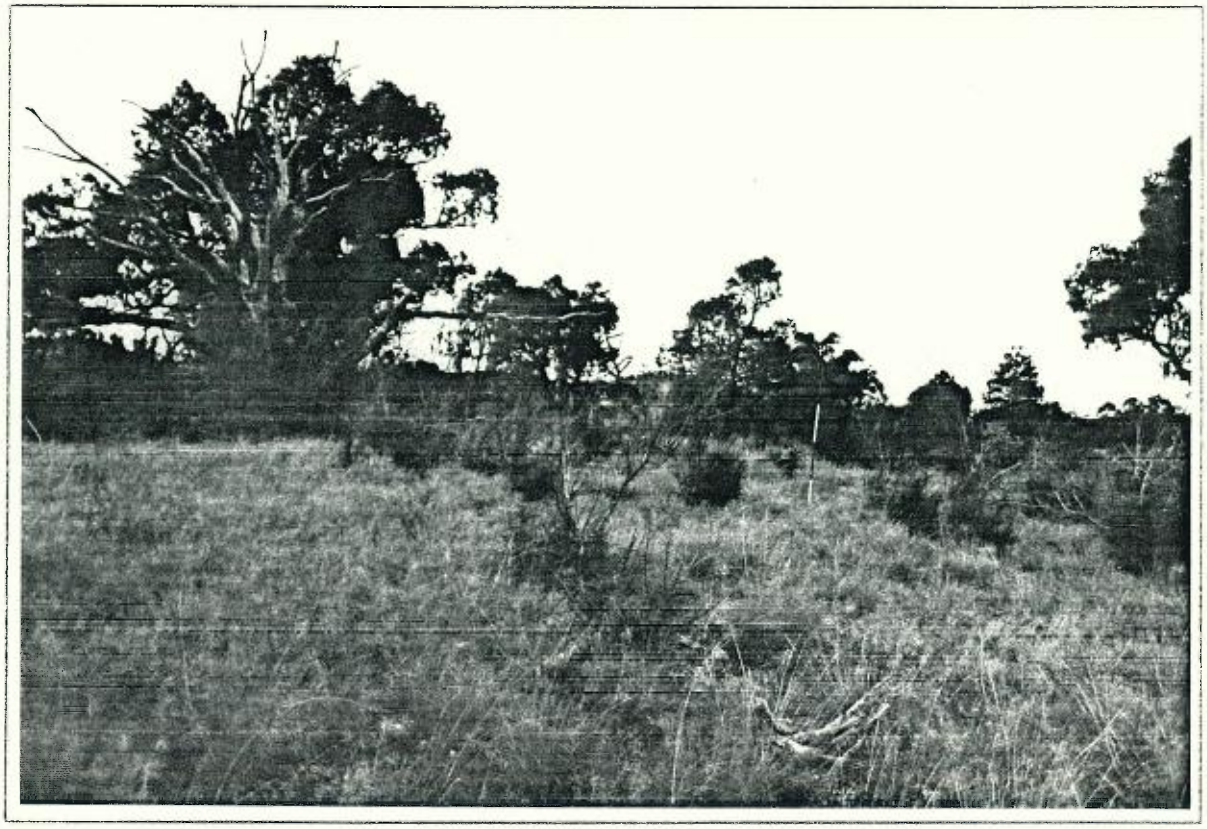


Plate 17: View of site C2 looking south. A backed blade was located at the ranging pole position.

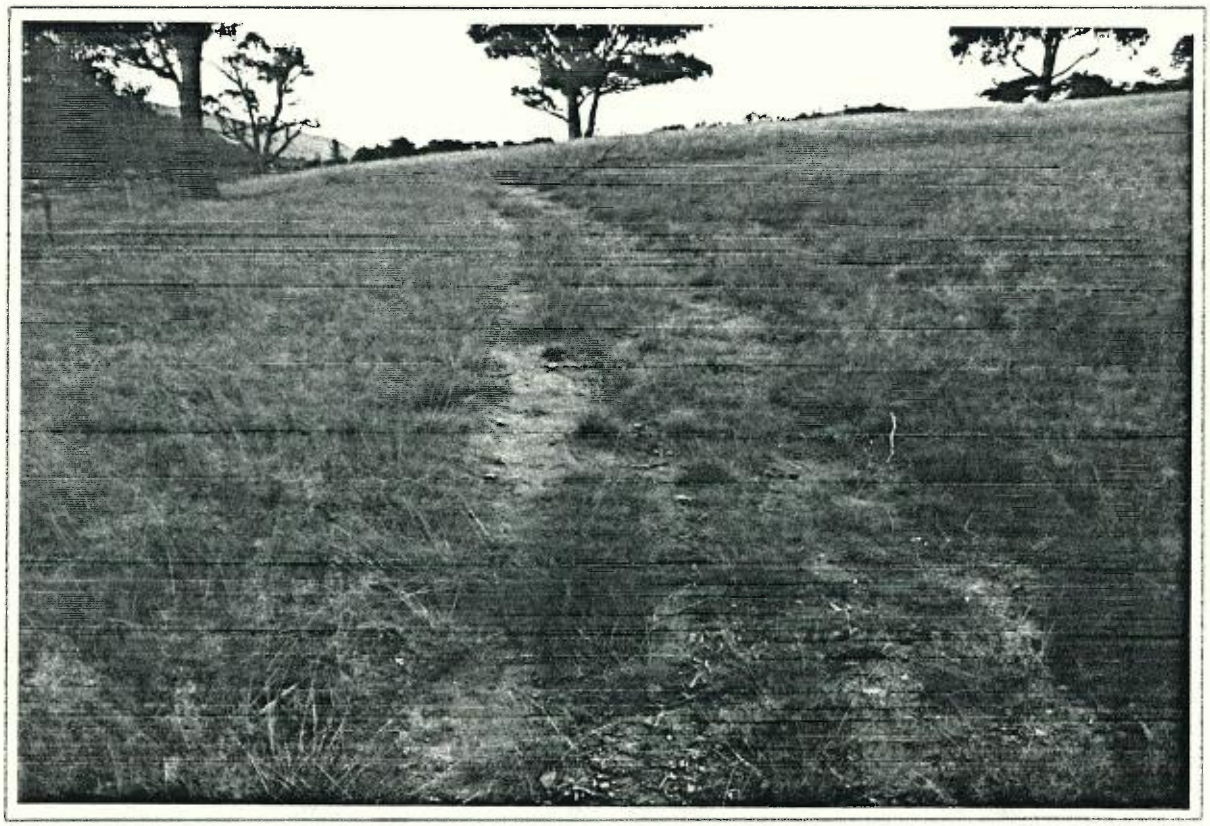


Plate 18: View of exposure 'b' in site C3, looking north. A low density surface artefact scatter occurs within the track exposure. Terrace sediments occur further downslope (see Plate 19).

Plate 19: View of exposure 'a' in site C3. Note terrace sediments overlying bedrock.

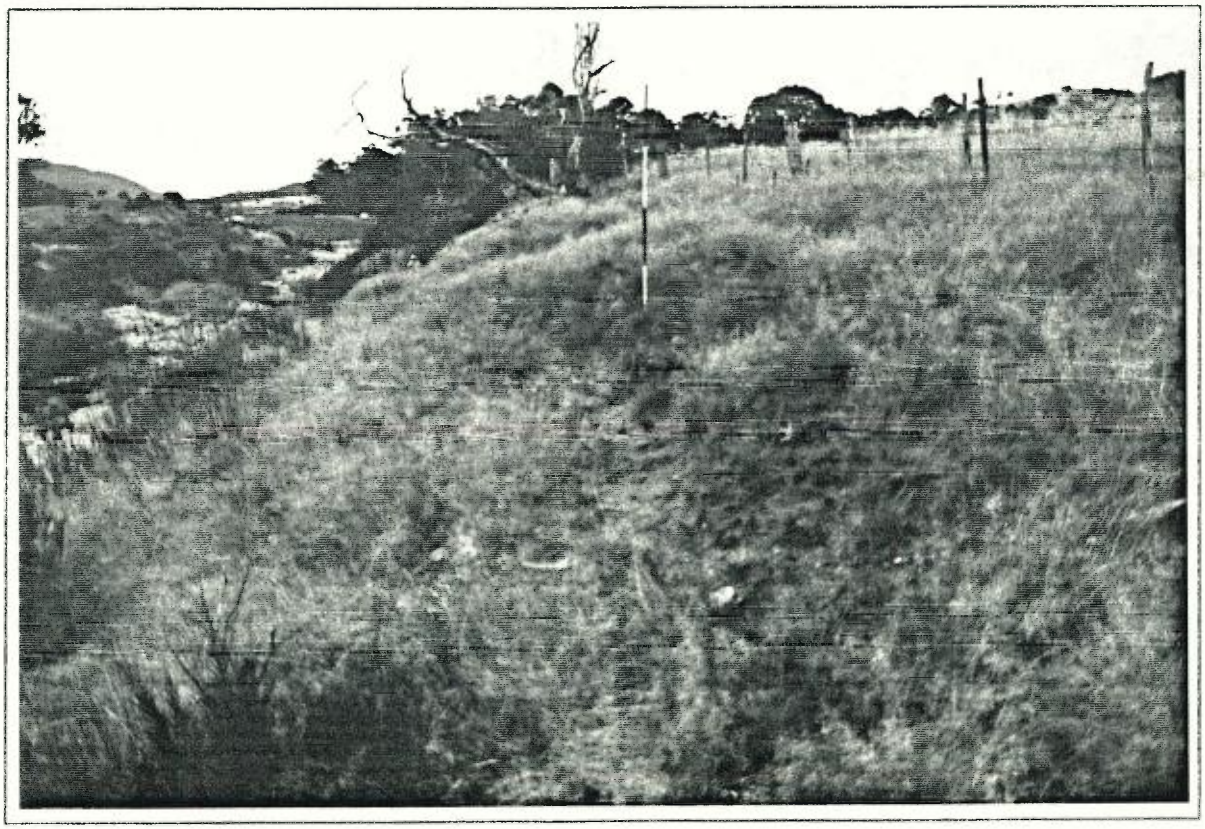


Plate 20: View along eastern bank of flood channel looking north. Site C5 is located in the vicinity of the ranging pole.